Bermuda National Cancer Control Plan

Phase I: National Cancer Assessment

April 2022

Bermuda
Cancer and
Health Centre
BERMUDA REGISTERED CHARITY #070

Foreword

In the last decade, delivery of cancer care in Bermuda has undergone a significant transformation. In 2015 the island had one resident oncologist, and at the end of 2021 now has four. Referrals to oncology services increased by fifty percent between 2015-2020 and 80% percent more chemotherapy appointments were delivered on island during this period. Bermuda Cancer and Health Centre opened the island's first radiation facility in 2017 and treated nearly 1000 patients by the end of 2021. The island's population has not increased in that time; rather the population has far better access to on island treatment modalities. This has meant those who may not have previously had treatments have received it, and those who previously may have chosen overseas treatment have preferred to stay on island to be near their family during their treatment.

This growth of services has had a positive impact on cancer care in Bermuda. However, the island must strive to continue to improve care and support for people affected by cancer and be accountable for outcomes of cancer healthcare delivery.

Over the last five years talks have occurred on island about how to continue this improvement. Those talks turned to action with Bermuda Cancer and Health Centre's application to the Bermuda Health Council's Chronic disease innovation fund to support the project to develop a national cancer control plan. A National Cancer Control Plan (NCCP) is a systematic and holistic approach to ensure implementation of best practices which will reduce the burden of cancer and improve quality of life for patients.

The following document contains the findings of the national cancer assessment as the first step to developing the national cancer control plan.

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Acknowledgments

The Bermuda Cancer and Health Centre would like to acknowledge the contribution to the development of the National Cancer Assessment from the following organisations:

- Bermuda National Tumour Registry
- Bermuda Health Council
- Bermuda Ministry of Health
- Bermuda Department of Health
- Bermuda Hospitals Board

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Suggested citation:

Bermuda Cancer and Health Centre. Bermuda National Cancer Control Plan. Phase I: National Cancer Assessment. Bermuda, April 2022.

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1 Introduction

Cancer is currently one of the most significant causes of morbidity and mortality worldwide (1). With global population growth, ageing populations, and increases in the prevalence of risk factors for cancer, it is projected that cancer will continue to be an increasing cause of ill health in the future (2). However, the World Health Organization (WHO) estimates that at least one-third of cancer is preventable and a further one-third can be cured with prompt detection and treatment.[1]

National cancer control strategies are an integral component to address the cancer needs of a population with appropriate prevention, early diagnosis, treatment, and care. A National Cancer Control Plan (NCCP) is a systematic and holistic approach to ensure implementation of best practices which will reduce the burden of cancer and improve quality of life for patients. Over 80% of WHO member states (158 countries) have cancer control strategies.[2]

In November 2020, the Bermuda Cancer and Health Centre began a one-year planning phase for the development of a NCCP. This planning phase focussed on assembling and analysing the available data to produce a current assessment of cancer in Bermuda including the national burden of cancer, prevalence of risk factors, economic cost of cancer, cancer services and programmes, and equity in access to cancer screening and treatment. This document presents the findings from this process.

This project was led by the Bermuda Cancer and Health Centre, and made possible by the Bermuda Health Council's Chronic Disease Innovation Fund which supports public health interventions that complement the health system and address chronic disease (3). Key partners include the Bermuda Health Council (BHeC), Bermuda Tumour Registry, Ministry of Health, and the Office of the Chief Medical Officer. Technical support was received from the Caribbean Public Health Agency (CARPHA), the United States National Cancer Institute (NCI) and the Union for International Cancer Control (UICC).

The data used to inform this assessment include cancer registrations captured in the Bermuda National Tumour Registry, cancer mortality estimates produced by the Global Burden of Disease Study (4), cancer insurance claims data provided by BHeC and national surveys and reports including STEPS to a Well Bermuda 2014, Health in Review 2017, Health Disparities Report 2013, Bermuda Census 2016, among others. Historic cancer mortality from vital registration was reviewed from published sources, but recent mortality data were unavailable. Cancer professionals working in

[1] WHO. Cancer Control: Knowledge into Action. WHO Guide for Effective Programs (2007). Geneva, World Health Organization.
[2] WHO. WHO Report on Cancer: Setting Priorities, Investing Wisely and Providing Care for All (2020). Geneva, World Health Organization.

Bermuda provided information on cancer workforce, infrastructure, clinical services, screening, and health education programmes.

The findings from this report are used to better understand the current burden of cancer in Bermuda, identify current gaps, and develop recommendations for priority areas of focus. These findings will be used to inform the NCCP development. This process facilitates the use of local data and information to guide decision making and implementation.

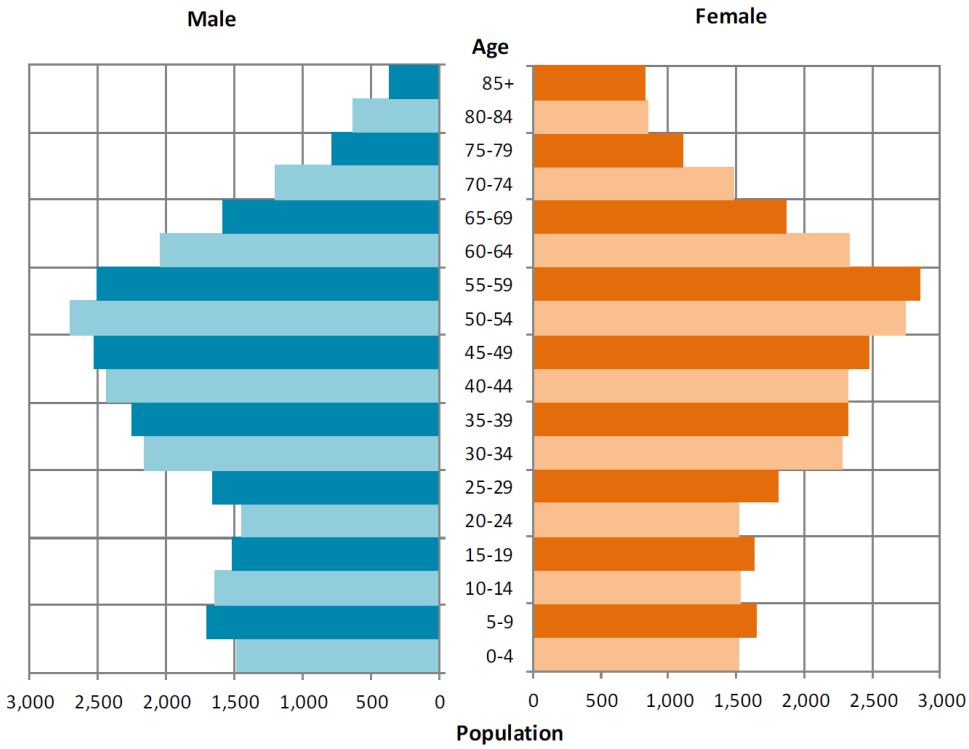
2 Country Profile

2.1 Demographics

Bermuda is a small archipelago situated in the northern Atlantic Ocean. It is comprised of seven main islands and over 100 smaller islands. The main land area is approximately 21 square miles and densely populated. The estimated population size in 2016 was 63,917 with a racial make-up of 52% Black, 31% White, 9% Mixed, 4% Asian, and 4% Other (5). Life expectancy at birth was 81.9 years, and higher for females (85.2 years) compared to males (77.7 years) (6).

Bermuda has an ageing and declining population as illustrated by the constrictive population pyramid in Figure 2-1. The narrow base of the pyramid illustrates the smaller number of children and young adults, while the gradually declining top of the pyramid illustrates the ageing population (5). Differences in life expectancy accounts for the excess of females compared to males in the older ages of the pyramid. It is projected that emigration will overtake births leading to a contracting population by 2026 (6).

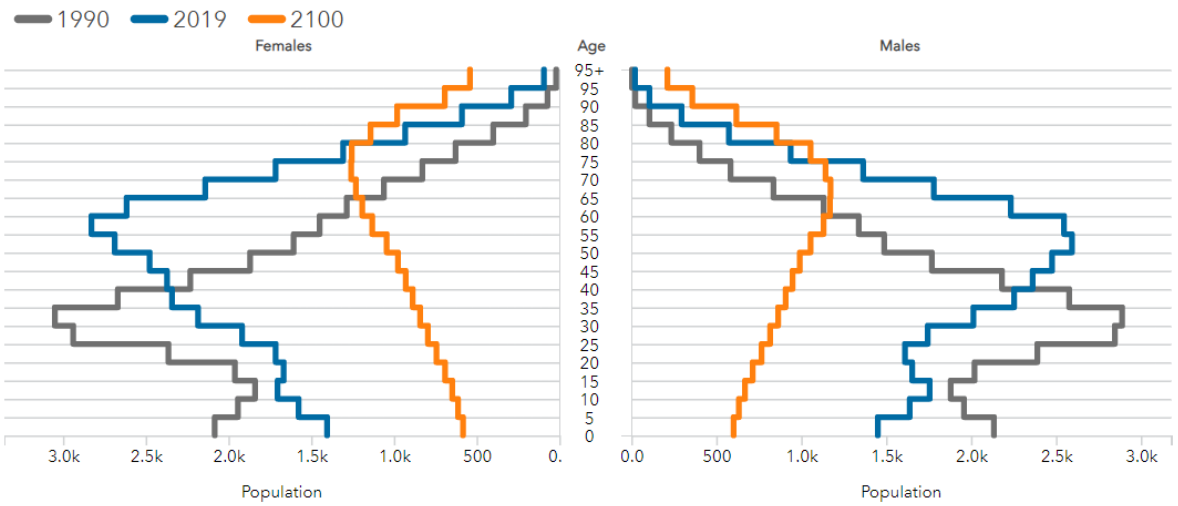
Figure 2-1 Population pyramid by five-year age group and sex, Bermuda, 2016



Source: Bermuda 2016 Population and Housing Census Report

The forecasted population pyramid for Bermuda produced as part of the Global Burden of Disease Study 2017 (7) illustrates the projected longer-term effects of the ageing and declining population in Bermuda by 2100, Figure 2-2.

