

Cancer Control in Small Island Nations 3



Cancer control in the Caribbean island countries and territories: some progress but the journey continues

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Cancer causes a fifth of deaths in the Caribbean region and its incidence is increasing. Incidence and mortality patterns of cancer in the Caribbean reflect globally widespread epidemiological transitions, and show cancer profiles that are unique to the region. Providing comprehensive and locally responsive cancer care is particularly challenging in the Caribbean because of the geographical spread of the islands, the frequently under-resourced health-care systems, and the absence of a cohesive approach to cancer control. In many Caribbean countries and territories, cancer surveillance systems are poorly developed, advanced disease presentations are commonplace, and access to cancer screening, diagnostics, and treatment is often suboptimal, with many patients with cancer seeking treatment abroad. Capacity building across the cancer-control continuum in the region is urgently needed and can be accomplished through collaborative efforts and increased investment in health care and cancer control.

Introduction

The Caribbean is a distinct region within the Americas, comprising many low-lying island countries and territories, and certain countries in mainland South and Central America (figure 1), which share strong cultural, social, and historical connections. This Series paper focuses on 31 island countries and territories, particularly small island nations, in the Caribbean region that are full or associate members of, or are small island nation observers of, the Caribbean Community (CARICOM). These nations are home to around 40 million people, and typically have small populations that are spread across large geographical areas. Haiti, Dominican Republic, Puerto Rico, Jamaica, and Trinidad and Tobago have the largest populations (ranging from 1 million to 11 million), with the other nations each having a population of fewer than 500 000 (table 1).¹ Although these small island nations share a common history marked by invasion and the slave trade, they show a notable diversity of languages, culture, political systems, and socioeconomic conditions.³ Most of these nations have small, open economies and are susceptible to external natural and anthropogenic events. Other than Haiti and Guyana (a low-income and a lower-middle-income country, respectively), countries in CARICOM are classified as upper-middle-income and high-income,⁴ with gross domestic product per capita between US\$5000 and \$86 000 (table 1). By comparison, in 2018, data from the World Bank showed gross domestic product per capita in the USA was \$62 641, and in the UK was \$42 491. The high dependency of most of these nations on tourism and agriculture renders them susceptible to climate change. Changes in annual precipitation, rising temperatures, and extreme weather events (eg, storms, hurricanes, floods, and droughts) will all have adverse

effects on agriculture and crop yield.⁵ Furthermore, many Caribbean states are in the hurricane belt, with a high proportion of their populations and infrastructure in coastal zones; an increase in hurricanes will therefore negatively affect tourism.^{5,6}

Cancer is a major public health problem in the Caribbean, causing approximately a fifth of all deaths in the region in 2015.⁷ The grouping by policy makers (eg, the Pan American Health Organization [PAHO]) of the Caribbean region with other, larger nations in the Americas means the cancer-control issues in these small islands are often overlooked or downplayed. The development of cancer surveillance has been hindered by insufficient ongoing resources and by poor prioritisation of cancer registries. Organised primary and secondary prevention services, including cancer screening, are still being developed. Advanced disease presentations are common and, even when patients do present early, diagnostic and treatment services are often inadequate, costly, and overburdened. Oncological surgery, medical oncology, and radiotherapy are commonly limited to larger and more populous islands, where patients from smaller islands are often referred. Palliative care services are underdeveloped throughout the region.⁸ The 2015 *Lancet Oncology* Commission⁹ on cancer control in Latin America and the Caribbean highlighted some positive advances in cancer care in the region, including the implementation of newly adopted cancer plans in the Dominican Republic, Puerto Rico, and Trinidad and Tobago. This Series paper focuses on current cancer control in the Caribbean countries and territories, with the fourth paper¹⁰ of the Series describing examples of innovative practices geared towards reducing the cancer burden and impacting change in the Caribbean region.

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This is the third in a **Series** of five papers about cancer control in small island nations

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For the World Bank see <https://data.worldbank.org>

For more on the Pan American Health Organization see <http://www.paho.org/hq/>



Figure 1: Map of the Caribbean countries and territories

Political, economic, and health systems in the Caribbean region

Of the Caribbean island countries and territories discussed in this Series paper (table 1), 12 are independent countries, and the rest are territories, dependencies, or special areas of a developed country. Cuba is excluded from this Series paper because of its large land mass and population compared with the other small island nations in the region, as well as its unique health-care system.

Many countries in this region are challenged with a large debt burden and substantial debt-servicing costs, as well as fiscal pressures that have reduced public investments. Many of these nations also do poorly on the inequality index (eg, Jamaica, Haiti, Dominican Republic, and Trinidad and Tobago), with insufficient government commitment to reducing the gap between the rich and the poor.¹¹ Yet the classification of Caribbean nations as upper-middle-income and high-income countries (HICs) restricts their access to bilateral grants and multilateral grants from development banks such as the World Bank or the Caribbean Development Bank.¹² Consequently, support from external partners and official development assistance has substantially diminished since around 2008.¹² The EU is the largest provider of official development assistance to the Caribbean, with the Canadian Government, the Inter-American Development Bank, and the Caribbean Development Bank also having important roles in developmental assistance, especially for health funding.

There is substantial cooperation in economic, foreign, and health policy for the region, supported by the

socioeconomic grouping of CARICOM, whose member states also include the mainland countries of Belize, Guyana, and Suriname (which have been included in this Series paper for completeness). The Caribbean Cooperation in Health provides a framework that promotes collective actions that are best addressed through a regional approach.¹³ Strengthening health systems and addressing the increasing burden of non-communicable diseases (NCDs), including cancer, are among the priorities of the Caribbean Cooperation in Health.¹³ CARICOM's Human and Social Development Council of Health Ministers is overseen by the Caribbean Cooperation in Health, and international organisations, including PAHO and the Caribbean Public Health Agency (CARPHA), work closely with governments to implement this cooperation's framework.^{13,14}

Human and infrastructural resources for health are more readily available in the larger islands with more robust economies, such as The Bahamas, Jamaica, Dominican Republic, Puerto Rico, Martinique, Barbados, and Trinidad and Tobago, than they are in the smaller islands, although detailed data are not available for all countries (table 1). In terms of medical and nursing education, the Caribbean is well supplied, with 80 medical schools (21 public and 59 private) across the region, and 32 nursing schools. The effect of cancer on both health services and overall economic development is likely to be greatest in the smaller or less affluent countries, such as Haiti, Guyana, and the ten members of the Organisation of Eastern Caribbean States. Travel between islands is difficult and relatively expensive and

Country	Estimated population (2017)	Income classification	Year of independence or political affiliations	GDP per capita (US\$, 2018)	Private health expenditure (% of GDP, 2015)	Public expenditure on health (% of GDP, 2015)	Out-of-pocket expenditure on health (% of total health expenditure, 2015)	Mean life expectancy at birth (years)	Mortality for the total population (age-adjusted per 100 000 population)	Health-care staff per 10 000 population	
										Physicians	Nurses
Anguilla*	17 000	..	Territory of the UK	..	..	..	..	81.6	4.8	14.0	50.1
Antigua and Barbuda*	95 000	High income	1981	\$16 864.4	1.6%	3.2%	24.3%	76.7	6.6	27.7	31.2
Aruba	115 000	High income	Territory of the Netherlands	\$25 630.3	..	..	..	76.2	5.2	15.9	22.2
The Bahamas	395 000	High income	1973	\$41 857.9	3.7%	3.6%	27.8%	76.0	6.2	19.4	31.4
Barbados	292 000	High income	1966	\$16 327.6	3.9%	3.4%	44.2%	76.2	..	24.9	60.3
Belize	375 000	Upper-middle income	1981	\$5025.2	1.7%	4.1%	22.7%	70.8	9.5	11.5	11.1
Bermuda	61 695	High income	Territory of the UK	\$85 748.1	..	..	12.6%	81.5	3.5	26.3	78.1
Bonaire	19 400	..	Municipality of the Netherlands	..	..	..	..	..	..	..	..
British Virgin Islands*	35 000	High income	Territory of the UK	..	..	..	..	78.9	..	18.6	64.3
Cayman Islands	60 413	High income	Territory of the UK	\$56 334.2	..	..	..	81.4	..	36.3	71.6
Curaçao	150 000	High income	Country of the Netherlands	\$19 457.5	..	..	..	78.7	..	12.4	..
Dominica*	74 000	Upper-middle income	1978	\$7031.7	1.6%	3.7%	28.4%	77.4	6.8	10.9	59.0
Dominican Republic	10 767 000	Upper-middle income	1844	\$7650.1	3.3%	2.5%	42.5%	74.2	..	15.6	3.1
Grenada*	112 000	Upper-middle income	1974	\$10 833.7	2.8%	1.9%	57.0%	73.9	8.7	14.5	31.5
Guadeloupe	450 000	..	Department of France	..	..	..	..	81.8	3.9	8.0	4.7
Guyana	778 000	Upper-middle income	1970	\$4634.7	1.8%	2.3%	40.5%	66.9	11.5	..	..
Haiti	10 981 000	Low income	1804	\$863.3	2.8%	0.7%	35.5%	63.8	..	2.3	3.5
Jamaica	2 890 000	Upper-middle income	1962	\$5355.6	2.3%	3.5%	23.7%	76.2	5.9	13.2	..
Martinique	385 000	..	Department of France	..	..	..	..	82.4	3.5	..	..
Montserrat*	5000	..	Territory of the UK	..	..	..	..	74.8	10.3	3.8	22.3
Puerto Rico	3 663 000	High income	Territory of the USA	\$31 651.3	..	..	..	80.3	4.6	28.2	74.2
Saba	2000	..	Municipality of the Netherlands	..	..	..	..	..	..	..	..
Saint Kitts and Nevis*	53 000	High income	1983	\$19 829.4	3.5%	2.1%	37.8%	76.2	6.8	25.3	39.8
Saint Lucia*	165 000	Upper-middle income	1979	\$10 315.0	3.1%	2.5%	40.9%	75.9	..	19.3	15.9
Saint Vincent and the Grenadines*	102 000	Upper-middle income	1979	\$7377.7	1.0%	2.9%	19.4%	73.4	8.2	9.5	22.9
Sint Eustatius	3200	..	Municipality of the Netherlands	..	..	..	..	..	..	..	..

(Table 1 continues on next page)

Estimated population (2017)	Income classification	Year of independence or political affiliations	GDP per capita (US\$, 2018)	Private health expenditure (% of GDP, 2015)	Public expenditure on health (% of GDP, 2015)	Out-of-pocket expenditure on health (% of total health expenditure, 2015)	Mean life expectancy at birth (years)	Mortality for the total population (age-adjusted per 100 000 population)	Health-care staff per 10 000 population	
									Physicians	Nurses
(Continued from previous page)										
Sint Maarten	High income	Country of the Netherlands	..	..	..	..	78.5	..	82.0	..
Suriname	Upper-middle income	1975	\$5950.2	2.7%	3.3%	7.6%	71.6	8.3	0.8	4.3
Trinidad and Tobago	High income	1962	\$16843.7	2.8%	3.2%	35.6%	70.9	..	26.7	..
Turks and Caicos Islands	High income	Territory of the UK	\$27142.2	..	..	..	80.1	2.5	18.7	60.0
Virgin Islands	High income	Territory of the USA	\$35938.0†	..	..	..	80.1	3.9	..	..

GDP=gross domestic product (included for all countries for which data are reported by the World Bank). *Organisation of the Eastern Caribbean States member states; †GDP for 2017, data for 2018 not available.

Table 1. Socioeconomic characteristics of the Caribbean countries and territories²

sharing of health-care resources between islands is challenging, even within single-country archipelagos. Individually, the islands are small, with little purchasing power; services can be outsourced to the USA (eg, by the Virgin Islands and The Bahamas) or to France (eg, by Guadeloupe and Martinique), which can be feasible for some islands, but cost-prohibitive for others, especially small islands in the eastern Caribbean.

Strengthening health systems and making progress towards universal health coverage are essential to improve Caribbean countries' response to the growing burden of cancer and other NCDs. Health care in most Caribbean countries is heavily dependent on private funding and provision, with no Caribbean country (except Cuba) reaching the regionally recognised target for public health-care expenditure of at least 6% of gross domestic product (table 1).¹⁵ Most Caribbean countries provide basic health-care coverage, and primary health-care services are generally well established, while secondary and tertiary care varies greatly by country. Reliance on private funding and care results in large out-of-pocket costs to patients, representing 41–44% of health expenditure in Barbados, Dominican Republic, and Saint Lucia, and 57% in Grenada (table 1). Insufficient human resources for health care continues to be a major challenge in the region, with many Caribbean countries falling short of the WHO recommended minimum of 25 health personnel per 10 000 people (table 1). Only 11 of the 31 countries have established regulatory protocols for medicines and other health technologies. The Caribbean Regulatory System is a regional initiative that was developed to strengthen regulatory capacity and ensure the quality and safety of essential medicines, including cancer drugs and technologies.¹⁶

NCD policy and risk factors

NCDs are highly prevalent in the Caribbean, and there is strong political commitment to prevent and control NCDs, including cancer. In their 2007 Declaration¹⁷ on uniting to stop the epidemic of chronic NCDs, the CARICOM heads of government called for increased awareness, public policies, and health-system interventions to reduce the burden of NCDs for the region. A 10-year evaluation¹⁸ of this Declaration noted little progress in NCD prevention, leading to a renewed NCD commitment by CARICOM in 2016, which called for stronger legislative action to reduce tobacco use and prioritise prevention of childhood obesity. NCD policies are now widespread (table 2),^{21–25} although these policies are varied in scope and stage of implementation. Many Caribbean countries have implemented aspects of WHO's Framework Convention on Tobacco Control, CARPHA has pursued a six-point policy package for healthier food environments with the CARICOM Council of Trade and Economic Development, and discussion about the use of taxes on sugary drinks to control obesity is ongoing.²¹ Some financing for health care, including

Country	Cancer registration*	National cancer plan (years the plan was designed to cover)	Current NCD plan	Prevalence of adult smokers (%)		Tobacco control measures (number of indicators in place†)		Prevalence of overweight and obese adults (%)		Obesity prevention measures (number of indicators in place‡)	Hepatitis B virus vaccination coverage (%), 2018	Human papillomavirus vaccination		Organised national screening programme present		
				Male	Female	Male	Female	Male	Female			Year vaccine introduced [§]	Target age group (estimated coverage, %)	Cervical cancer	Breast cancer	Bowel cancer
Anguilla	Registry activity [§]	No	Yes	..	..	1-2	..	..	..	3-4	..	2016	9-year-old girls (37%) ³⁰	No	No	No
Antigua and Barbuda	Registry activity	No	Yes	..	..	1-2	40.1%	55.6%	3-4	3-4	..	2018	9-13-year-old, both sexes [¶]	No	No	No
Aruba	Registry activity	No	No	..	..	..	..	..	..	..	..	2014	9-year-old girls [¶]	No	Yes (mammogram)	No
The Bahamas	Registry activity	No	Yes	20.4%	3.1%	1-2	60.3%	68.1%	1-2	1-2	..	2015	9-12-year-old, both sexes ³⁰	No	No	No
Barbados	National high-quality PBCR	No	Yes	14.5%	1.9%	3-4	44.7%	59.9%	5	5	..	2014	10-11-year-old, both sexes	No	No	No
Belize	Registry activity	Yes (2013-19)	Yes	..	..	1-2	48.1%	61.2%	3-4	3-4	55%	2016	9-13-year-old girls [¶]	No	No	No
Bermuda	National high-quality PBCR	No	No	..	..	3-4	79.1%	69.6%	3-4	3-4	..	2007	..	No	No	No
Bonaire	No registry activity	No	No	..	..	..	..	..	..	..	..	2015	..	No	No	No
British Virgin Islands	No registry activity [§]	No	Yes	..	..	3-4	..	..	None	None	..	Vaccine not available	..	No	No	No
Cayman Islands	Registry activity	No	No	..	..	3-4	..	..	1-2	1-2	..	2009	..	No	No	No
Curaçao	PBCR (currently inactive)	No	No	20.4%	8.3%	3-4	62.1%	67.0%	..	..	..	Vaccine not available	..	No	No	No
Dominica	No registry activity [§]	No	Yes	..	..	3-4	54.7%	65.7%	3-4	3-4	46%	2017	9-year-old girls [¶]	No	No	No
Dominican Republic	Registry activity	No	Yes	19.1%	8.5%	1-2	56.9%	65.3%	..	..	80%	2017	9-year-old girls [¶]	No	No	No
Grenada	Registry activity [§]	No	Yes	..	..	1-2	43.7%	58.8%	3-4	3-4	95%	Vaccine not available (planned introduction November 2019)	..	No	No	No
Guadeloupe	PBCR	Yes (2014-19)||	..	..	..	..	..	..	..	..	..	2008	11-year-old girls [¶]	No	Yes (mammogram)	Yes (faecal occult blood)
Guyana	PBCR	No	Yes	..	..	3-4	41.5%	56.6%	3-4	3-4	..	2012	10-13-year-old girls (10-50%) ³⁰	..	..	..
Haiti	Registry activity	No	..	23.1%	2.9%	None	51.1%	58.3%	..	..	79%	Vaccine not available	..	No	No	No

(Table 2 continues on next page)

Country	Cancer registration*	National cancer plan (years the plan was designed to cover)	Current NCD plan	Prevalence of adult smokers (%)		Tobacco control measures (number of indicators in place)†	Prevalence of overweight and obese adults (%)		Obesity prevention measures (number of indicators in place)‡	Hepatitis B virus vaccination coverage (%), 2018		Human papillomavirus vaccination	Organised national screening programme present			
				Male	Female		Male	Female		Birth dose	Three paediatric doses		Year vaccine introduced [§]	Target age group (estimated coverage, %)	Cervical cancer	Breast cancer
(Continued from previous page)																
Jamaica	High-quality regional PBCR	Yes (2013–18)	Yes	28.6%	5.3%	3–4	47.4%	63.2%	3–4	..	97%	2017	10–11-year-old, both sexes¶	Yes (Pap test)	No	No
Martinique	High-quality national PBCR	Yes (2014–19)¶¶	..	..	..	..	..	..	..	..	..	Vaccine not available	..	Yes (Pap test)	Yes (mammogram)	Yes
Montserrat	No registry activity§	No	No	..	..	None	..	..	1–2	..	..	..	..	No	No	No
Puerto Rico	High-quality national PBCR	Yes (2015–20)	Yes	..	..	..	..	..	..	..	..	2006	11–12-year-old, both sexes ^{§§}	Yes (Pap test)	Yes (mammogram)	Yes
Saba	No registry activity	No	No	..	..	..	..	..	..	..	..	2013	>95%¶¶	No	No	No
Saint Kitts and Nevis	No registry activity§	No	Yes	..	..	None	45.0%	59.3%	3–4	96%	98%	Vaccine not available	..	No	No	No
Saint Lucia	Registry activity§	No	..	..	..	3–4	39.3%	56.3%	1–2	95%	95%	Vaccine not available (planned introduction October 2019)	..	Yes (Pap test)	Yes (mammogram)	No
Saint Vincent and the Grenadines	No registry activity§	No	Yes	..	..	1–2	48.9%	61.1%	3–4	97%	97%	2017	..	No	No	No
Sint Eustatius	No registry activity	No	No	..	..	..	..	..	..	..	..	2013	..	No	No	No
Sint Maarten	PBCR	No	..	..	..	..	..	..	..	..	..	2013	9–10-year-old girls¶¶	No	No	No
Suriname	Registry activity	Draft (2018–28)	Yes	42.9%	7.4%	3–4	53.4%	64.2%	1–2	79%	95%	2013	11–12-year-old girls (50–70%) ^{§§}	No	No	No
Trinidad and Tobago	National PBCR	Yes	Yes	..	..	3–4	37.1%	54.5%	3–4	..	99%	2012	11–15-year-old, both sexes (<10%) ^{§§}	No	No	No
Turks and Caicos Islands	No registry activity	No	Yes	..	..	3–4	..	..	1–2	..	..	2019	..	No	No	No
Virgin Islands	High-quality national PBCR	No	..	..	..	..	..	..	..	..	..	2006	..	..	..	..

NCD=non-communicable disease. PBCR=population-based cancer registry. *Data on cancer registration provided by the Global Initiative for Cancer Registry Development. †Five indicators for tobacco control measures: excise tax >50%; smoke-free environments; health warnings; advertising, promotion, and sponsorship; and national anti-tobacco media campaign in the past 24 months. ‡Five indicators for obesity prevention measures: food fiscal policies; healthy food policies in schools; food-based dietary guidelines; salt consumption policies; and compulsory physical education in schools. §Plan to join proposed Organisation of Eastern Caribbean States joint cancer registry, no current cancer registry. ¶Data from personal knowledge of the authors. ¶¶Use the French National Cancer Plan 2014–19.

Table 2. Characteristics of Caribbean countries and territories, and their cancer surveillance and prevention status^{1,2,3,5}

care for NCDs, is derived from taxes collected on alcohol and cigarette sales.²⁶ Caribbean Wellness Day, an annual event celebrated in all CARICOM countries for the past 10 years, has led to numerous community-based events to raise awareness of, and to promote, healthy living.

Cancer surveillance and epidemiology

Cancer is the second leading cause of death after cardiovascular disease in most countries and territories in the Caribbean region.²⁷ The GLOBOCAN database, which compiles mortality data from WHO and global data from high-quality, population-based cancer registries, provides estimates of cancer incidence in the Caribbean.²⁸ Data from the Global Initiative on Cancer Registration show that nine Caribbean small island nations have population-based cancer registries (table 2).¹⁰ For countries without population-based cancer registry data, GLOBOCAN uses documented methods to estimate cancer incidence on the basis of data from neighbouring countries.²⁸ Although cancer incidence and mortality patterns in the Caribbean reflect broader epidemiological transitions, they also show cancer profiles that appear to be unique to the region. GLOBOCAN data (available for 11 Caribbean small island nations^{7,29}) indicate an estimated 103 800 new cancer cases in 2018, and 60 800 cancer deaths in the region (figure 2).³⁰ Prostate cancer and breast cancer are the most common cancer types in men and women, respectively. In men in the Caribbean, prostate cancer represents almost one in three diagnoses of cancer, and one in six deaths from cancer; in women, breast cancer accounts for more than one in four cancer cases and almost one in five deaths from cancer. After prostate, the cancers with the highest incidence in men are lung, colorectal, stomach, and laryngeal, and although liver cancer is not among the five cancers with the highest incidence, it ranks fifth in terms of mortality (figure 2). Together, these cancers account for about 60% of all cancer cases and deaths in men in the region (figure 2). In women, the cancers with the highest incidence after breast cancer are those of the colorectum, lung, cervix, and corpus uteri (figure 2). Stomach cancer is the fifth leading cause of cancer death in women, although it is not among the five cancers with the highest incidence (figure 2). Together with breast cancer, these cancers account for about six of ten of all cancer cases and deaths in women in the Caribbean (figure 2).