Figure 2-2 Population, 1990-2100, Bermuda. Forecasted data based on Global Burden of Disease Study 2017

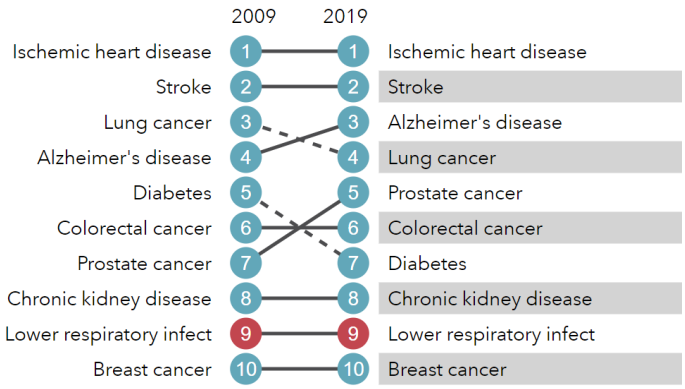


Source: Institute for Health Metrics and Evaluation, http://www.healthdata.org/bermuda

Educational attainment statistics from the 2016 Housing and Population Census report that over half (51%) of the population aged 16 and older have achieved further qualification above high school certification, while 35% have achieved a high school certificate and 14% have no formal academic qualification. Educational attainment above the high school level was greater among females (55%) compared to males (48%) (5).

The leading causes of death in Bermuda – heart disease and stroke – have remained consistent in the past decade. Deaths due to lung, prostate, colorectal and breast cancers have remained among the top ten causes of death, Figure 2-3.

Figure 2-3 Top 10 causes of total number of deaths in 2019, Bermuda, all ages



Source: Institute for Health Metrics and Evaluation, http://www.healthdata.org/bermuda

2.2 Economy

Bermuda has one of the highest per capita incomes in the world. In 2019, gross domestic product (GDP) per capita (current US$) was $116,890 ranking Bermuda the third highest GPD per capita in the world (8). International business, insurance and financial services account for over half of GDP (9). The tourism industry accounts for just over 5% of GDP but is among the largest sectors of employment (10). In the 2016 census, 66% of residents 16 years of age and older were employed, 5% were unemployed and 29% were economically inactive (5).

2.3 Health system

Health authorities have the responsibility for the governance of the health sector. The Ministry of Health is comprised of the Department of Health, Health Insurance Department, Office of the Chief Medical Officer, Ageing and Disabilities Services, and two quasi-autonomous non-governmental organisations ("QUANGOs") – the Bermuda Hospitals Board and the Bermuda Health Council. Regulation of the health system is coordinated by the Bermuda Health Council.

Bermuda has been undergoing a strategy of health system reform. The Bermuda Health Strategy 2014-2019 defines the priorities for this reform and is complemented by the Bermuda Health Action Plan 2014-2019 which outlines the necessary actions for implementation. The Bermuda Health Strategy has now expired, and a subsequent Bermuda Health Strategy 2020-2025 is under development (11).

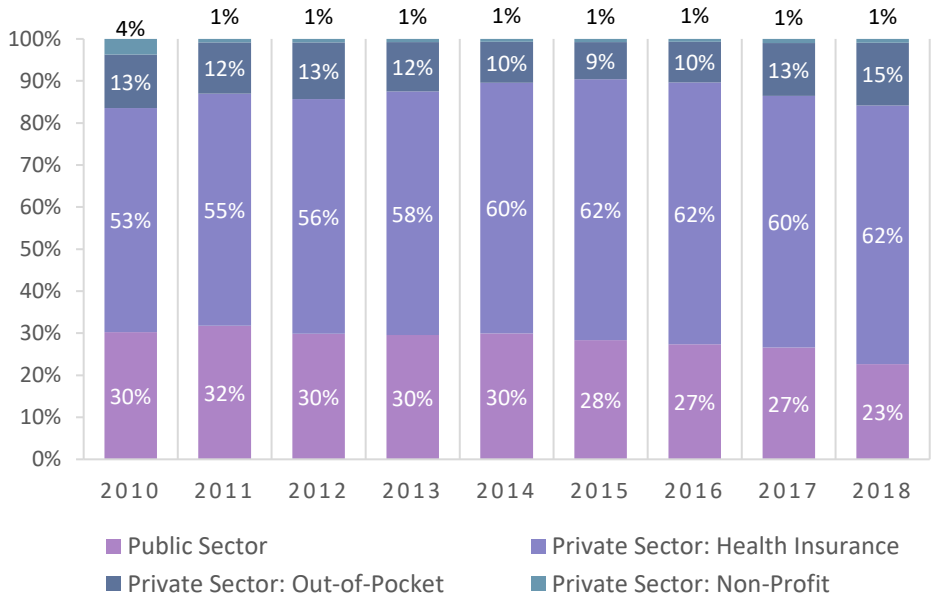
2.3.1 Service Delivery

The Bermuda Hospitals Board Quango oversees two hospitals and one urgent care facility – the King Edward VII Memorial Hospital (KEMH), the Mid-Atlantic Wellness Institute (MWI), and the Lamb-Foggo Urgent Care Centre. Both public and private providers deliver health services. Public health service delivery is predominantly the responsibility of the Department of Health and includes community health, oral health, health promotion, environmental health, a central government laboratory, and administration. Primary care is predominantly provided by private providers and secondary care is provided by KEMH and MWI. Overseas health centres are utilised for services not provided on island.

2.3.2 Health financing and expenditure

Health service delivery in Bermuda is primarily funded by private health insurance plans. In the fiscal year ending 31 March 2018 (FYE2018), private health insurance accounted for 62% of health financing followed by public sector funding (23%), out-of-pocket payments (15%) and charitable donations (1%), Figure 2-4 (12). The private health insurance share of total health financing has increased compared to FYE2010, while the public sector share has decreased, Figure 2-4.

Figure 2-4 Sources of health financing, Bermuda, FYE2010 – FYE2018

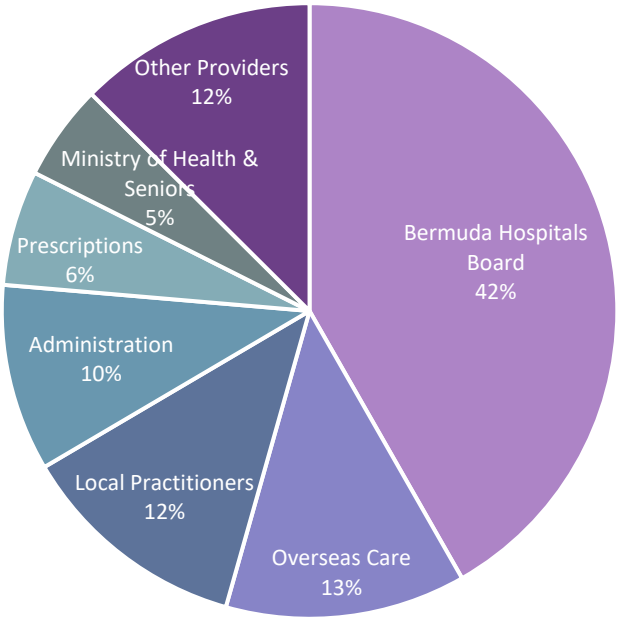


Source: Bermuda Health Council, 2019 National Health Accounts Report

Health expenditure in Bermuda is increasing while there is a declining population to support it. Total expenditure on health increased from $427 million in FYE2006 to $737 million in FYE2018. Figure 2-5 illustrates public and private sector expenditure by category for FYE2018. Bermuda Hospitals Board expenditure (KEMH, Mid-Atlantic Wellness Institute and the Lamb Foggo Urgent Care Centre)

accounted for the largest proportion of health expenditure ($308 million), followed by overseas care ($93 million), local practitioners ($89 million), health system administration ($72 million), prescription drugs ($45 million), and the Ministry of Health and Seniors ($37 million) (12).

Figure 2-5 Public and private sector expenditure by category for FYE2018



Source: Bermuda Health Council, 2019 National Health Accounts Report

Per capita health expenditure in FYE2018 was $11,529 (12). Compared to OECD countries, per capita health expenditure in Bermuda is nearly double the OECD average and superseded only by Switzerland and the US (13, 14).

2.3.3 Health insurance coverage

Most of the population has major medical health coverage in Bermuda. In 2016, nearly three-quarters (72%) had major health coverage, 17% were underinsured (only basic private coverage, Government Health Insurance Plan, or FutureCare), and 8% were uninsured. Between 2010-2016, the proportion of the population with major health insurance declined by 12% and the proportion underinsured or uninsured increased by 7% and 3% respectively, Table 2-1.

Table 2-1 Population by type of health insurance coverage, Bermuda, 2016 and 2010

Type of Health Insurance Coverage	Number 2016	Number 2010	Percentage Distribution 2016	Percentage Distribution 2010	Percentage Point Change 2010-2016
Total	63,779	64,237 [1]	100	100	
Major Health Coverage (Private or GEHI[2])	46,084	50,759	72	84	-12
None	5,341	3,233	8	5	+3
Only Private Basic Health Coverage	4,015	1,349	6	2	+4
Only Government's HIP[3]	3,632	3,053	6	5	+1
Only FutureCare	3,244	1,965	5	3	+2
Insured - Type Unknown	1,389	. .	2	. .	
Not Stated	74	1,327			

** Less than 1%.

[1] Includes 2,551 persons for whom there is no data - see Technical Note.

[2] GEHI - Government Employee Health Insurance

[3] HIP - Health Insurance Plan

Source: Bermuda 2016 Population and Housing Census Report

The demographic characteristics of the uninsured population are described in Table 2-2. In 2016, more males (56%) than females (44%) were uninsured, over three-quarters (77%) of the uninsured population were black, 93% were Bermudian, and 70% were at the lowest end of the educational attainment scale, Table 2-2.

Table 2-2 Population without health insurance by demographic characteristics, Bermuda, 2016

Demographic characteristics	Number	Percentage (%)
Sex	**5,341**	**100**
Male	3,000	56
Female	2,341	44
Age Groups	**5,341**	**3233**
0-14	1,008	19
15-29	1,286	24
30-44	942	18
45-64	1,541	29
65+	564	11
Race	**5,341**	**100**
Black	4,085	77
White	499	9
Mixed & Other	754	14
Not stated	3	<1
Bermudian Status	**5,341**	**100**
Bermudian	4,949	93
Non-Bermudian	392	7

Highest academic qualifications (16+ yrs)	**4,254**	**100**
No formal certificate	880	21
High School certificate	2,063	49
Tec/Voc/Assoc/Diploma	845	20
Degree	460	11
Not stated	6	<1

Source: Bermuda 2016 Population and Housing Census Report

2.3.4 Human resources for health

The Bermuda Hospitals Board, comprised of KEMH, Mid-Atlantic Wellness Institute and the Lamb Foggo Urgent Care Centre, is the second largest employer in Bermuda with approximately 1800 employees (15). The healthcare workforce overall in Bermuda is on par with the OECD (Organisation for Economic Development and Cooperation) average. By specialty, Bermuda has more general practitioners and fewer paediatricians and psychiatrists (per 1000 population) compared to the OECD average. Bermuda also has fewer nurses, dentists, pharmacists and physiotherapists (13).