Mortality from prostate and breast cancer in several Caribbean countries is among the highest in the world. For example, breast cancer mortality (age-adjusted per 100 000) in Antigua and Barbuda (44·7), The Bahamas (29·0), Grenada (43·5), and Saint Kitts and Nevis (31·3) is high compared with in the USA (15·4).³⁰ Similarly, prostate cancer mortality (age-adjusted per 100 000) in Anguilla (49·5), Antigua and Barbuda (50·4), Dominica (91·4), Grenada (90·3), Montserrat (99·8), Saint Kitts and Nevis (89·9), and Saint Vincent and the Grenadines (115·2) is extremely high compared with in the USA

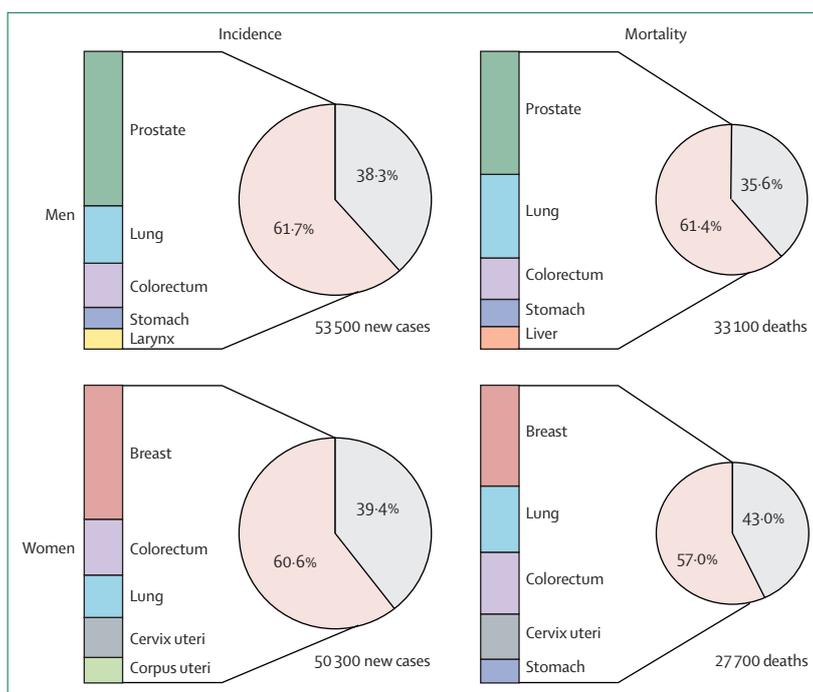


Figure 2: The contribution of the top five cancers to cancer incidence and mortality by sex³⁰

(11·5).³¹ The Caribbean has a complex cancer profile, with some cancers linked to poverty and infection (eg, cervical and liver cancer), and others that are more associated with western lifestyles (eg, lung, colorectal, and corpus uteri cancer; table 3).³⁰ Lung and cervical cancer are important contributors to preventable cancer morbidity and mortality in most Caribbean countries.⁷ The very high incidence and mortality of prostate cancer in the Caribbean is unexplained^{32–36} but is probably caused by the combination of largely unidentified genetic and environmental risk factors, health service factors (eg, screening, diagnostic capacity, and treatment capacity), and artifacts due to data recording (anecdotal evidence exists of elderly men with elevated prostate specific antigen being certified as having died from prostate cancer).^{32–36} Regardless, prostate cancer is a high priority for research activity in the region.

More generally, concerted action is needed to reduce cancer incidence in the Caribbean, especially considering the projection of cancer cases and deaths in the region up to 2040 (appendix p 1). Even if cancer incidence remains stable over the next two decades, demographic changes will result in a projected cancer burden of 160 564 new cases (an increase of 55%) and 101 693 deaths (an increase of 67%) between 2018 and 2040 (appendix p 1).

See Online for appendix

Cancer-control planning in the region

Optimal cancer control requires coordination both between and within governments, multisectoral policies, and strategies to address cancer prevention, treatment, palliative care, and survivorship, including progressing

	Cancer incidence (age standardised rate per 100 000, men to women)	Cancer mortality (age standardised rate per 100 000, men to women)	Most frequent cancers in men*					Most frequent cancers in women*				
			1	2	3	4	5	1	2	3	4	5
The Bahamas	210.6 to 162.6	106.0 to 80.5	Prostate	Colorectum	Lung	Thyroid	Non-Hodgkin lymphoma	Breast	Colorectum	Uterus	Cervix	Thyroid
Barbados	287.6 to 216.3	140.7 to 110.8	Prostate	Colorectum	Lung	Pancreas	Stomach	Breast	Colorectum	Uterus	Cervix	Non-Hodgkin lymphoma
Dominican Republic	168.1 to 161.1	100.9 to 89.1	Prostate	Lung	Colorectum	Stomach	Liver	Breast	Cervix	Colorectum	Lung	Liver
Guadeloupe	342.9 to 183.1	101.7 to 59.1	Prostate	Colorectum	Stomach	Lung	Pancreas	Breast	Colorectum	Stomach	Uterus	Cervix
Haiti	150.6 to 136.7	111.6 to 98.7	Prostate	Stomach	Colorectum	Liver	Lung	Breast	Cervix	Colorectum	Stomach	Lung
Jamaica	196.7 to 211.7	129.1 to 113.7	Prostate	Lung	Colorectum	Stomach	Non-Hodgkin lymphoma	Breast	Colorectum	Cervix	Uterus	Stomach
Martinique	308.9 to 201.1	107.9 to 73.8	Prostate	Colorectum	Stomach	Lung	Leukaemia	Breast	Colorectum	Lung	Stomach	Uterus
Puerto Rico	280.1 to 238.5	93.6 to 60.6	Prostate	Colorectum	Lung	Bladder	Non-Hodgkin lymphoma	Breast	Colorectum	Thyroid	Uterus	Lung
Saint Lucia	181.7 to 138.5	107.4 to 65.4	Prostate	Colorectum	Lung	Stomach	Non-Hodgkin lymphoma	Breast	Colorectum	Cervix	Stomach	Non-Hodgkin lymphoma
Trinidad and Tobago	187.9 to 173.4	118.5 to 90.2	Prostate	Lung	Colorectum	Pancreas	Bladder	Breast	Colorectum	Uterus	Cervix	Ovary

Data provided for small island nations in the Caribbean where available in GLOBOCAN (non-island Caribbean states and Cuba excluded). *Five cancers with the highest incidence, ranked with 1 as the overall most frequent and 5 as the fifth most frequent.

Table 3: Cancer incidence, mortality, and ranking of the five cancers with the highest incidence by sex for selected Caribbean island countries and territories³⁰

For the Extension for
Community Healthcare
Outcomes Project see
<https://echo.unm.edu>

towards universal health coverage.³⁷ International partnership and support are likely to be essential for success, particularly for the smallest countries or those with fewest resources.³⁷ Only seven Caribbean countries and territories (Belize, Jamaica, Guadeloupe, Martinique, Puerto Rico, Suriname, and Trinidad and Tobago) have operational, stand-alone national cancer-control plans.²³ Four countries (Dominica, Puerto Rico, Aruba, and Saint Kitts and Nevis) have national cancer guidelines addressing screening, diagnosis, and treatment for at least one cancer type;²³ three of these countries have guidelines that are specific to cervical cancer. Other countries have incorporated elements of cancer control into their NCD plans, for instance Antigua and Barbuda's NCD Plan (2015–2019)³⁸ includes objectives for establishing a cancer registry, achieving breast and cervical cancer screening of 80% of eligible women, and addressing cancer and other NCD risk factors (ie, tobacco, alcohol, physical inactivity, and unhealthy diet). Unfortunately, many Caribbean small island nations struggle to implement and deliver such ambitious plans.⁹

Collaborative efforts have sought to improve cancer-control guidelines, often with technical input from external agencies. The US National Cancer Institute collaborated with Caribbean and international partners to build country capacity around national cancer-control programmes, with two cancer leadership forums (held in 2015 and 2017), which resulted in ten countries developing cancer-control and action plans, and others taking substantial steps towards this.^{39,40} The Caribbean Association of Oncology and Hematology collaborated

with the US National Comprehensive Cancer Network to adapt the network's guidelines for the Caribbean context¹⁰. The Caribbean Extension for Community Healthcare Outcomes Project has supported the development of a working network of multisector health-care professionals, dedicated to the development and implementation of national cancer-control plans in the Caribbean region, with a special focus on breast and cervical cancer. This network model emphasises the sharing of best practices and applied case-based learning, thus disseminating knowledge and expanding the capacity of countries to address current challenges in cancer control.

Immunisation and screening

Prevention programmes targeting the precursors for most liver cancer, hepatitis B virus and hepatitis C virus, have largely been successful in the Caribbean, with continued reductions anticipated in incidence of liver cancer.⁴¹ Coverage of hepatitis B virus vaccination in infants is more than 90% in all countries except Haiti, where the estimated coverage was 79% in 2018.²² Many countries in the region are yet to incorporate the vaccination against hepatitis B at birth (table 2) as recommended by WHO.²² Human papillomavirus (HPV) vaccination is included in the national immunisation programmes of 20 Caribbean countries, with at least three others (Grenada, Saint Lucia, and Saint Kitts and Nevis) planning to introduce it in the near future; the HPV vaccine is available via the private sector in at least one country (Curaçao). HPV vaccination coverage is

unknown or low in most Caribbean countries; for example, in Barbados and in Trinidad and Tobago coverage is less than 50% (table 2).²⁰ In Haiti, a school-based HPV vaccination pilot programme run by a non-governmental organisation (NGO) obtained nearly 90% coverage for girls aged 9–13 years who attended schools in rural areas.⁴² Other immunisation campaigns led by NGOs are also working to address Haiti's substantial cervical cancer burden.