The small population size, geographic isolation and limited opportunities for higher education training are key challenges for healthcare human resources in Bermuda. Key personnel gaps identified in the *Bermuda Healthcare Workforce, 2017* situation analysis include oncology, urology and otolaryngology which have "struggled to maintain safe levels of professionals to meet population needs" (14). Urology, geriatrics, orthopaedic surgery, rehabilitation medicine, and ear, nose and throat are anticipated to have a growing need due to ageing population (14). Key gaps identified in the nursing workforce in Bermuda are personnel with advanced and specialty skills, and gaps in the quality of local education and training for nurses compared to international training (14).

3 Data Summary

3.1 Epidemiology

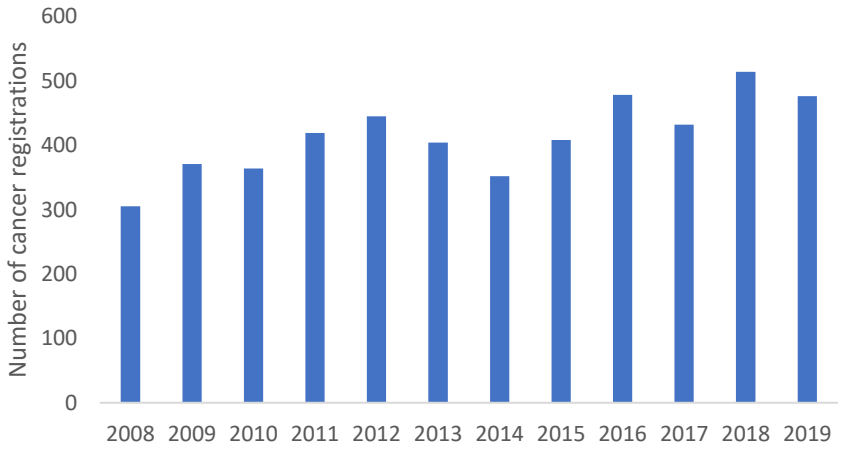
Cancer is a major cause of morbidity and mortality in Bermuda. It accounts for over 170 deaths each year, nearly one-third of all deaths (4). In 2019, there were 476 cancer cases reported (including non-melanoma skin cancer) and an estimated 178 deaths due to cancer (4).

3.1.1 Incidence

Nearly 5,000 cancer cases were registered in Bermuda between 2008–2019. The number of cases registered per year has increased over time from 305 in 2008 to 476 in 2019, Figure 3-1. Cancer registration is not mandatory in Bermuda thus the increase in registrations over time may also reflect changes in reporting and data collection. Further, cancer cases diagnosed and treated overseas may not be captured in the registry which may contribute to fluctuations in the number of cancer registrations observed each year.

Between 2008 and 2019, the most diagnosed cancer was non-melanoma skin cancer which accounted for 19% of registered cases, followed by breast (17%), prostate (11%), colon (6%), and lung cancer (6%). These five cancers accounted for nearly 60% of all cancers registered during this period (Appendix-I).

Figure 3-1 Number of new cancer registrations, 2008-2019

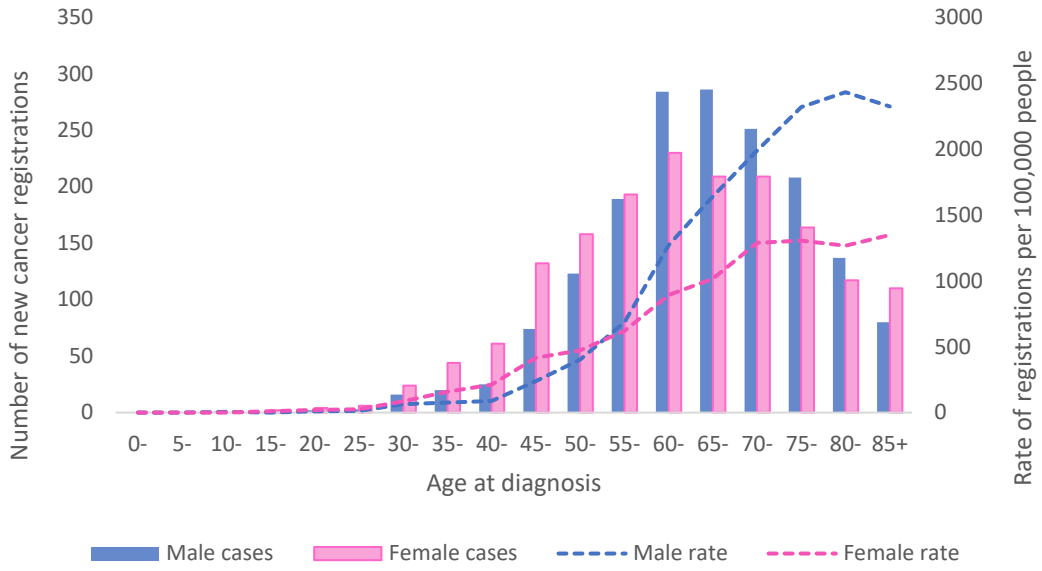


Data source: Bermuda National Tumour Registry, Bermuda Hospitals Board.
Note: All registrations, including in-situ carcinomas and non-melanoma skin cancer.

Cancer predominantly affects adults at older ages. Adults aged 55 years and older accounted for nearly 80% of all cancer registrations between 2008 and 2019, Figure 3-2. During this same period, the incidence of invasive cancer was higher in women than men for all age groups 20-55 years, but higher in men compared to women at all age groups over 55 years, Figure 3-2. These trends may

reflect, in part, gender differences in healthcare-seeking behaviours and in the prevalence of risk factors (13). It should be noted that the lack of paediatric cancer cases may reflect missing data due to overseas diagnosis and treatment.

Figure 3-2 Number of cancer registrations and age-specific incidence rates (per 100,000) in Bermuda (2008–2019 average)

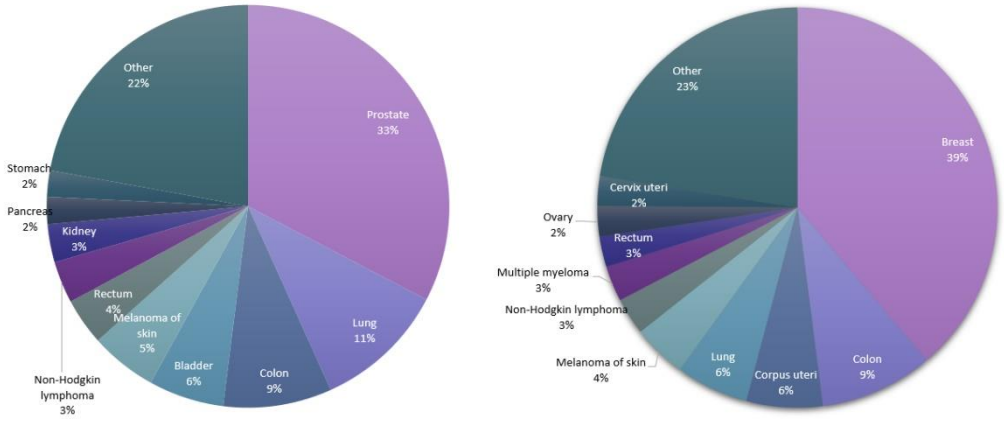


Data source: Bermuda National Tumour Registry, Bermuda Hospitals Board.
Note: Excluding in-situ carcinomas, non-melanoma skin cancer.

Prostate cancer is the most common cancer affecting men in Bermuda. Excluding non-melanoma skin cancer, the next most common cancers in men are lung, colon, bladder, and melanoma of skin, Figure 3-3. Breast cancer is the most common cancer in females. Excluding non-melanoma skin cancer, the next most common cancers in females are colon, uterus, lung, and melanoma of skin, Figure 3-3. Age-specific incidence rates of cancer, by major site and sex, are included in Appendix-II and further illustrate the increase in incidence with age and the elevated incidence of cancer in males compared to females.

Figure 3-3 Ten most common cancers among males and females by site, Bermuda, 2008–2019

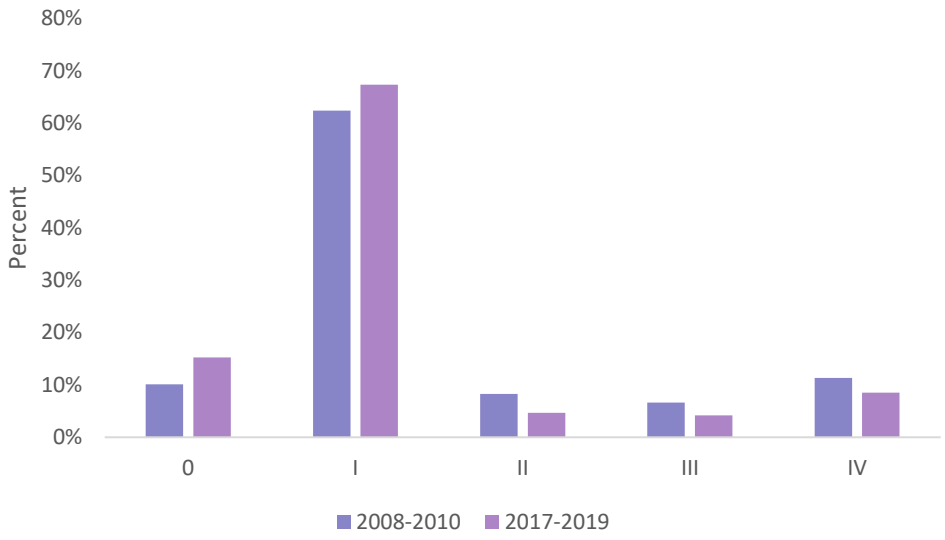
A) Males **B) Females**



Data source: Bermuda National Tumour Registry, Bermuda Hospitals Board.
Note: Excluding in-situ carcinomas, non-melanoma skin cancer.

Most cancer cases in Bermuda are diagnosed in Stage I, the localized stage. Stage I is also the default stage coded in the National Tumour Registry database when the stage at diagnosis is unknown. As a result, the proportion of cancer cases diagnosed in Stage I may be over-represented. Figure 3-4 illustrates the distribution of cancer cases by stage at diagnosis in the period 2008-2010 compared to the recent period 2017-2019. Stage 0 refers to carcinoma in situ, Stage I is localized cancer, Stages II and III refers to regional cancer that has grown into nearby tissues or lymph nodes, and Stage IV is distant or metastatic cancer. Comparing cases diagnosed in 2008-2010 with those diagnosed in 2017-2019, there has been an increase in the proportion of cancers now diagnosed in Stages 0 and I (73% vs 83%, respectively) and a decrease in the proportion of cancers diagnosed at all later stages (26% vs 17%, respectively), Figure 3-4.