Cancer screening programmes are generally underdeveloped and poorly implemented throughout the Caribbean region (table 2), reflecting resource constraints in infrastructure and public education. There are six countries with one or more organised national screening programmes (table 2): Puerto Rico and Martinique (cervical, breast, and colorectal), Saint Lucia (cervical and breast), Guadeloupe (breast and colorectal), Aruba (breast), and Jamaica (cervical). Outside of these countries, cervical cancer and, to a lesser extent, breast, colorectal, and prostate cancer, are screened opportunistically to varying degrees, with services provided by public and private practitioners, cancer societies, and other NGOs. Copayments are often required for screening and follow-up treatment, which are frequently available only in the private health sector, thereby restricting access to services.^{26,43} Civil society has an important role in promoting and facilitating cancer screening, including screening for disadvantaged or uninsured individuals. Poor awareness, geographical inaccessibility, fear, and some traditional beliefs further reduce uptake of screening.^{44–47}

Cervical cancer prevention is a regional priority, with the PAHO plan of action aspiring to reduce cervical cancer incidence and mortality by a third by 2030.⁴⁸ All countries in the Caribbean report having cytology services for cervical cancer screening, and some also provide screening by visual inspection with acetic acid.²⁶ However, screening coverage tends to be low at less than 50% in many places (eg, Jamaica, Trinidad and Tobago, and Saint Vincent and the Grenadines), and follow-up of women with abnormal results is often challenging.^{20,46}

Effective cervical screening requires clear organisational structures and quality assurance processes, as well as high participation rates. Previous research has indicated that organised cervical screening has had no effect on cervical cancer mortality in Latin America and the Caribbean.⁴⁴ Most small island nations in the Caribbean are likely to face similar issues, including unmeasured or little participation.²⁶ Opportunistic screening might cause inequalities within countries to increase because uptake is highest among women at low risk for cervical cancer (who might be over-screened), whereas many women at higher risk miss out.⁴⁴

Breast cancer screening (ie, mammography and clinical breast examination) is also of suboptimal quality and coverage, with estimates of coverage ranging from 10% to 70%.²⁰ Scarce mammography units and weak

supporting infrastructure mean these examinations are used primarily as a diagnostic rather than a screening tool.²⁰ Although early clinical diagnosis is important,⁹ strengthening of treatment services is also required.

In the Caribbean, some urologists have advocated for the development of prostate cancer screening based on prostate-specific antigen, despite little evidence for the effectiveness of such screening.^{49–51} The cost-effectiveness of prostate-cancer screening in the region should be formally assessed before any such programme is initiated.

Cancer diagnosis and treatment

Pathology, laboratory, and radiology services

The Caribbean states are well served with basic diagnostic radiology services in both their public and private sectors (table 4),^{48,52,53} with radiologists absent only in the smallest island nations (ie, Montserrat, Saba, and Sint Eustatius), and up to 40 radiologists working in larger countries (except Puerto Rico). However, specialised radiology services are less common, with CT, MRI, and nuclear medicine facilities available only in the private sector in at least seven countries and territories.

Providing timely and comprehensive histopathological diagnosis is difficult because of poor infrastructure, insufficient specialised equipment and supplies, and scarce laboratory services and human and financial resources. Most countries have some diagnostic laboratory and histopathology and cytopathology services across private laboratories, public laboratories, or both; however, at least three Caribbean territories (Anguilla, Montserrat, and Bonaire, Sint Eustatius, and Saba) have no on-island pathology services (table 4). Those islands with insufficient pathology services on-island typically refer specimens to partner laboratories regionally or further abroad. For instance, histology and cytology specimens from the public laboratory in Anguilla are sent to Saint Lucia for analysis, and cervical smears are sent from Saba to the Netherlands. Immunohistochemistry testing is available only sporadically, even in the larger islands, and specimens are often sent to the USA, often at substantial cost to the individual patient.

Approximately 160 pathologists work across 18 countries in the Caribbean (table 4) and there is marked variation in the number of pathologists per capita between HICs and lower-middle-income countries; for example, Puerto Rico, with a population of less than 4 million, has six times more pathologists than Haiti, which has an estimated population of more than 10 million. Of note, 11 (38%) of the included 31 countries did not have information available regarding the number of specialist diagnostic staff (table 4). Inter-island personnel overlap is common, with consultant staff from relatively well resourced countries travelling to the other countries to provide services as requested.

International practice guidelines for cancer diagnosis include morphological (histopathological) evaluation plus

	Publicly available diagnostic services			Publicly available cancer treatment and palliative care							Formal palliative care services available	Oral morphine available in primary care or public health sector
	Pathology	Radiology	Number of specialist diagnostic staff	Operational cancer unit	Chemotherapy	Number of medical oncologists	Radiotherapy centres	Number of radiotherapy centres	Number of radiation oncologists	Cancer surgery		
Anguilla	Not available on island	x-ray, ultrasonography, mammogram, and CT	No pathologists; 1 radiologist	No	No	No	No	No	None	Little	No	Yes
Antigua and Barbuda	Histology and cytology	x-ray, ultrasonography, mammogram, and CT	..	No (1 private facility)	Yes	5	Yes	1	..	Yes	Yes	Yes
Aruba	Histology and cytology	..	1 pathologist; 4 radiologists	Yes	Yes	1	No	None	None	Yes	..	..
The Bahamas	Histology and cytology	x-ray, ultrasonography, mammogram, and CT (private MRI and nuclear medicine)	No pathologists; 2 radiologists	No (1 private facility)	Yes	2	Yes	1	..	Yes	Yes	Yes
Barbados	Histology and cytology	x-ray, ultrasonography, mammogram, and CT (private MRI and nuclear medicine)	5 pathologists; 12 radiologists	No	Yes	4	Yes	1	2	Yes	Yes	Yes*
Belize	Histology and cytology	..	2 pathologists	Yes	Yes	1	No	None	None	Yes	Yes	Yes
Bermuda	Histology and cytology	x-ray, ultrasonography, mammogram, CT, and MRI	2 pathologists; 4 radiologists	Yes	Yes	2	Yes	1	1	Yes	Yes	Yes
Bonaire	Not available on island	x-ray, ultrasonography, and CT	1 radiologist	No	No	None	No	None	None	Little	Yes	..
British Virgin Islands	Histology and cytology	x-ray, ultrasonography, mammogram, and CT (private MRI)	..	No	..	1 (visiting)	No	None	None	Little	..	..
Cayman Islands	Histology, cytology, and immunohistochemistry	x-ray, ultrasonography, mammogram, CT, and MRI (private nuclear medicine)	1 pathologist; 3 radiologists	Yes	Yes	1	No	None	None	Yes	Yes	Yes
Curacao	Histology, cytology, and immunohistochemistry	x-ray, ultrasonography, mammogram, CT, and MRI	2 pathologists; 3 radiologists	No	Yes	3	Yes	1	2	Yes	Yes	Yes
Dominica	..	x-ray, ultrasonography, mammogram, and CT	..	No	Yes	1	No	None	1	..	..	..
Dominican Republic	..	..	..	Yes	Yes	..	Yes	12	26	..	Yes	Yes*
Grenada	Histology and cytology	x-ray, ultrasonography, and mammogram (private CT and MRI)	1 pathologist; 1 radiologist	No	Yes	2	No	None	None	..	No	..
Guadeloupe	Histology and cytology	x-ray, ultrasonography, mammogram, CT, MRI, and nuclear medicine	8 pathologists; more than 30 radiologists	..	Yes	2	Yes	1	5	Yes	Yes	..
Guyana	..	..	..	..	..	..	Yes	1	..	..	..	..
Haiti	Histology and cytology	x-ray, ultrasonography, mammogram, and CT	14 pathologists; 19 radiologists	Yes	Yes	4	No	None	None	Yes	No	No
Jamaica	Histology, cytology, and immunohistochemistry	x-ray, ultrasonography, mammogram, CT, and MRI	21 pathologists; many radiologists	Yes	Yes	15	Yes	4	3	Yes	Yes	Yes

(Table 4 continues on next page)

	Publicly available diagnostic services				Publicly available cancer treatment and palliative care						Formal palliative care services available	Oral morphine available in primary care or public health sector
	Pathology	Radiology	Number of specialist diagnostic staff	Operational cancer unit	Chemotherapy	Number of medical oncologists	Radiotherapy	Number of radiotherapy centres	Number of radiation oncologists	Cancer surgery		
(Continued from previous page)												
Martinique	Histology and cytology	x-ray, ultrasonography, mammogram, CT, MRI, and nuclear medicine	5 pathologists; 35 radiologists	Yes	Yes	3	Yes	1	6	Yes	Yes	Yes
Montserrat	Not available on island	x-ray and ultrasonography	No pathologists; no radiologists	No	No	None	No	None	None	Little	..	..
Puerto Rico	Histology, cytology, and immunohistochemistry	x-ray, ultrasonography, mammogram, CT, MRI, and nuclear medicine	93 pathologists; many radiologists	Yes	Yes	111†	Yes	12	20	Yes	Yes	Yes
Saba	Not available on island	x-ray, ultrasonography	No pathologists; no radiologists	No	No	None	No	None	None	Little	Yes	..
Saint Kitts and Nevis	..	x-ray, ultrasonography, mammogram, and CT (private MRI)	..	Yes	Yes	1	No	None	None	Yes	..	..
Saint Lucia	..	x-ray, ultrasonography, mammogram (private CT and MRI)	..	Yes (private)	Yes	1	No	None	..	Yes	..	..
Saint Vincent and the Grenadines	..	x-ray, ultrasonography, mammogram, and CT	..	Yes	Yes	2	No	None	None	Yes	No	..
Sint Eustatius	Not available on island	x-ray, ultrasonography	No pathologists; no radiologists	No	No	None	No	None	None	Little	Yes	..
Sint Maarten	..	x-ray, ultrasonography, mammogram, and CT	..	No	Yes	1	No	None	None	Yes	..	..
Suriname	Histology, cytology, and immunohistochemistry	..	1 pathologist	Yes	Yes	2	Yes	1	..	Yes	Yes (1 private hospice)	Yes*
Trinidad and Tobago	Histology, cytology, and immunohistochemistry	x-ray, ultrasonography, mammogram, CT, MRI, and nuclear medicine	..	Yes	Yes	10	Yes	3	7	Yes	Yes	Yes*
Turks and Caicos Islands	Histology and cytology	x-ray, ultrasonography, mammogram, CT, and MRI	1 pathologist; 1 radiologist	No	Yes	1 (visiting)	No	None	None	Yes	No	Yes
Virgin Islands	..	x-ray, ultrasonography, mammogram, CT, MRI, and nuclear medicine	..	No	Yes	2	No	None	1	Yes	Yes	..

Data (excluding radiotherapy and number of radiotherapy centres) collected from ministries of health and key informants across the region. *One or more issue affecting availability (eg, not always in stock, reluctance to prescribe, available in private practice). †Including haematologists.

Table 4: Capacity for cancer care and numbers of specialist staff in Caribbean countries and territories (2018)^{18,33}

ancillary immunohistochemical and genetic testing.⁵⁴ The portfolios for many pathology laboratories in the Caribbean do not include the full spectrum of these ancillary tests. Local immunohistochemistry capacity is limited by low volumes of specimens and the absence of centres of excellence, rendering the purchase of many monoclonal antibodies economically imprudent. An explicit tiered approach to laboratory services, such as that recommended in the *Lancet* Series⁵⁵ on pathology and laboratory medicine services, might be a useful approach for the region.