Figure 3-4 Distribution of cancer cases by stage at diagnosis, 2008-2010 vs 2017-2019

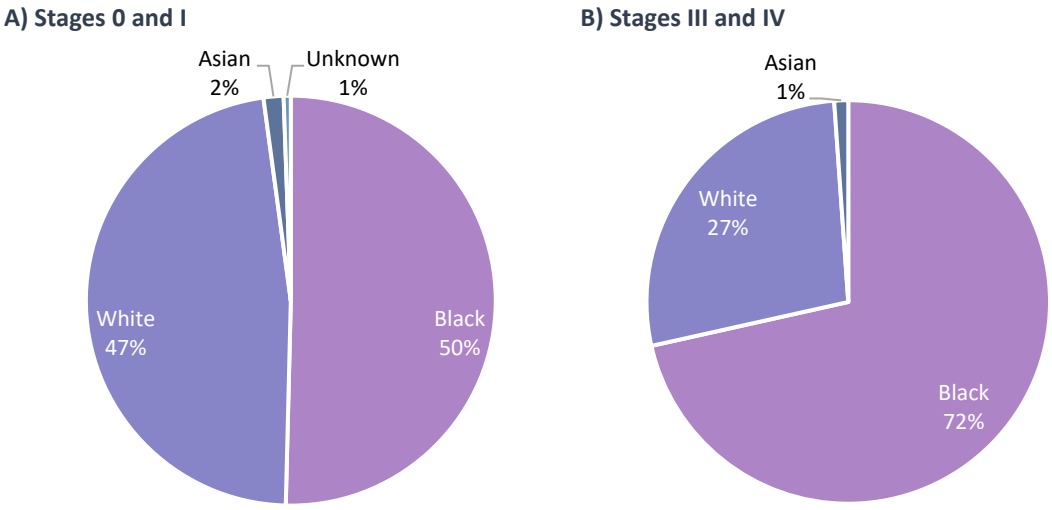


Data source: Bermuda National Tumour Registry, Bermuda Hospitals Board.
Notes: Non-melanoma skin cancer included. Cases with unknown stage at diagnosis are registered as Stage I. Stage 0=in situ, I=local, II & III= regional, IV=distant

The information on the race of cancer patients captured in the National Tumour Registry is determined by patient information found in hospital records. The race categories used are White, Black, Asian, Other and Unknown. These categories differ from the Census which additionally includes a mixed-race category. Alignment of race groups would support the calculation and reporting of incidence rates by racial grouping.

The racial make-up of the population in Bermuda in the 2016 Census was 52% Black, 31% White, 9% Mixed, 4% Asian, and 4% Other, as described in Section 2.1. In the recent period 2017-2019, 50% of cancer cases diagnosed in Stages 0 and I occurred among individuals of black race, Figure 3-5A. However, 72% of cancer cases diagnosed at advanced stages (Stages III and IV), were among individuals of black race, Figure 3-5B.

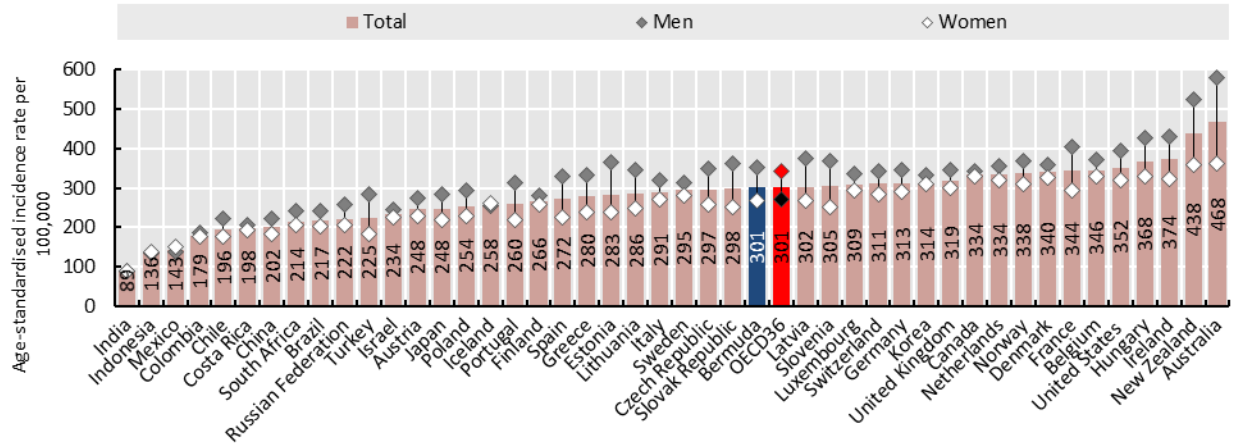
Figure 3-5 Cancer cases 2017-2019 by stage at diagnosis and race



Data source: Bermuda National Tumour Registry, Bermuda Hospitals Board.
Note: Excluding non-melanoma skin cancer

Age-standardised rates are used to compare cancer incidence rates in different populations. Standardisation is necessary when comparing across different populations because age has a strong influence on cancer incidence. Standardisation allows for comparison without influence of the different age structures in different populations. Compared to OECD countries, age-standardised incidence rates of all cancers combined in Bermuda (2017-2019 average) are on par with the OECD average (2018), Figure 3-6. The gender gap observed in Bermuda is also similar to OECD countries with higher incidence rates in males than females.

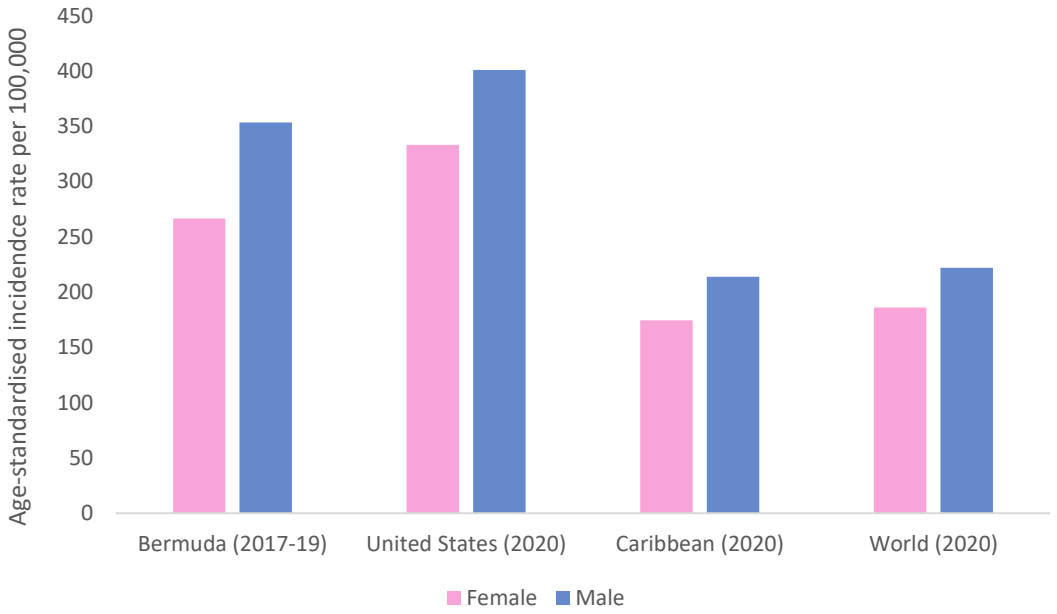
Figure 3-6 Age-standardised cancer incidence rates per 100,000 population, OECD comparison, 2018



Data sources: Bermuda National Tumour Registry 2017-2019 average; Health at a Glance 2019, OECD.
Notes: World standard population. Incidence rates include non-melanoma skin cancer, exclude carcinoma in situ.

Compared to the 2020 estimates for the United States, Caribbean, and World, the sex-specific incidence rates of all cancers combined in Bermuda (2017-2019 average) are lower compared to the United States, but higher compared to the Caribbean and World, Figure 3-7.

Figure 3-7 Age-standardised cancer incidence rates per 100,000 population, by sex - US, Caribbean, World comparison

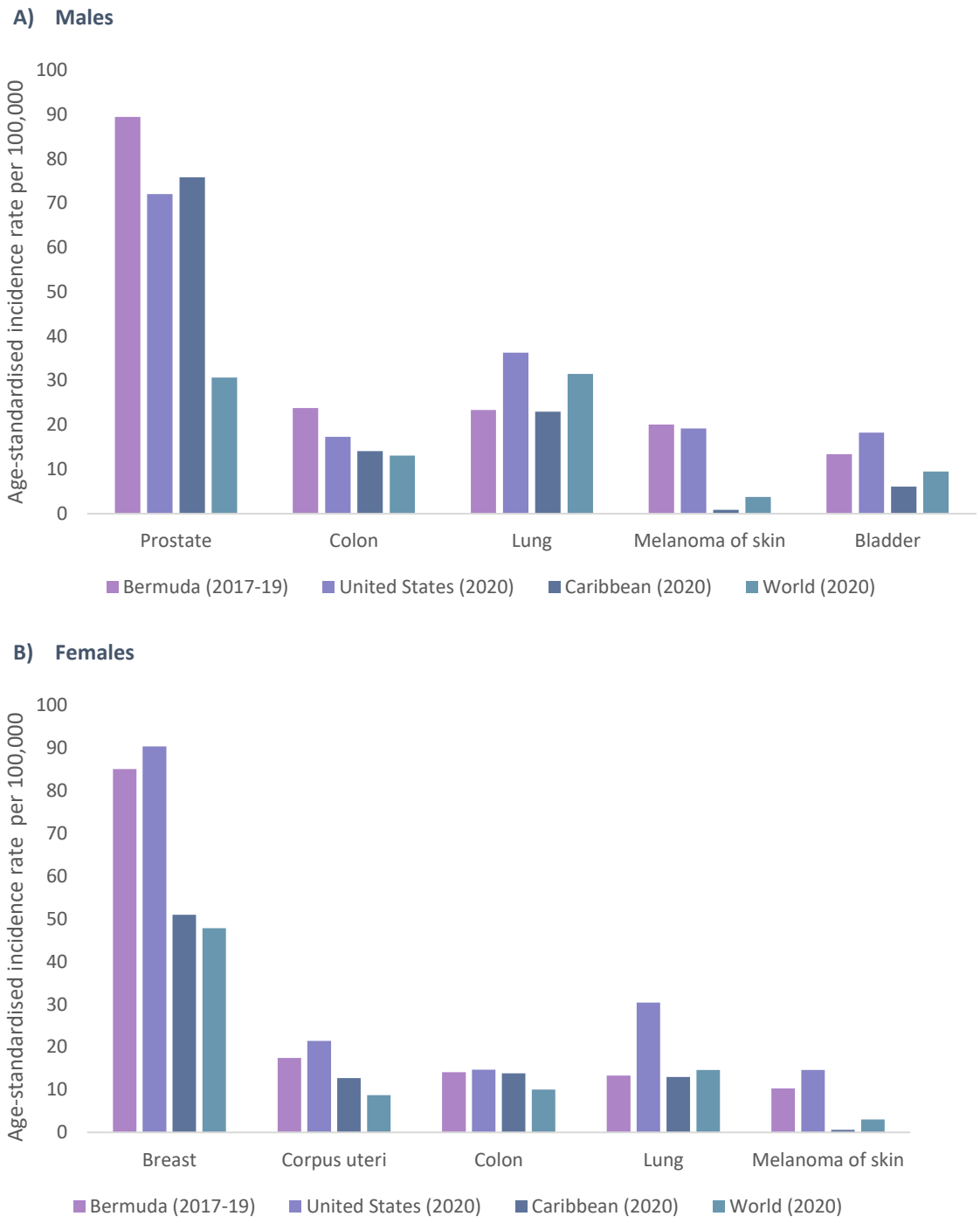


Data sources: Bermuda National Tumour Registry; GLOBOCAN 2020 Bermuda Hospitals Board.
Notes: World standard population. Incidence rates include non-melanoma skin cancer, exclude carcinoma in situ.

Among men, the age-standardised incidence rates of cancers of the prostate, colon, and melanoma are higher in Bermuda compared to men in the United States, Caribbean, and World, Figure 3-8A. The incidence rate of lung cancer among men in Bermuda is on par with the Caribbean, but lower compared to the United States and World. Bladder cancer among men in Bermuda is lower compared to the United States, but higher compared to the Caribbean and World, Figure 3-8A.

Among women, the age-standardised incidence rates of the five most common cancers affecting women in Bermuda (breast, corpus uteri, colon, lung, and melanoma) are lower compared to the United States, Figure 3-8B. However, Bermuda has higher incidence rates of cancers of the breast, corpus uteri (endometrium), and melanoma compared to the Caribbean and World, Figure 3-8B. Incidence rates of colon and lung cancer among women in Bermuda are on par with Caribbean rates Figure 3-8B.

Figure 3-8 Age-standardised cancer incidence rates per 100,000 by sex and major cancer site – US, Caribbean, World comparison



Data sources: Bermuda National Tumour Registry; GLOBOCAN 2020 Bermuda Hospitals Board.
Note: World standard population.

When comparing incidence rates across settings, it should be noted that differences in the availability and quality of cancer surveillance will also affect the comparability of the data. Cancer incidence rates will also be elevated in high income settings compared to lower income settings,

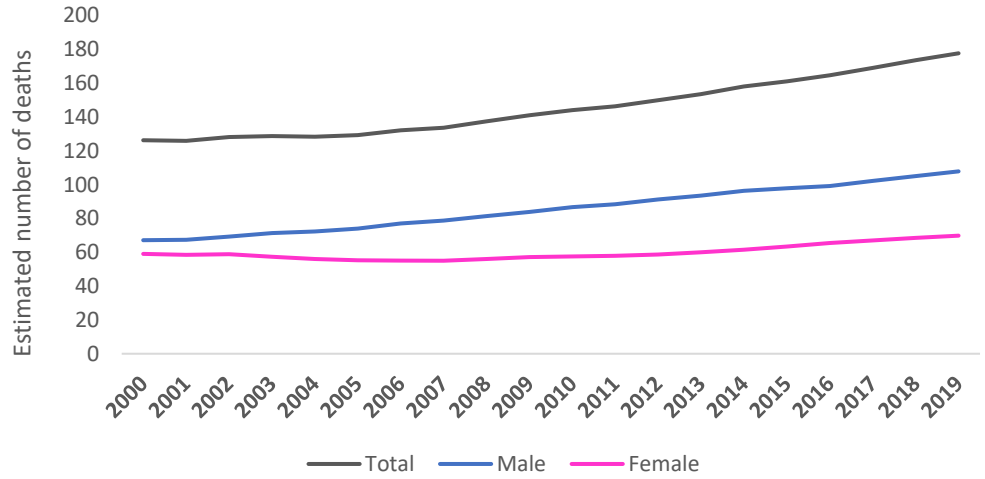
reflecting not only differences in surveillance and data collection, but also differences in availability and access to healthcare, cancer screening and diagnosis, and the prevalence of risk factors.

3.1.2 Mortality

We were unable to obtain national vital registration data to inform an updated assessment of cancer mortality in Bermuda. Subsequently, we have included modelled estimates of cancer mortality in Bermuda produced by the Institute for Health Metrics and Evaluation as part of the Global Burden of Disease study (4). These estimates are produced using vital registration data, additionally informed by national cancer registrations and regional trends (16).

The number of estimated deaths due to all cancers combined have increased over time, increasing from an estimated 126 deaths in 2000 to 178 in 2019. A greater number of men die from cancer each year compared to women, Figure 3-9.

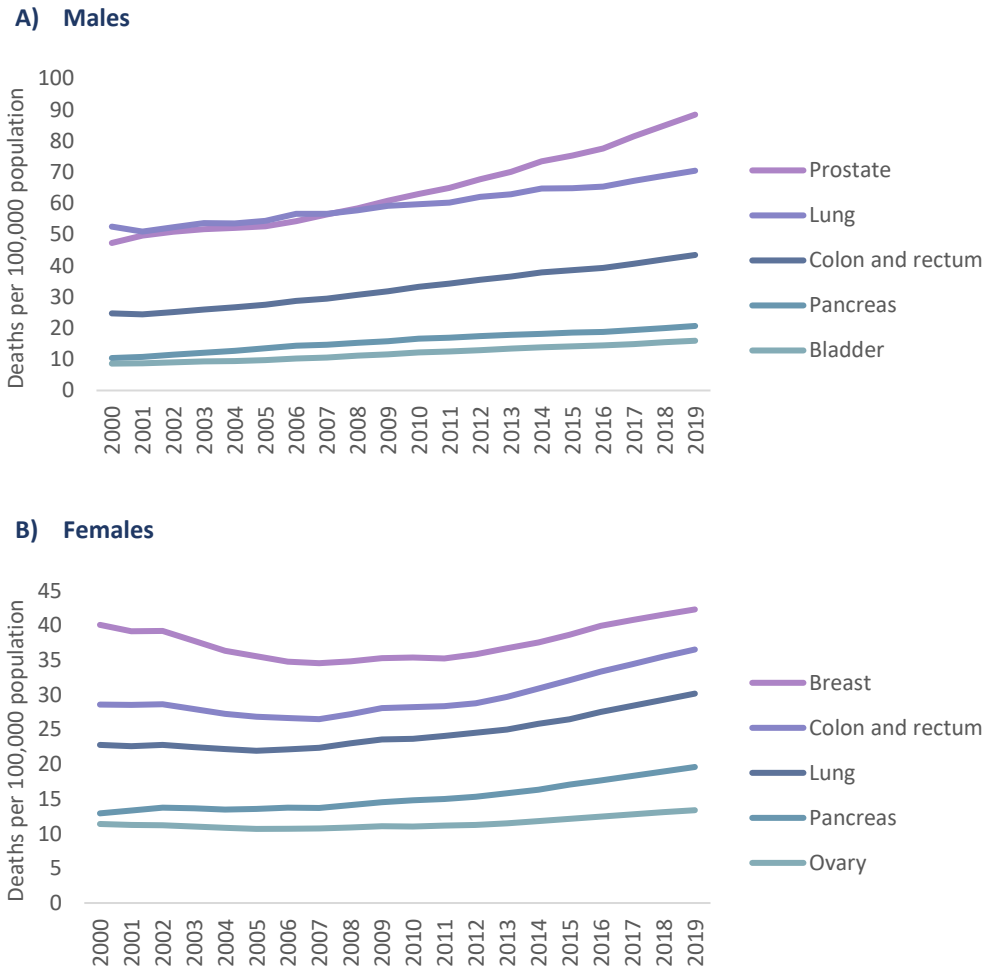
Figure 3-9 Estimated deaths due to all cancers combined, Bermuda, 2000-2019



Source: Estimated produced by the Institute for Health Metrics and Evaluation, Global Burden of Disease Study 2019

Prostate cancer has overtaken lung cancer as the most common cause of cancer death among males in Bermuda, followed by colorectal, pancreatic, and bladder cancer, Figure 3-10A.

Figure 3-10 Estimated mortality rates by major cancer site, Bermuda, 2000-2019

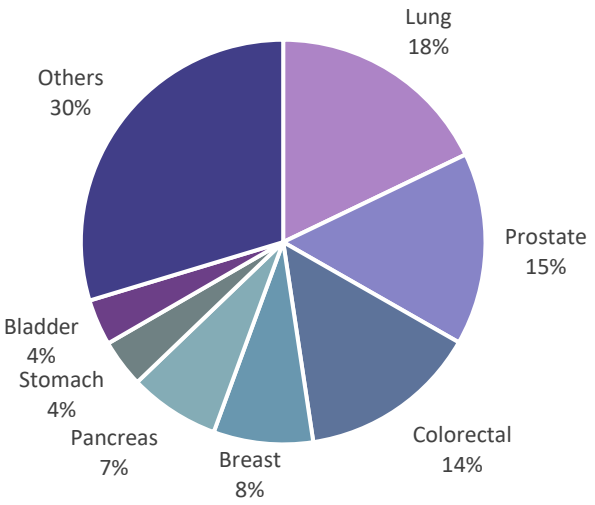


Source: Estimated produced by the Institute for Health Metrics and Evaluation, Global Burden of Disease Study 2019

Breast cancer is the most common cause of cancer death among females, followed by colorectal, lung, pancreatic and ovarian cancer, Figure 3-10B.

In 2019, lung cancer accounted for the greatest proportion of all cancer deaths in Bermuda, followed by deaths due to prostate, colorectal and breast cancer. These four cancers combined accounted for an estimated 56% of all cancer deaths in Bermuda in 2019, Figure 3-11.