Treatment

In HICs, cancer treatment is generally provided by medical specialists, often within well resourced treatment centres. In the Caribbean context, however, it is difficult to train or attract cancer specialists, and specialised treatment centres might not be feasible given the low caseloads. A regional approach to cancer care is limited by geographical separation and differing policies and practices of countries and territories, each of which has its own medical council and practising licences, which creates barriers to the timely movement of surgical and oncological specialists to provide services in underserved areas.⁵⁶

Pathways for referral of patients with cancer can be inconsistent, even within the same hospital system. No clinical guidelines exist to direct physicians practising primary or secondary care who might be the first to see a patient with cancer. This absence of guidelines can result in ad-hoc and inconsistent patterns of referral, leading to long delays in patients moving between one service and another.⁵⁷ The concept of cancer navigators, who identify and resolve barriers to care to improve outcomes, is new, but interest in this area of care is growing.⁵⁸

Reliance on private care for cancer is widespread, particularly in the English-speaking countries in the Caribbean and, although most oncologists practise in both public and private sectors, access to treatment in the public sector is likely to be hampered by long waiting times and inadequate access to imaging and pathology services. In countries for which there are available data, out-of-pocket expenditure for cancer care varies from 7% to 57% of total health-care expenditure (table 1). Financial hardship for families of patients with cancer is not unusual. Furthermore, some patients might be referred or choose to seek cancer treatment overseas. In most English-speaking countries in the Caribbean, patients are responsible for their own care, which includes seeking a referral centre or physician, making their own travel arrangements, and covering their own finances. However, a few places exist (mostly those that are still British Commonwealth Overseas Territories or French Overseas Territories) where the government funds all or part of the patient's care.

Cancer surgery

In Caribbean nations, it is common for a small group of general surgeons to provide surgical care across a wide

range of specialties.^{56,59} These surgeons have a smaller number of individual cases but cover a much wider range of conditions than their counterparts in HICs.⁵⁶ The general surgeons often work in a resource-constrained environment, with most countries having few intensive-care beds, equipment shortages, and an insufficient supply of surgical consumables and blood-banking stores within the public system.^{56,59,60} Patients requiring complex operations are therefore often transferred to high-volume centres in neighbouring HICs.

Despite the challenges of delivering surgical oncology services in this environment, practice in the region has had many advances. In countries such as The Bahamas, Barbados, Jamaica, and Trinidad and Tobago, multi-disciplinary teams have been incorporated into clinical practice.⁵⁹ Surgical education has advanced in recent decades,^{61,62} with all surgical graduates in the region now strongly encouraged to seek further subspecialty training in HICs.^{56,59,61-63} This training ensures that new graduates are exposed to state-of-the-art treatment practices in HICs, thus raising the standard of care regionally when they return to practise in the Caribbean.^{61,63} Additionally, many surgical societies (eg, the Caribbean Urological Association and the Caribbean College of Surgeons) promote surgical education in their specialty area.

The capacity for complex operations is increasing in the region.^{56,63-67} For example, liver resection for colorectal metastases was previously unavailable in the Caribbean.⁶³ This situation was reversed during the past decade, with the return of five trained hepatobiliary surgeons to the region, and their strategic placement within multidisciplinary centres to ensure optimal service delivery (an early attempt at centralisation). There are three established hepatobiliary centres in the Caribbean: the largest is in Trinidad and Tobago and is staffed by two hepatobiliary surgeons and support staff. This centre has a patient load that would be considered high volume in international centres (defined as >16 procedures per year⁶⁸), with more than 25 major cases annually. The other two hepatobiliary centres are in Jamaica and The Bahamas, each staffed by one hepatobiliary surgeon. As a result of the introduction of these centres, outcomes for colorectal cancer are now similar to those achieved by high-volume treatment centres.^{69,70} Similar results have been published for Whipple's pancreaticoduodenectomy,⁷¹ laparoscopic colectomy,⁶⁶ mastectomy,⁷² and other major operations.⁷³

The region faces challenges in the use of minimally invasive oncology operations, including acquisition and maintenance of expensive equipment, the high cost of disposable instruments, and a paucity of required consumables.⁷⁴ These obstacles have been addressed in some countries by regional integration and collaboration with specialist centres in neighbouring HICs. Instead of transporting patients to treatment centres in HICs, experts have been contracted to provide training and mentorship to local surgical teams, which develop

relevant skills and expertise.^{74,75} By engaging surgical mentors from within the Caribbean, overseen by regional surgical societies, support is provided for local surgeons to overcome obstacles and advance care in their own countries.^{74,75}

Medical oncology

The availability of specialist medical oncology services in the Caribbean varies, ranging from private, well equipped cancer units delivering comprehensive chemotherapy services (eg, in Antigua and Barbuda), to a few public chemotherapy services (eg, in Haiti), to no on-island medical oncology services (eg, in Anguilla, Bonaire, Sint Eustatius, Saba, and Montserrat; table 4). Patients might be referred or choose to seek chemotherapy further abroad, often at their own expense. Many countries have inadequate numbers of medical oncologists and haematologists per capita. For instance, Jamaica and Trinidad and Tobago have fewer than half the number of medical oncologists per capita than was suggested to be sufficient to meet demand in previous estimates from the USA (ie, 1.8 medical oncologists per 100 000).⁷⁶ Haiti has only four medical oncologists, and the Turks and Caicos Islands' oncology service is staffed by oncology nurses supported by a visiting clinical oncologist from a larger island (table 4). Provision of specialist oncology training in the region is currently limited to Jamaica, with plans to establish a programme in Trinidad and Tobago; however, clinicians who are not nationals of the island often require sponsorship by their government to undertake specialist training, and retention of overseas-trained specialists can be problematic.⁷⁶

Overburdened health systems struggle to provide quality and timely cancer care in the context of competing priorities, poor diagnostic and supporting infrastructure, and insufficient health-care workforces.³⁷ Restricted health-care coverage and high treatment costs exacerbate a propensity for late-stage diagnosis and further disadvantage many vulnerable groups, while even those with health insurance are often left financially drained following treatment.^{45,77} Many countries include WHO's essential oncology medications on their national medicines formularies; however, poor bargaining power means they often struggle to procure these expensive drugs and ensure a constant supply of quality medicines. Pooled procurement frameworks, such as those provided by the PAHO Strategic Fund and the Organisation of Eastern Caribbean States, can enhance access to specific medications, including antineoplastics, by allowing members to negotiate lower set prices.

As with other aspects of cancer treatment, partnerships with specialist centres in HICs can be very effective in improving access to oncological treatment for Caribbean states. One such partnership is the Sick Kids Caribbean Initiative, a non-profit partnership between the Hospital for Sick Kids in Toronto, Canada, and six Caribbean countries. This programme has improved outcomes for

children with cancer by improving local access to treatment, infrastructure, and workforce capacity (including training of oncologists, nurses, and technologists) and by providing ongoing mentoring via case consultations and teleconferences.^{10,78}

Radiotherapy

About 50% of patients with newly diagnosed cancer (an estimated 78 000 people annually in the Caribbean) will need radiotherapy at least once during their illness.⁷⁹ Cancer outcomes are therefore highly influenced by the availability, distribution, and cost of radiotherapy. Compelling evidence shows that investment in radiotherapy not only enables treatment and improves outcomes for many patients with cancer, but also brings economic benefits.⁸⁰

Data from the Directory of Radiotherapy Centres indicate that there are around 70 megavoltage radiotherapy machines across 13 countries in the Caribbean, with capacity to treat about 20 000 cases annually; however, two-thirds of these machines are located in just two countries (Dominican Republic and Puerto Rico), and 18 countries have no radiotherapy capabilities (table 4).³² Dominican Republic has seen a substantial expansion and modernisation of facilities since radiotherapy was included in their national health insurance scheme in 2009. In Dominican Republic, workforce gaps have been filled by a radiation oncology workforce that was predominantly trained overseas, although a local residency programme began in 2010, which has two residents graduate annually, and support staff are largely trained on the job.⁸¹ Jamaica has procured two linear accelerators with the capacity to deliver intensity-modulated radiotherapy. In the French Caribbean, both Martinique and Guadeloupe have centres equipped with modern linear accelerator technology.

In countries without radiotherapy facilities, patients requiring this treatment are obliged to travel to other Caribbean islands or to Canada, Colombia, the Netherlands, the UK, or the USA. For example, contractual arrangements exist between the Turks and Caicos Islands and Jamaica, The Bahamas, and the Dominican Republic to provide radiotherapy for the population of the Turks and Caicos Islands. Jamaica is the only country in the region offering linear-accelerator-based three-dimensional conformal radiotherapy and intensity-modulated radiotherapy treatment in the public sector with no user fees at the point of access. In Bermuda, radiotherapy access in the public sector is supported by a not-for-profit charity. In Antigua, The Bahamas, Barbados, and Trinidad and Tobago, patients have access to public facilities for treatment on cobalt (low energy) machines, and governments subcontract with private facilities to provide linear accelerator-based radiotherapy at a subsidised price.

Haiti, with around 800 new cancer cases annually, has no radiotherapy facilities and very few resources for

health care.⁸¹ In addition to the restricted availability, high cost of radiotherapy outside of Haiti renders it inaccessible for many patients in this country. The modernisation of Dominican Republic's radiotherapy programme has actually made it more challenging for Haitian patients to receive treatment, with the cost of care increasing prohibitively from around \$2000 for cobalt-led treatment to approximately \$10 000 for linear accelerator-based care (DeGennaro Jr V, Innovating Health International, personal communication).

One of the most difficult challenges the Caribbean faces is the ability to recruit, train, and retain highly specialised staff who are essential to support local radiotherapy centres.⁷⁶ Countries with very few megavoltage facilities are likely to struggle to achieve the depth and breadth of expertise necessary to deliver radiotherapy that meets internationally acceptable standards.

Palliative care services

In the Caribbean, the combination of ageing populations, increasing NCD prevalence, high cancer incidence, late presentation of cancer,^{82,83} and high mortality from both cardiovascular and malignant disease²⁷ means that there is a crucial need to improve quality of life and provide relief from suffering for those with advanced disease. Estimates suggest that such diseases result in more than 81 million days of serious health-related suffering per year, including 25 million days of pain and dyspnoea.⁸⁴

Palliative care services are in various stages of development in the region. Although many islands have isolated pockets of palliative care services, none have fully integrated palliative care into their health systems.⁸ Models of palliative care delivery include NGOs, not-for-profit, stand-alone hospice units, ambulatory clinics, hospice-at-home services, and government-funded inpatient hospital services.⁵⁷ Four countries (Barbados, Jamaica, Trinidad and Tobago, and the Cayman Islands) have national palliative care associations and a regional association is in early development.

Access to palliative care and pain relief in the Caribbean is poor. Even in high-income islands, public health-care systems are often overburdened and under-resourced,⁵⁷ and the concept of palliative care is not well understood, meaning that palliative care might not be included in cancer-control plans in any valuable way.⁸⁵ A pervasive opiophobia among health-care professionals and policy makers is exacerbated by little or no training in palliative care available in the region, few doctors and health professionals with palliative care training or expertise, few specialist palliative care facilities, isolated service provision, and low prioritisation of access to opioids, leaving many patients with unrelieved pain and suffering.⁸⁴ Palliative care is recognised as an essential component of universal health coverage.⁸⁴ To meet the enormous need for this service in the Caribbean, each country needs to incorporate clear guidelines for palliative care service delivery into national NCD and

cancer plans. Most islands belong to CARICOM and the Caribbean Palliative Care Association and these institutions can serve as platforms for information sharing, guideline development, regional education initiatives, and streamlining of national opioid policies.

Traditional and alternative medicine

Traditional medicine refers to ancient and culture-bound medical practices, which have existed in human societies for millennia. The practice of traditional medicine varies widely, in keeping with the societal and cultural heritage of different countries. WHO notes that more than 80% of the population in low-income countries uses traditional medicine, such as herbal remedies, for the management of health.⁸⁶ The widespread use of traditional and complementary and alternative medical therapies in the treatment of cancer is no exception. Therapeutic use of cannabis has increased dramatically in the Caribbean, with Jamaica leading the way following a 2015 legal amendment allowing for its medicinal use.⁸⁷ There are some concerns about patients' frequent use of traditional medicine as an alternative to conventional cancer treatment, particularly where access to mainstream treatment is either unavailable or very costly, because this often means that patients delay presentation until the disease is either locally advanced or metastatic.⁵⁷ Physicians trained in HICs have little formal training in traditional medicine or complementary and alternative therapies, and consequently are often uncomfortable engaging patients in this area.⁸⁸ Although many of these therapies might be effective in managing cancer or treatment-related symptoms, insufficient evidence exists to support their use as alternative treatments. More research on the prevalence of complementary and alternative medicine use in the Caribbean and the efficacy of common remedies is urgently needed. An integrative medicine approach would be ideal.

Travel for cancer services and overseas referral

Patients are often obliged to travel for cancer treatment, either to other Caribbean islands or to other regions, particularly the USA and Canada. Within the Organisation of Eastern Caribbean States, there is substantial health-related travel between islands, and patients in the Dutch-speaking and French-speaking islands might also travel to Europe for care. The Turks and Caicos Islands has links with Jamaica, The Bahamas, and the Cayman Islands for access to cancer treatment services, including complex surgery and radiotherapy. Unfortunately, many patients cannot benefit from such links because of travel restrictions, financial issues, absence of health-insurance coverage, or an absence of social support structures.⁷⁷ There are few data available on overseas travel for cancer care, because most travel and treatment costs and arrangements are often borne by patients and their families.

Panel: Recommendations for cancer control in the Caribbean region**Policy and planning**

- A Caribbean-wide comprehensive cancer strategy and regional plan of action should be developed, including plans for shared funding, pooling, and bulk purchasing, and for regional partnerships in the Caribbean. Island-specific issues can be elaborated within a broader cancer strategy. This strategy should be adopted by health ministers through the existing framework of the Caribbean Community (CARICOM) Council for Human and Social Development, including incorporation of key indicators into the Caribbean Cooperation in Health Phase Four targets, with planned annual monitoring. This strategy should also be brought to the attention of the lead head for health and human development in CARICOM, and collective solutions sought via the CARICOM Council of Finance and Planning for issues of fiscal space and financing.

Expanding systems for cancer intelligence

- Necessitate the mapping of cancer burden and services currently available across the region; identifying specific needs and opportunities to improve service capacity; and facilitating inter-island resource sharing and exchange of care. These actions will require collaboration and partnership between public and private sectors, civil society, and international partners.
- Investment in population-based cancer registries, such as through the International Agency for Research on Cancer Caribbean Hub, as part of the Global Initiative for Cancer Registry Development.
- Quality-improvement methods for cancer diagnosis and treatment, including integrating key metrics and continuous monitoring of quality indicators, such as time from diagnosis to treatment, to ensure quality of care and optimal outcomes for all patients with cancer.

Improving risk reduction, cancer prevention, and early diagnosis strategies

- Legislation, regulations, and public policies should be improved to reduce the main risk factors for cancer. These improvements should include increasing tobacco taxes; introducing regulations to provide 100% smoke-free public spaces throughout CARICOM, with a focus on providing a 100% smoke-free Caribbean by 2022; and implementing the Council for Trade and Economic Development-ratified statement for tobacco labelling (as agreed by the CARICOM heads of government in 2016) to reduce tobacco use. Improvements should also include addressing the obesity epidemic by implementing in a stepwise manner a suite of evidence-informed measures, such as the CARICOM and the Caribbean Public Health Agency (CARPHA) six-point policy package for healthier food environments,²¹ and joint work

with the CARICOM Council for Trade and Economic Development to implement policies with careful attention to policy sequencing.

- Prevention of cervical cancer should be prioritised in line with a regional cervical cancer plan of action and global elimination strategy. All countries should commit to primary prevention with the human papillomavirus (HPV) vaccination in girls aged 9–13 years, reaching a vaccination coverage of at least 80%.⁹⁵ All Caribbean countries should also commit to secondary prevention of cervical cancer by screening women aged between 30 and 49 years with either HPV tests, visual inspection with acetic acid, or Pap smear (cervical cytology) every 3–5 years (HPV test every 5 years). Screening coverage should reach at least 70% in this population and follow-up care for those with precancerous cervical lesions ensured.
- To ensure these recommendations can be properly achieved, emphasis should be on increasing health literacy, improving public education, and using traditional and new social media marketing campaigns to drive a social movement and demand for improved cancer risk reduction public policies.

Providing access to quality treatment for cancer

- Training and education of the health-care workforce should be invested in, especially in pathology, diagnostics, medical and radiation oncology, surgery, and palliative medicine. This education will require engagement with local training institutions (eg, the University of the West Indies) and the regional heads of health ministries through CARICOM for health workforce planning for cancer control, along with agreements with neighbouring high-income countries (HICs) to help develop human resources and training. In the short term, focusing on multiskilling existing health-care personnel should be prioritised. The long-term goal is not only a well trained workforce, but also to build capacity in terms of intraregional training networks.
- Investment should be made in service infrastructure and processes, equipment, and supplies. Cancer-control plans should prioritise equitable access for both adults and children to diagnosis, cancer surgery, radiotherapy, medical oncology, and palliative-care services. Resource-stratified guidelines for cancer care should be embraced, and the recently developed Caribbean Association of Oncology and Hematology cancer care guidelines should be further disseminated and providers trained on their use. Referral pathways to secondary or tertiary care need to be properly embedded in the health system to enable timely diagnosis and treatment of those suspected of having cancer. Creative health-care financing and collaborative partnerships will be essential to ensuring access to radiotherapy.

For more on the **Global Initiative for Cancer Registry Development** see <http://gicr.iarc.fr>

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(Panel continued from previous page)

- Access to, and the availability and quality of, drugs specific to cancer and supportive care as specified by the WHO Essential Medicines List (including opioids) should be improved. These medicines should be on the Caribbean Regulatory System recommended list for CARPHA member states. Given the high cost of some essential cancer drugs, it is urgent to bring manufacturers and distributors together to explore options for increasing access and reducing costs. Consideration should be given to use of the Pan American Health Organization's strategic fund as a pooled procurement mechanism, enhancing access to essential medicines and other health supplies (the fund is intended to strengthen strategic supply management systems and support technical input to manage demand, guarantee rational use, and avoid running out of stock in the countries of the Americas).⁹⁶ Consideration should also be given to scaling up the Organisation of Eastern Caribbean States' pooled procurement service.

Expanding existing research networks

- Ongoing support of the matrix of regional institutions and networks involved in health and cancer research

needs to be fostered. Caribbean-specific research questions should be prioritised, defined, and addressed. Institutions, such as the Council on Health Research for Development, the Caribbean Institute for Health Research, and CARPHA, which incorporates the role of the former Caribbean Health Research Council, should have a more active and engaged role in stimulating and fostering investments in cancer research that generates information relevant to the region's efforts to address the prevention and control of cancer.

Building capacity for palliative care

- Using the WHO public health model for palliative care, a resource-stratified approach should be adopted, including integration of palliative care into existing community-based and primary health-care settings. An essential package of services should be implemented within all Caribbean small island nations, as recommended by the *Lancet* Commission⁸⁴ on global access to pain relief and palliative care. Physicians, nurses, and other allied health-care providers also need training in palliative medicine.

Research

Research has a pivotal role in advancing cancer-control planning and care, because it provides a means of evaluating and monitoring progress in cancer treatment. The Caribbean has a history of high-quality health research with substantial regional and international impact,⁸⁹ including extensive research on NCDs. Despite the endorsement of a research agenda by the region's senior policy makers,⁹⁰ disparities in research capacity and output remain a challenge; the region is under-represented in basic science, and in population-based, clinical-based, and community-based studies. During the past few years, however, progress has been made in increasing both the funding for research projects relevant to the region and the number of Caribbean research scientists.^{91,92}

Competing priorities, a paucity of research collaboration and impactful research publications, and inadequate funding opportunities and research resources have been identified as barriers to research in the region.⁹³ The Caribbean Health Research Council was merged into CARPHA in 2013, with the aim of improving links between research and policy. The US National Cancer Institute provides funds for projects specific to the Caribbean; for example, the Clinical and Epidemiological Research on Chronic Disease in the Caribbean grant.

Regional research networks, such as the Eastern Caribbean Health Outcomes Research Network, the African Caribbean Cancer Consortium, and the Jamaica Cancer Care and Research Institute, actively conduct and support cancer research enhancement activities in the Caribbean. The Caribbean Centre for Health Systems

Research and Development (University of the West Indies, Trinidad and Tobago), established in 2018, is a welcome addition to the research landscape, with mandates to facilitate the uptake of research into health policy, programming, and practice.

Conclusion and recommendations

The increasing cancer burden in Caribbean small island nations reflects multiple drivers, including excess tobacco and alcohol use, increasing obesity, increasingly sedentary lifestyles, and persistent carcinogenic infections. The capacity of Caribbean health systems to prevent cancer and manage new cases remains inadequate. Caribbean small island nations, irrespective of income classification, face severe challenges in delivering cancer care and control. The rising cancer burden stresses already weak health systems and economic infrastructure, and poses unique challenges, particularly because the cancer-control experiences of HICs cannot always be applied to lower-middle-income countries.⁹⁴ Strengthening cancer-control programmes should start with those interventions that are the most cost-effective and benefit the largest populations (panel). For example, in the absence of any existing cancer-control plan, rapid gains can be made via an initial focus on prevention (including tobacco control), improving diagnostic capacity, basic treatment for a few common cancers, and palliative care.⁹⁷ A resource-stratified approach is particularly pertinent in this context. Although local cancer-control resources might be inadequate in many Caribbean small island nations, expectations of universal health coverage and the proximity to the USA and Canada

Search strategy and selection criteria

We identified references through searches of PubMed and grey literature to Dec 31, 2018; no earliest date for review was specified. We used the search terms “Caribbean”, “cancer”, “oncology”, “small island developing states”, “SIDS”, “palliative care”, “traditional medicine”, “alternative medicine”, “tobacco control”, “NCD control”, “surveillance”, “prevention”, “screening”, and “international referrals”. We searched grey literature from key regional and international agencies, including from WHO, World Bank, UN, the Caribbean Public Health Agency, Caribbean Community, and Pan American Health Organization, and through several non-governmental sources. We also requested specific data on cancer-control activities from ministries of health and clinicians within each country included in this paper (see appendix p 2 for list of key informants). We only reviewed literature in English. Despite multiple requests, some countries did not provide all relevant data. References were included on the basis of originality and relevance to the broad scope of this Series paper.

mean that there is public pressure to improve access to high-quality cancer care, either at home or abroad.