Figure 3-11 Cancer deaths by major cancer site, both sexes, Bermuda, 2019



Source: Estimated produced by the Institute for Health Metrics and Evaluation, Global Burden of Disease Study 2019

Historic cancer mortality in Bermuda compared to other settings has been summarised in previous publications. *Health in Review 2017*: *An International Comparative Analysis of Bermuda Health System Indicators* (13) compares cancer mortality in Bermuda (2010-2014 average) to OECD averages (2014). The mortality rate in Bermuda for all cancers combined was slightly higher compared to the OECD average (222/100,000 populations compared to 202/100,000, respectively). By sex, cancer mortality for females in Bermuda was on par with the OECD average (166/100,000 compared to 160/100,000 for OECD, respectively), but was much higher for males than the OECD average (301/100,000 compared to 269/100,000, respectively) (13).

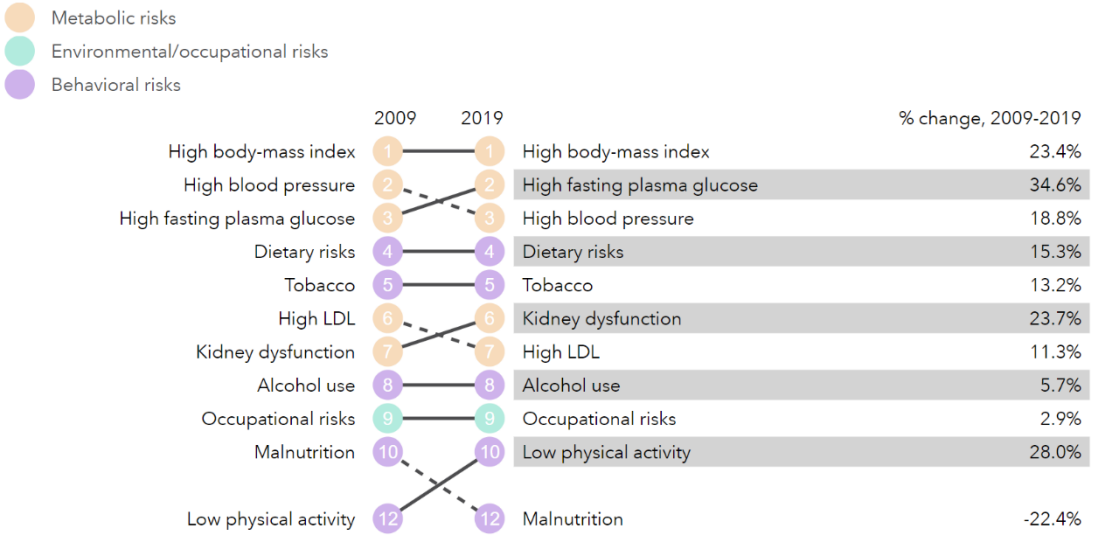
By major cancer site, lung and breast cancer mortality rates in Bermuda were lower than the OECD average (36/100,000 vs 42/100,000 for lung cancer and 20/100,000 vs 25/100,000 for breast cancer, respectively). Cervical and colorectal cancer mortality in Bermuda were on par with the OECD average. However, prostate cancer mortality in Bermuda greatly exceeded the OECD average (65/100,000 vs 33/100,000 respectively) (13).

It should be noted the comparability of cancer mortality data across different settings can be affected by differences in death certification across countries. Misclassification of cause of death can occur across all cancers. However, the potential for misclassification of cause of death in prostate cancer patients is of particular concern, largely due to the advanced age at which many of the deaths occur. In Bermuda, discussions remain whether there is misattribution of cause of death due to prostate cancer which is contributing to the elevated level of prostate cancer mortality (17). This issue has been subject to investigation in other countries (18-22) .

3.2 Prevalence of risk factors for cancer

Key risk factors for cancer include age, obesity, lack of physical activity, poor diet, tobacco, alcohol, exposure (for example, sun) and viruses (for example, hepatitis B and human papillomavirus) and genetic predisposition. Many of these risk factors overlap with the risk factors identified as driving death and disability (overall) in Bermuda. Figure 3-12 depicts the top ten risks contributing to ill health in 2019, and the percent change between 2009 and 2019.

Figure 3-12 Top 10 risks contributing to total number of disability-adjusted life years in 2019 and percent change 2009-2019, Bermuda, all ages



Source: Institute for Health Metrics and Evaluation, www.healthdata.org/Bermuda

The prevalence in Bermuda of key risk factors for cancer are described in turn.

3.2.1 Age

Age is a well-recognised risk factor for cancer. While cancer can occur at any age, the majority of cancer diagnoses and cancer deaths occur in the over-65 population (23). As a result, population ageing will have consequences for cancer control. In Bermuda, the Population Projections report for 2016-2026 predicts that the proportion of seniors 65 years and older in Bermuda will increase from 16.9% in 2016 to 24.9% by 2026. Across this same time period, the old-age dependency ratio – the ratio of the population 65 years and over compared to the population 15-94 years – is expected to increase from 24.7 to 39.9 (6). It can be anticipated that the ageing population in Bermuda will increase the future need for cancer services.

3.2.2 Diet, obesity and physical inactivity

The *STEPS to a Well Bermuda: Health Survey of Adults in Bermuda* is a population-based cross-sectional assessment of chronic disease risk factors among adults in Bermuda. Many chronic disease

risk factors are also key risk factors for cancer thus data from the STEPS survey was used to inform the prevalence of poor dietary habits, obesity, and physical inactivity in Bermuda.

It is estimated that up to 30% of all cancer cases, and up to 70% of cancers of the gastrointestinal tract are linked to poor dietary habits and thus preventable (24). In the 2014 STEPS survey, 82% of the adult population in Bermuda report inadequate fruit and vegetable intake with less than five servings per day of fruits and vegetables. Adequate fruit and vegetable intake varied by education and household income. Adults with higher education (technical or greater) and those with greater household income ($108,000 or more) were more likely to eat five or more servings of fruits and vegetables per day, Table 3-1 (25). Compared with OECD data, Bermuda is on par with the OECD average for consumption of at least one serving of fruit daily, and at least one vegetable serving per day (13).

Table 3-1 Fruit and vegetable consumption, Bermuda, STEPS 2014

		<1 serving per day		1-2 servings per day		3-4 servings per day		5+ servings per day	
		N	%	N	%	N	%	N	%
Total		83	6.5%	497	48.3%	371	27.1%	242	18.1%
Gender	Men	43	7.3%	223	55.4%	146	22.7%	81	14.6%
	Women	40	5.7%	274	40.5%	225	31.8%	161	22.0%
Education	Secondary & lower	38	7.8%	209	61.4%	117	20.2%	57	10.6%
	Technical & higher	45	5.8%	288	40.4%	254	31.2%	185	22.6%
Household income	Under $72,000	44	7.8%	228	54.9%	157	23.9%	86	13.5%
	$72,000 to $107,999	15	7.5%	74	44.0%	70	30.0%	28	15.5%
	$108,000 and over	5	1.6%	106	38.0%	93	32.1%	89	28.3%
	Not stated	19	10.5%	89	53.4%	51	21.2%	39	14.8%

Source: Reproduced from Steps to a Well Bermuda: Health Survey of Adults in Bermuda 2014

Epidemiological studies have shown that obesity is a risk factor for many types of cancer (26). In Bermuda, 74.6% of adults are overweight or obese (40.2% and 34.4%, respectively), a prevalence that is among the highest in the world (13, 25). Prevalence of overweight is higher among males than females in Bermuda, while the prevalence of obesity is higher among females compared to males, Table 3-2 (27). By age, younger adults (18-34 years) were the least likely to be above a normal or healthy body weight. However, over half (52.9%) of young adults are overweight or obese. The prevalence of overweight and obesity in older age groups is above 80% (25), Table 3-2.

Table 3-2 Body mass index category, Bermuda, STEPS 2014

	Underweight	Normal weight	Overweight	Obese	Overweight or obese

		N	%	N	%	N	%	N	%	N	%
Total		7	0.7%	296	24.6%	417	40.2%	422	34.4%	839	74.6%
Gender	Men	2	0.3%	116	20.6%	205	49.6%	155	29.4%	360	79.1%
	Women	5	1.2%	180	29.1%	212	29.6%	267	40.0%	479	69.6%
Age	18-34	4	2.5%	84	44.9%	58	28.6%	49	24.2%	107	52.9%
	35-54	2	0.3%	100	19.0%	137	44.6%	176	36.1%	313	80.7%
	55-64	1	0.5%	50	18.8%	82	33.3%	104	47.4%	186	80.7%
	65+	0	0.0%	62	21.3%	140	49.0%	93	29.7%	233	86.0%

Source: Reproduced from Steps to a Well Bermuda: Health Survey of Adults in Bermuda 2014
Note: Body mass index category calculated by measurement of height and weight

Regular physical activity can reduce the risk of some cancers (28). WHO recommends that adults do at least 150 minutes of moderate intensity aerobic physical activity, or 75 minutes of vigorous physical activity, or an equivalent combination of moderate and vigorous physical activity every week (29). However, nearly one-third (27%) of adults in Bermuda do not meet the WHO recommendations for physical activity for health, Table 3-3. More women (33.7%) compared to men (20.2%) do not meet the WHO recommendations for physical activity, and a greater proportion of adults at older ages (44.4% among 65 years and older) compared to adults at younger ages (range 18.6% - 30.1% among adults 18-64 years) do not the meet the WHO recommendations for physical activity, Table 3-3 (25).

Table 3-3 Physical activity, Bermuda, STEPS 2014

		Physical activity does not meet WHO recommendations	
		N	%
Total		362	27.1%
Gender	Men	110	20.2%
	Women	252	33.7%
Age	18-34	40	18.6%
	35-54	97	22.2%
	55-64	78	30.1%
	65+	147	44.4%

Source: Reproduced from Steps to a Well Bermuda: Health Survey of Adults in Bermuda 2014

3.2.3 Alcohol and tobacco

Alcohol use has been linked to cancers of the mouth and throat, voice box, oesophagus, liver, breast colon and rectum and may increase the risk of other cancers as well (27). In Bermuda, 64% of the adult population reported currently drinking alcohol, an increase from 50% in 2011. More men (76%) than women (51%) reported current alcohol use, and a higher proportion of young people compared to older individuals reported current alcohol use (30). By race, current consumption of alcohol was

reported by 82% of whites, 63% of those identifying as mixed & other, and 52% of blacks (25). Binge drinking – drinking five or more alcoholic beverages in a single setting – was reported by 20% of current drinkers. The prevalence of binge drinking was higher among males (37%) compared to females (15%).

Tobacco use is the leading preventable cause of cancer and cancer deaths. Smoking is the leading cause of lung cancer, linked to 80-90% of lung cancer deaths in the US, but can cause cancer almost anywhere in the body (30). In the 2014 STEPS survey in Bermuda, current tobacco use was reported by 14% of the adult respondents. Men were more likely to be current smokers (20%) compared to women (7%) and there have not been significant changes in tobacco use overall 2006-2014 (25). Compared to OECD countries, the reported rate of daily smoking in Bermuda is lower than the OECD average (13).

3.2.4 Sun exposure

Globally, one in every three cancers diagnosed is a skin cancer (31), and the global prevalence of both melanoma and non-melanoma skin cancers have increased over time (32). Invasive melanoma is responsible for 80% of all deaths due to skin cancer, despite accounting for only 2% of skin cancer cases (33). High levels of exposure to ultraviolet (UV) radiation exposure increases the risk of both non-melanoma and melanoma skin cancers (34).

The UV index is an international standard of the strength of UV radiation at a particular place and time. The UV index is reported on a scale from 1 to 11+, with 1-2 representing “low”, and 11+ representing “extreme” (35). In Bermuda, the average UV index is measured as “high” or greater for eight months of the year – from March through October. The average UV index in Bermuda is 10, or “very high”, from May through August (36). Population exposure to UV radiation is likely greater in Bermuda compared to settings with a lower average UV index. As a comparison, the UV index in the UK does not normally exceed 8 (37). Sun protective behaviours including limiting exposure during peak hours, wearing protective clothing, and using appropriate sunscreen protection are important interventions to reduce exposure to UV radiation. The prevalence of sun protective behaviours in Bermuda is unknown.

3.2.5 Virus exposure

Virus exposure can also be a risk factor for cancer. Hepatitis B is a liver infection caused by the hepatitis B virus. Chronic hepatitis B can lead to chronic inflammation of the liver, cirrhosis, and cancer. It is estimated that 23% of liver cancer deaths in Bermuda are due to hepatitis B infection (38). The hepatitis B vaccine can prevent hepatitis B infection which provides protection from hepatitis B-related liver cancer. Routine hepatitis B vaccination among infants was introduced in

Bermuda in 1998. HBV vaccine coverage among infants under 1 year of age in Bermuda fluctuated between 85-97% between 2010-2015 (39).

Human papillomavirus (HPV) is a group of common viruses predominantly transmitted through sexual contact. There are over 100 types of HPV, of which at least 14 are cancer causing. Nearly all cases of cervical cancer are directly attributable to HPV. However, cervical cancer is preventable with HPV vaccination and routine screening programmes. Certain HPV types also cause a proportion of anogenital, mouth and throat cancers, some of which can also be prevented with HPV vaccination (40). In 2016, the HPV vaccine was approved in Bermuda for administration as part of the routine Childhood Immunization Service. All children (boys and girls) aged 11 years are recommended to receive the HPV vaccine, and the Department of Health provides the vaccine free of charge. However, only 30% of children 11-12-years of age in Bermuda have been vaccinated for HPV.

3.2.6 Genetic predisposition

Bermuda cancer genetics and risk assessment clinic has run through Bermuda Cancer and Health centre since 2006. However, to date the overall prevalence and influence of genetic mutations within the Bermudian population has not been analysed.

3.3 Economic cost of cancer in Bermuda

The economic cost of cancer includes the costs of diagnosis and care and the production loss due to cancer morbidity and mortality. The cost of production loss due to cancer morbidity and mortality in Bermuda has not been quantified, and the cost of cancer diagnosis and treatment in Bermuda not readily transparent. Cancer expenditure from different data sources was obtained to produce an approximation. Cancer expenditure from insurance claims paid out for both on-island and overseas care ranged between US$ 11.3 to 14.5 million per year during fiscal years 2017–2020 (41). These figures exclude Bermuda Hospitals Board cancer expenditure. Bermuda Hospitals Board expenditure on chemotherapy services ranged from US$ 5.2 to 7.5 million per year during fiscal years 2017–2020 (42). It was not possible to obtain cancer expenditure occurring at BHB for other services including screening, diagnosis, and surgery. The Bermuda Cancer and Health Centre provided an additional value of US$ 1.8–2 million per year between 2018 and 2020 for clinical services for underinsured or uninsured patients (43). From these data sources, a minimum of US$ 18.3 million was spent on cancer care and treatment in 2018 (see Appendix-IV), representing approximately 2.5% of total health expenditure. In comparison, health expenditure on cancer care and treatment as a proportion of total health expenditure was 6.4% in Europe in 2018 (44), approximately 6% in the United States in 2015 (45, 46) and 7% in select OECD countries (expenditure data from 2008-2011)(47).

3.4 Cancer health services

Cancer service provision in Bermuda is largely provided by KEMH and the Bermuda Cancer and Health Centre. KEMH provides cancer screening, detection, surgery, chemotherapy services and palliative care services, and is *Accredited with Exemplary Standing* by Accreditation Canada. Bermuda Cancer and Health Centre provides cancer screening, detection and radiation therapy services and is accredited by the American College of Radiology. Palliative care for cancer patients is provided by PALS and Friends of Hospice.

3.4.1 Cancer workforce

There is no medical training for oncology available in Bermuda and very limited opportunities on-island for cancer-specific professional education. The cancer healthcare workforce receives training overseas, often in the United Kingdom, United States or Canada. Table 3-4 summarizes the cancer specialists currently working in Bermuda.

Table 3-4 Cancer healthcare workforce in Bermuda, 2021

Specialty	Number of practitioners
Oncology	4*: 1.7 radiation, 1.8 medical oncology, 0.5 malignant haematology

Surgical oncology	5**: Oncological surgery for breast, thoracic, skin and gastro-intestinal cancers
Radiotherapy	4 radiotherapy technologists, 2 radiation nurses
Chemotherapy	3 chemotherapy nurses
Palliative care	2 cancer-specific palliative care physicians, 5 palliative care nurses

*Dana-Farber/Brigham and Women's Cancer Center additionally provides overseas radiation
**Additionally, 2 ENT specialists, 3 urological surgeons, 8 gynaecologists perform biopsies and scope but do not remove; 3 dermatologists perform biopsies

The number of new oncology patients in Bermuda has increased in recent years, but the levels of staffing have not risen in conjunction with this increase. Since 2015, within the medical oncology unit at BHB, the number of new patients has increased by 52%, the number of patient reviews has increased by 62%, chemotherapy appointments have increased by 80%, while overseas referrals have decreased by 47% (42). Over the same period, the changes in human resources (full time equivalent) have been a 15% increase in oncologists, a 25% increase in chemotherapy nurses, and a 20% decrease in administrative support (42).

Any changes in the cancer healthcare workforce in Bermuda will have a significant impact on cancer care. Palliative care is an essential component of cancer care and changes to delivery of palliative care will impact patient experience.

3.4.2 Acute oncology

Acute oncology is a subspecialty created in the UK to manage the care needs of cancer patients in emergency situations (48). Cancer places a large burden on acute services, and inpatient care accounts for a substantial proportion of cancer expenditure. The involvement of cancer specialists at an early stage in emergency care can avoid unnecessary investigations and treatments, improve patient care and outcomes, and reduce the length of hospital stays. Acute oncology was created with the aim to provide a systematic approach to dealing with cancer related emergencies to optimise patient care. Bermuda does not currently have an acute oncology service at KEMH.

3.4.3 Cancer screening programmes

Cancer screening is readily available in Bermuda and supported by the Standard Health Benefit with provision free of co-payment. However, there are no formal cancer screening programmes in Bermuda, i.e., there are no national guidelines for screening. Cancer screening guidance is provided by the Bermuda Cancer and Health Centre based on recommendations from the American Cancer Society (https://www.cancer.bm/cancer-information/bermudas-cancer-screening-guidelines), but

these recommendations are general guidance and not national guidelines. Financial barriers and facilitators to cancer screening are identified in Table 3-5.

Table 3-5 Cancer screening programmes in Bermuda and financial barriers and facilitators to access

Cancer	Screening programme	Screening test	Financial barriers and facilitators to screening
Breast	No formal screening programme, readily available on *ad hoc* basis	Mammogram	Facilitator: Standard Health Benefit
Cervical	No formal screening programme, readily available on *ad hoc* basis	Pap test HPV testing	Facilitator: Standard Health Benefit (Pap test)
Colorectal	No formal screening programme, available on *ad hoc* basis	Stool test Colonoscopy	Barrier: Colonoscopy may not be covered by insurance
Lung	No formal screening programme, available through GP on *ad hoc* basis	Low-dose CT scan	Facilitator: Standard Health Benefit
Prostate	No formal screening programme, available through GP on *ad hoc* basis	Digital rectal exam (DRE) Prostate-specific antigen test (PSA)	Facilitator: Standard Health Benefit
Skin	No formal screening programme, available through specialist on *ad hoc* basis	Skin check	Barrier: Requires referral; high cost of co-payment

Special targeted screening opportunities also exist in Bermuda. The Bermuda Cancer and Health Centre provides an annual Men's Health Screening in November of each year. This free event is open to all men and targets prostate cancer screening and general health screening. Men without health insurance and those who have not visited their general practitioner in the past year are particularly encouraged to attend.

Finally, the Bermuda Cancer Genetic Risk Assessment Programme, launched in 2006, was the first programme for cancer genetics testing in Bermuda. This programme aims to identify, educate and support persons who may be at higher risk of developing breast or ovarian cancer (49).

3.4.4 Health promotion programmes

There are several cancer-specific health promotion programmes in Bermuda covering the topics of smoking cessation, sun exposure, lung cancer, breast health and prostate health, Table 3-6. There are also several monthly cancer awareness initiatives in Bermuda including cervical health (January), melanoma (May), lung cancer (June), ovarian cancer (September), breast cancer (October), prostate cancer (November).

Table 3-6 Cancer prevention organised programmes in Bermuda

Focus Area	Programme(s)
Tobacco	Quit Smart; LungSmart; Ann Penman Stop Smoking Programme; Dr Benjamin Lau; The Pathways Smoking Cessation Programme
Sun protection	Bermuda Cancer and Health Centre SunSmart programme
Breast health	Bermuda Cancer and Health Centre Reduce Your Risk; Know Your Lemons; Ultimate Imaging Project Pink
Prostate health	Bermuda Cancer and Health Centre *Silent Killer* film; Dynamic Urology prostate screenings

3.4.5 Cancer survivorship

Cancer survivorship begins at the time of diagnosis and continues after treatment. It includes the individuals who experience cancer as well as family, friends, and caregivers. A cancer survivorship programme can address the physical, emotional, psychosocial, and spiritual support needed to manage and improve life across the cancer journey. There are several support programs available to cancer patients and survivors in Bermuda (Bosom Buddies, Healing Vibes). The first formal programme focusing on survivorship was started by PALs in October 2021.