Cancer care and cancer-control responses should not exist in isolation from strengthening health services, including primary-care services and management of other chronic diseases. Many initiatives targeted at improving cancer control (such as improved health literacy, diagnostic and referral processes, data collection strategies, health financing, and palliative care) are applicable across the spectrum of chronic NCDs. This so-called diagonal approach offers an effective framework for health system strengthening.³⁷ Regional health-policy makers, researchers, and health-care professionals are committed to addressing NCDs, including cancer, via universal health coverage, and are employing innovative solutions to overcome existing obstacles. Much work needs to be done to reproduce examples of good practice across the region, and to implement new evidence-based solutions to improve care across the cancer continuum, including palliative care (panel). The region offers many examples of innovative action to build capacity and positively affect cancer outcomes; these examples include improving cancer surveillance through establishment of a Caribbean cancer registry hub, development of regional resource-stratified treatment guidelines, improved access to care for childhood cancers, and progressive models of supportive and palliative care.

Contributors

DSp was the lead author and participated in writing of the palliative care and recommendations sections. DSa, SS, and JH designed the concept. DSp, DSa, RD, SS, and JH reviewed and edited all sections. RD collected the data, drafted the tables and figures, and participated in the writing of all sections. SL led the sections on the political, economic and health systems, and cancer-control planning in the region, with input from GA-B and DM. FB drafted the surveillance section, with input from GT. DSi drafted the immunisation and screening section. BH drafted the

diagnosis section. SC drafted the surgery section. GW and OG led the medical oncology section, with input from MN. MB, SE-B, CF, and DSp drafted the radiotherapy section. DSp drafted the travel and traditional medicine sections. CR drafted the research section. All authors reviewed and approved the final submitted version of the manuscript.

Declaration of interests

SS has received consultancy support from Roche, Clinigen, Eli Lilly, and Novartis, outside of the submitted work. DM is a National Institutes of Health federal employee. The views expressed here are those of the authors only and do not represent any official position of the National Cancer Institute or National Institutes of Health. The views expressed in the report do not necessarily represent the views of the US federal government. All other authors declare no competing interests.

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References

- 1 Pan American Health Organization: PLISA health information platform for the Americas. Core indicators. Dec 3, 2018. <http://www.paho.org/data/index.php/en/indicators/visualization.html> (accessed March 1, 2019).
- 2 Bermuda Health Council. 2018 National health accounts report: Bermuda health system finance and expenditure for the fiscal year 2016–2017. Hamilton: Bermuda Health Council, 2018.
- 3 Sutton P. Politics in the commonwealth Caribbean: the post-colonial experience. *Rev Eur Estud Latinoam Caribe* 1991; **51**: 51–66.
- 4 The World Bank. World Bank country and lending groups. 2019. <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> (accessed March 1, 2019).
- 5 United Nations Economic Commission for Latin America and the Caribbean. The economics of climate change in the Caribbean. https://unctad.org/meetings/en/Contribution/cimem7_2014_C1_ClimateChange_Caribbean_Summary_en.pdf (accessed July 18, 2019).
- 6 Taylor MA, Stephenson TS, Anthony Chen A, Stephenson KA. Climate change and the Caribbean: review and response. *Caribbean Studies* 2012; **40**: 169–200.
- 7 Luciani S, Hutton M, Hennis A, Hassell T. Cancer prevention and control in the Caribbean. *Cancer Control* 2017; **53**–61.
- 8 Lynch T, Connor S, Clark D. Mapping levels of palliative care development: a global update. *J Pain Symptom Manage* 2013; **45**: 1094–106.
- 9 Strasser-Weippl K, Chavarri-Guerra Y, Villarreal-Garza C, et al. Lancet Commission: progress and remaining challenges for cancer control in Latin America and the Caribbean. *Lancet Oncol* 2015; **16**: 1405–38.
- 10 Spence D, Argentieri MA, Andall-Brereton G, et al. Advancing cancer care and prevention in the Caribbean: a survey of promising strategies in the region. *Lancet Oncol* 2019; published online Aug 5. [http://dx.doi.org/10.1016/S1470-2045\(19\)30516-9](http://dx.doi.org/10.1016/S1470-2045(19)30516-9).
- 11 Lawson M, Martin M. The commitment to reducing inequality index 2018: a global ranking of governments based on what they are doing to tackle the gap between rich and poor. OXFAM. Oct 9, 2018. <https://www.oxfam.org/en/research/commitment-reducing-inequality-index-2018> (accessed March 28, 2019).
- 12 Economic Commission for Latin America and the Caribbean. The Caribbean outlook 2018. UN. https://repositorio.cepal.org/bitstream/handle/11362/43581/4/S1800607_en.pdf (accessed July 10, 2018).
- 13 Pan-American Health Organization. Caribbean Cooperation in Health (CCH). https://www.paho.org/spc-crb/index.php?option=com_content&view=article&id=376:caribbean-cooperation-in-health-cch&Itemid=1459 (accessed March 3, 2019).
- 14 Caribbean Public Health Agency. Pathway to 2025: strategic plan 2018 to 2020. Port of Spain: The Caribbean Public Health Agency, 2018.
- 15 Ottersen T, Elovainio R, Evans DB, et al. Towards a coherent global framework for health financing: recommendations and recent developments. *Health Econ Policy Law* 2017; **12**: 285–96.
- 16 Preston C, Chahal H, Porrás A, et al. Regionalization as an approach to regulatory systems strengthening: a case study in CARICOM member states. *Rev Panam Salud Publica* 2016; **39**: 262–28.

- 17 CARICOM. Declaration of Port-of-Spain: uniting to stop the epidemic of chronic NCDs. Greater Georgetown: CARICOM, 2007.
- 18 Pan American Health Organization, WHO, CARICOM. Evaluation of the 2007 CARICOM heads of government Port of Spain NCD summit declaration. 2017. http://oncaribbeanhealth.org/wp-content/uploads/2018/01/POSDEVAL_The-Investigators-report_FINAL.pdf (accessed July 22, 2019).
- 19 Pan American Health Organization and WHO. Countries and territories (n=40) with HPV vaccine policies: Region of the Americas, June 2019. https://www.paho.org/hq/images/stories/AD/FCH/IM/new_vaccines/hpv_introduction_e_.png?ua=1 (accessed July 29, 2019).
- 20 Pan American Health Organization. Women's cancer and comprehensive care in the Caribbean—situation and challenges. Geneva: World Health Organization, 2016.
- 21 Healthy Caribbean Coalition. 2017 Port of Spain NCD summit grid report. September, 2017. <https://www.healthycaribbean.org/pos-ncd-summit-progress-grids> (accessed March 12, 2018).
- 22 WHO. WHO vaccine-preventable diseases: monitoring system 2019 global summary. 2019. http://apps.who.int/immunization_monitoring/globalsummary (accessed April 7, 2019).
- 23 Pan American Health Organization, WHO. National country capacity survey for NCDs and RFs. 2017. https://www.paho.org/hq/index.php?option=com_content&view=article&id=13440:ccs&Itemid=42359&lang=en (accessed July 22, 2019).
- 24 WHO. Global status report on noncommunicable diseases. Geneva: World Health Organization, 2014.
- 25 WHO. Noncommunicable diseases country profiles 2018. Geneva: World Health Organization, 2018.
- 26 Franklin RA, Simeon DT. Urgent need to strengthen and expand screening and other cancer control programs in the CARICOM Caribbean. *Cancer Causes Control* 2017; **28**: 1177–85.
- 27 Razzaghi H, Quesnel-Crooks S, Sherman R, et al. Leading causes of cancer mortality—Caribbean region, 2003–2013. *MMWR Morb Mortal Wkly Rep* 2016; **65**: 1395–400.
- 28 Ferlay J, Colombet M, Soerjomataram I, et al. Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods. *Int J Cancer* 2019; **144**: 1941–53.
- 29 Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. 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.
- 30 Global Cancer Observatory. Cancer today population fact sheets. 2018. International Agency for Research on Cancer: World Health Organization. <http://gco.iarc.fr/today/fact-sheets-populations> (accessed Sept 17, 2018).
- 31 Pan American Health Organization and WHO. Health situation in the Americas: core indicators 2018. http://iris.paho.org/xmlui/bitstream/handle/123456789/49511/CoreIndicators2018_eng.pdf?sequence=1&isAllowed=y&ua=1 (accessed July 23, 2019).
- 32 Belpomme D, Irigaray P. Environment as a potential key determinant of the continued increase of prostate cancer incidence in martinique. *Prostate Cancer* 2011; **2011**: 819010.
- 33 Bunker CH, Patrick AL, Konety BR, et al. High prevalence of screening-detected prostate cancer among Afro-Caribbeans: the Tobago prostate cancer survey. *Cancer Epidemiol Biomarkers Prev* 2002; **11**: 726–29.
- 34 Center MM, Jemal A, Lortet-Tieulent J, et al. International variation in prostate cancer incidence and mortality rates. *Eur Urol* 2012; **61**: 1079–92.
- 35 Cattin LM, Pinheiro PS, Callahan KE, Hage R. Twenty-first century cancer patterns in small island nations: Grenada and the English-speaking Caribbean. *Cancer Causes Control* 2017; **28**: 1241–49.
- 36 Taitt HE. Global trends and prostate cancer: a review of incidence, detection, and mortality as influenced by race, ethnicity, and geographic location. *Am J Mens Health* 2018; **12**: 1807–23.
- 37 UN. Resolution adopted by the General Assembly on 14 November 2014: 69/15 SIDS accelerated modalities of action (SAMOA) pathway. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/69/15&Lang=E (accessed July 22, 2019).
- 38 Ministry of Health and Environment. National policy and multisectoral action plan for the prevention and control of non-communicable diseases in Antigua and Barbuda. April 3, 2015. https://www.iccp-portal.org/system/files/plans/ATG_B3_ncd%20policy%20pdf.pdf (accessed July 22, 2019).
- 39 Ndumele A, Kostecky B, Flanigan J. Caribbean cancer control leadership forums. *Proc Am Soc Clin Oncol* 2017; **3** (suppl 2): A61 (abstr).
- 40 National Cancer Institute. Caribbean leadership forum meeting report 2015. <https://www.paho.org/hq/dmdocuments/2016/Caribbean-Leadership-Forum-Report-May2015.pdf> (accessed Oct 7, 2018).
- 41 Ropero Álvarez AM, Pérez-Vilar S, Pacis-Tirso C, et al. Progress in vaccination towards hepatitis B control and elimination in the Region of the Americas. *BMC Public Health* 2017; **17**: 325.
- 42 Ladner J, Besson M-H, Hampshire R, Tapert L, Chirenje M, Saba J. Assessment of eight HPV vaccination programs implemented in lowest income countries. *BMC Public Health* 2012; **12**: 370.
- 43 Pan American Health Organization, WHO, Healthy Caribbean Coalition. Situational analysis of cervical cancer prevention and control in the Caribbean. December, 2013. <https://www.paho.org/hq/dmdocuments/2013/Caribbean-cxca-situation-analysis-2013.pdf> (accessed July 22, 2019).
- 44 Murillo R, Almonte M, Pereira A, et al. Cervical cancer screening programs in Latin America and the Caribbean. *Vaccine* 2008; **26** (suppl 11): L37–48.
- 45 Thomas-Purcell KB, Tarver WL, Richards C, Primus-Joseph M, McBarnette B. Grenadian women's perspectives on screening for breast and cervical cancer: a participatory approach to understanding prevention. *Glob J Health Educ Promot* 2016; **17**: 1–16.
- 46 Lynch-George G, Maharaj RG. Cervical smears at public health centres in eastern Trinidad: coverage and follow-up, 2009–2010. *West Indian Med J* 2014; **63**: 575–81.
- 47 Doede AL, Mitchell EM, Wilson D, Panagides R, Oriá MOB. Knowledge, beliefs, and attitudes about breast cancer screening in Latin America and the Caribbean: an in-depth narrative review. *J Glob Oncol* 2018; **4**: 1–25.
- 48 56th Directing Council, 70th session of the Regional Committee of WHO for the Americas. Plan of action for cervical cancer prevention and control 2018–2030. Washington, DC: Pan American Health Organization, 2018.
- 49 Roberts R, Mitchell C, Tancawan AL, Pedican M, Jones GW. The prostate cancer screening clinic in the Bahamas: a model for low- and middle-income countries. *Cancer Causes Control* 2017; **28**: 1187–93.
- 50 Aiken WD, Eldemire-Shearer D. Prostate cancer in Jamaica and the wider Caribbean: it is time to consider screening. *West Indian Med J* 2012; **61**: 90–93.
- 51 Persaud S, Aiken WD. Prostate-specific antigen-based screening in Afro-Caribbean men: a survey of members of the Caribbean Urological Association. *Ecancermedicalscience* 2018; **12**: 842.
- 52 International Atomic Energy Agency. DIRAC (Directory of Radiotherapy Centres). 2019. <https://dirac.iaea.org/Data/Country> (accessed March 1, 2019).
- 53 RAD-AID. Haiti: radiology services. <https://www.rad-aid.org/countries/latin-america-and-the-caribbean/haiti> (accessed July 18, 2019).
- 54 National Comprehensive Cancer Network. NCCN guidelines. https://www.nccn.org/professionals/physician_gls/default.aspx#detection (accessed July 29, 2019).
- 55 Wilson ML, Fleming KA, Kuti MA, Looi LM, Lago N, Ru K. Access to pathology and laboratory medicine services: a crucial gap. *Lancet* 2018; **391**: 1927–38.
- 56 Naraynsingh V, Bahadursingh S, Maharaj R, Harnarayan P, Cawich SO. Surgery in the West Indies: a perspective from Trinidad. *J Curr Med Res Pract* 2014; **4**: 126–29.
- 57 Spence D, Argentieri MA, Greaves N, et al. Palliative care in the Caribbean through the lens of women with breast cancer: challenges and opportunities. *Curr Breast Cancer Rep* 2018; **10**: 157–69.
- 58 Braun KL, Kagawa-Singer M, Holden AEC, et al. Cancer patient navigator tasks across the cancer care continuum. *J Health Care Poor Underserved* 2012; **23**: 398–413.
- 59 Cawich SO, Johnson PB, Shah S, et al. Overcoming obstacles to establish a multidisciplinary team approach to hepatobiliary diseases: a working model in a Caribbean setting. *J Multidiscip Healthc* 2014; **7**: 227.
- 60 Fletcher P, McDonald A, McCartney T, Carpenter R. Surgery in Jamaica. *Arch Surg* 2003; **138**: 1150–53.

- 61 Cawich SO, Harding HE, Crandon IW, et al. Leadership in surgery for public sector hospitals in Jamaica: strategies for the operating room. *Perm J* 2013; **17**: e121.
- 62 Cawich SO, Johnson PB, Dan D, Naraynsingh V. Surgical leadership in the time of significant generational diversity. *Surgeon* 2014; **12**: 235–56.
- 63 Cawich S, Abu-Hilal M, Simpson L, Pearce N. Training for hepatobiliary surgery in the modern laparoscopic era. *West Indian Med J* 2013; **62** (suppl 4): 24–25.
- 64 Cawich SO, Albert M, Singh Y, et al. Clinical outcomes of single incision laparoscopic cholecystectomy in the anglophone Caribbean: a multi centre audit of regional hospitals. *Int J Biomed Sci* 2014; **10**: 191.
- 65 Dan D, Naraynsingh V, Cawich S, Jonnalagadda R. The history of laparoscopic general surgery in the Caribbean. *West Indian Med J* 2012; **61**: 467–71.
- 66 Plummer J, Mitchell D, Arthurs M, et al. Laparoscopic colectomy for colonic neoplasms in a developing country. *Int J Surg* 2011; **9**: 382–85.
- 67 Singh Y. Single incision laparoscopy with conventional ports and instruments: a new technique and review of case series. *Caribb Med J* 2013; **75**: 17–18.
- 68 Birkmeyer JD, Siewers AE, Finlayson EV, et al. Hospital volume and surgical mortality in the United States. *N Engl J Med* 2002; **346**: 1128–37.
- 69 Cawich SO, Thomas DA, Ramjit C, Bhagan R, Naraynsingh V. Complex liver resections for colorectal metastases: are they safe in the low-volume, resource-poor Caribbean setting? *Case Rep Surg* 2015; **2015**: 570968.
- 70 Cawich S, Maharaj R, Milne D, et al. Outcomes after major hepatectomy are acceptable in low volume centres in the Caribbean. *JCCS* 2018; **2**: 37–38.
- 71 Cawich S, Maharaj R, Milne D, et al. Whipple's pancreaticoduodenectomy in resource poor Caribbean countries. *JCCS* 2018; **2**: 17–18.
- 72 Naraynsingh V, Rambally R, Maharaj R, Dan D, Hariharan S. Early hospital discharge following breast cancer surgery in the West Indies: a Trinidad study. *J Natl Med Assoc* 2011; **103**: 754–56.
- 73 Shukla PJ, Sakpal SV, Naraynsingh V. Centralization of surgery: is it applicable to less populous nations? *HPB (Oxford)* 2008; **10**: 506–07.
- 74 Wilson C, Cawich S, Simpson L, Baker A. Starting a laparoscopic surgery service in a rural community hospital in Jamaica: successes and challenges of the Percy Junor Hospital experience. *Caribb Med J* 2014; **76**: 8–11.
- 75 Cawich SO, Pooran S, Amow B, et al. Impact of a medical university on laparoscopic surgery in a service-oriented public hospital in the Caribbean. *Risk Manag Healthc Policy* 2016; **9**: 253.
- 76 Alleyne-Mike K. The Caribbean community clinical oncology workforce: analyzing where we are today and projecting for tomorrow. *J Oncol* 2018; **2018**: 7286281.
- 77 Spence D, Crath R, Hibbert A, et al. Supporting cancer patients in Jamaica—a needs assessment survey. *West Indian Med J* 2010; **59**: 59–66.
- 78 Denburg A, Arora B, Arora RS, et al. Access to essential medicines for children with cancer: a joint SIOP-CCI position statement. *Lancet Oncol* 2017; **18**: 20–22.
- 79 Barton MB, Jacob S, Shafiq J, et al. Estimating the demand for radiotherapy from the evidence: a review of changes from 2003 to 2012. *Radiother Oncol* 2014; **112**: 140–44.
- 80 Atun R, Jaffray DA, Barton MB, et al. Expanding global access to radiotherapy. *Lancet Oncol* 2015; **16**: 1153–86.
- 81 Gajjar SR, Mellon EA, Castaneda SA, et al. Assessment of the radiation therapy model in the Dominican Republic and its impact on the Caribbean islands. *Int J Radiat Oncol Biol Phys* 2018; **101**: 503–09.
- 82 Plummer JM, Leake P-A, Ferron-Boothe D, Roberts PO, Mitchell DI, McFarlane ME. Colorectal cancer survival in Jamaica. *Ann Med Surg* 2016; **6**: 26–29.
- 83 Pan American Health Organization and WHO. Core indicators 2016: health situation in the Americas 2016. <http://iris.paho.org/xmlui/bitstream/handle/123456789/31289/CoreIndicators2016-eng.pdf?sequence=1&isAllowed=y> (accessed July 24, 2018).
- 84 Knaul FM, Farmer PE, Krakauer EL, et al. *Lancet* Commission: alleviating the access abyss in palliative care and pain relief—an imperative of universal health coverage. *Lancet* 2018; **391**: 1391–454.
- 85 Maharaj S, Harding R. The needs, models of care, interventions and outcomes of palliative care in the Caribbean: a systematic review of the evidence. *BMC Palliat Care* 2016; **15**: 9.
- 86 WHO. WHO traditional medicine strategy 2014–2023. Geneva: WHO, 2013.
- 87 The Government of Jamaica Ministry of Justice. Fact sheet prepared by the ministry of justice on the dangerous drugs (amendment) act 2015. https://moj.gov.jm/sites/default/files/Dangerous%20Drugs%20Amendment%20Act%202015%20Fact%20Sheet_0.pdf (accessed July 18, 2019).
- 88 Patel SJ, Kemper KJ, Kitzmiller JP. Physician perspectives on education, training, and implementation of complementary and alternative medicine. *Adv Med Educ Pract* 2017; **8**: 499–503.
- 89 Forrester T, Picou D, Susan W. The Tropical Metabolism Research Unit, the University of the West Indies, Jamaica, 1956–2006: the house that John built. Kingston: Ian Randle Publishers for The Tropical Medicine Research Institute, 2006.
- 90 Caribbean Health Research Council. Health research agenda for the Caribbean. Saint Augustine: Caribbean Health research Council, 2011.
- 91 Zicker F, Cuervo LG, Salicrup LA. Promoting high quality research into priority health needs in Latin America and Caribbean. *BMJ* 2018; **362**: k2492.
- 92 Tulloch-Reid MK, Saravia NG, Dennis RJ, et al. Strengthening institutional capacity for equitable health research: lessons from Latin America and the Caribbean. *BMJ* 2018; **362**: k2456.
- 93 Ragin C, Campbell J. African Caribbean Cancer Consortium Scientific and Training Conference: meeting report, 2010. http://ac3online.org/uploads/2010_AC3_meeting_report.pdf (accessed July 22, 2019).
- 94 Shah SC, Kayamba V, Peek RM Jr, Heimburger D. Cancer control in low- and middle-income countries: is it time to consider screening? *J Glob Oncol* 2019; **5**: 1–8.
- 95 WHO. From burden to 'best buys': reducing the economic impact of non-communicable diseases in low-and middle-income countries. Geneva: World Economic Forum and World Health Organisation, 2011.
- 96 Pan American Health Organization. PAHO. https://www.paho.org/hq/index.php?option=com_content&view=article&id=12163:paho-strategic-fund&Itemid=1694&lang=en (accessed 30 Oct 2017).
- 97 Knaul FM, Frenk J, Shulman L, for the Global Task Force on Expanded Access to Cancer Care and Control in Developing Countries. Closing the cancer divide: a blueprint to expand access in low and middle income countries. Boston: Harvard Global Equity Initiative, 2011.

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