3.5 Cancer health disparities

Health equity refers to the opportunity for every individual to attain their full health potential without disadvantage because of social position or other socially determined circumstances (50). Health inequity or disparities are preventable differences in the burden of disease or opportunities to achieve optimal health that are experienced by different groups of people. The *Health Disparities Report 2013* (51) investigated gaps in health outcomes and access to healthcare in Bermuda. While this report is focussed on all health disparities, the findings are also relevant for cancer health disparities.

The *Health Disparities Report 2013* highlights that socioeconomic factors have a strong association with health inequality in Bermuda. Lower socioeconomic status is associated with poorer health outcomes, poorer access to healthcare, and poorer health-related behaviours (51). Individuals with lower household income and education report poorer health compared to those with higher incomes and education (51). Lower income households spend a higher proportion of their income on healthcare compared to higher income households (51). Employment status is also linked to health, not just from an income standpoint, but because health insurance is mandated for all persons employed in Bermuda (51). The demographic characteristics of the uninsured population in the 2016 Census was previously described in Section 2.3.3 and illustrated the uninsured population was more likely to be male, black, Bermudian, and at the lower end of the education Spectrum (Table 2-2).

Cancer health disparities are adverse differences between certain groups of people in cancer measures such as incidence, prevalence, morbidity, mortality, survival, screening, stage at diagnosis, and financial burden, due to social, environmental and economic disadvantages (52). Disparities in cancer risk factors can also contribute to disparities in cancer measures. Specific examples of cancer health disparities identified in Bermuda are included below.

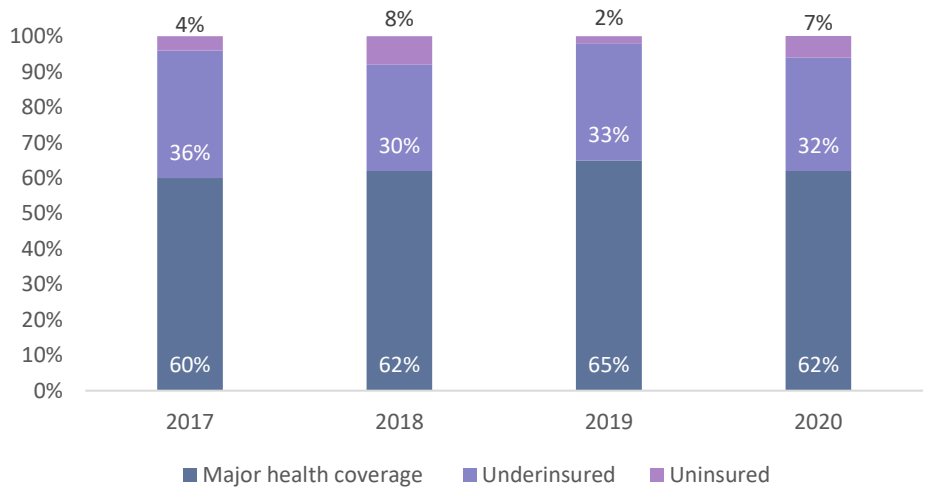
Income, employment

In Bermuda, income is related to two key cancer risk factors – smoking and poor diet. Individuals at the lower end of the earnings spectrum report higher prevalence of smoking and poor diet (51). Employment status is associated with differences in breast and cervical cancer screening with a greater proportion of employed women in Bermuda reporting having had a recent mammogram (69%) and Pap test (69%) compared to unemployed women (50% and 34%, respectively).

Health insurance

The insurance status of the population at the national level was previously described in Section 2.3.3 with 72% fully insured, 17% underinsured, 8% uninsured and 2% unknown in 2016. However, data from the Bermuda Cancer and Health Centre from 2017-2020 illustrate that only 60-65% of new radiation therapy patients have major medical insurance with an elevated proportion of patients are underinsured (30-36%), compared to the national average, Figure 3-13.

Figure 3-13 Bermuda Cancer and Health Centre new radiation therapy patients by insurance status, 2017-2020

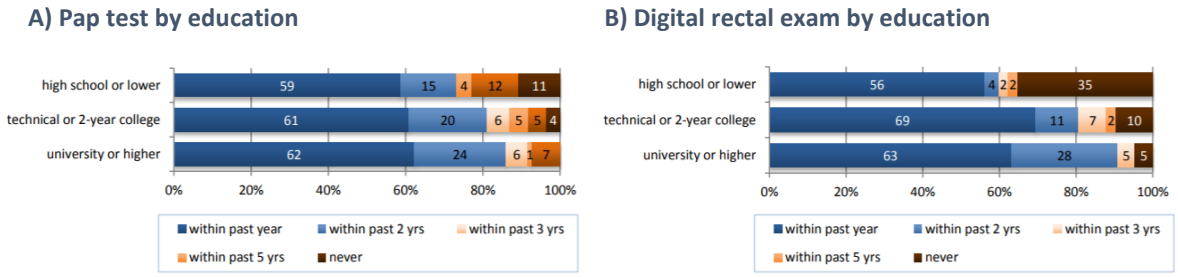


Source: Bermuda Cancer and Health Centre

Education

Higher educational attainment is associated with higher consumption of fruit and vegetables, and increased physical activity, both of which are cancer-preventive behaviours (51). With regards to cancer screening, individuals with lower educational attainment (high school or lower) were more likely to never have had screening tests for cervical cancer (Pap test) or prostate cancer compared to those with further education attainment, Figure 3-14 (51).

Figure 3-14 Cancer screening by educational attainment



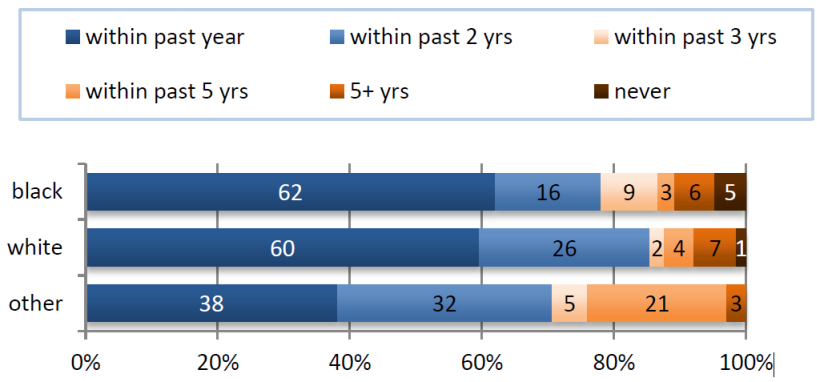
Source: Health Disparities Report 2013, Bermuda Health Council

Race

The *Health Disparities Report 2013* highlights that overall race was found to have a limited role in inequality of healthcare access and utilisation in Bermuda (51). For cancer screening, women in the "other race" category were the least likely to have had recent breast cancer screening and black women were more likely to have never had breast cancer screening compared to other races, Figure 3-15.

The review of cancer incidence (Section 3.1.1) also illustrated differences by race in the stage of cancer at diagnosis with 72% of the cases diagnosed at advanced stages occurring among blacks, which may also be related to cancer health disparities.

Figure 3-15 Mammogram by race



Source: Health Disparities Report 2013, Bermuda Health Council

Health equity is a national priority and a core value for the Bermuda health system (11). Policies and programmes currently exist which aim to address cancer health disparities. The Standard Health Benefit includes cancer screening and treatment without co-payments to facilitate access for everyone. The Bermuda Cancer and Health Centre also aims to allow everyone access to early cancer detection and treatment without financial barriers, providing clinical services including mammography, ultrasound, breast and prostate biopsies, and radiation therapy without patient co-payments. Additionally, community donations made to the Centre support an Equal Access Fund which helps subsidise the costs of clinical serves for individuals who are underinsured or without insurance (53).

3.6 Cancer research in Bermuda

There are currently no programmes of cancer research, participation in clinical trials, or contribution of data to international research projects.

4 Key Findings and Gaps Identified

4.1 Cancer burden

Key findings and gaps identified:

- Prostate cancer and breast cancer have the highest incidence
    - Incidence rate of prostate cancer in men in Bermuda is nearly four times higher than the next most common cancer (colon)
    - Incidence rate of breast cancer in women in Bermuda is nearly five times higher than the next most common cancer (corpus uteri)
- Incidence rate for all cancers combined in Bermuda (2017-19) is on par with the OECD, slightly lower compared to US.
- Cancer incidence rates that are better compared to other countries:
    - Lung cancer: Incidence rates for lung cancer in males and females in Bermuda are lower compared to US, World
- Cancer incidence rates that are worse compared to other countries:
    - Males: Incidence rates of cancers of the prostate, colon, rectum, and melanoma of skin in men are higher in Bermuda compared to US
- Demographics and cancer burden: Ageing and declining population in Bermuda will likely result in an increase in cancer cases and deaths over time (with a decreasing population to support the burden in terms of healthcare costs, human resources)
- Demographic cancer disparities:
    - Males: Higher rates of invasive cancer among males compared to females
    - Race: Elevated amount of later stage cancers occurring in blacks
    - Socioeconomic variables: Not currently captured in tumour registry database. Consider insurance coverage as a proxy.
- Leading causes of death from cancer: Bermuda mortality data were unavailable to inform an updated assessment of cancer mortality.
    - Findings from outdated mortality data and recent IHME estimates of mortality indicate:
        - Elevated amount of prostate cancer mortality in men
        - Lung, prostate, colorectal and breast have the highest mortality – all which can be reduced through screening, early detection, and treatment
- Mortality rates that are worse compared to other settings:
    - Prostate cancer mortality in Bermuda is nearly double the OECD average

4.2 Prevalence of cancer risk factors

Key cancer risk factors in Bermuda:

- Ageing population
- Diet, physical inactivity
- Genetics

Key gaps:

- Vaccination rates
    - HPV vaccination rates appear low
    - HBV vaccination rates could also improve

4.3 Cancer screening, diagnosis, treatment

Potential gaps in cancer screening, diagnosis, and treatment:

- Cancer screening in men
- Colorectal cancer diagnosis: Colonoscopies may not be covered by insurance, financial barriers for uninsured/underinsured
- Lung cancer: No bronchoscopies in Bermuda, hard to get biopsy, no formal thoracic surgery
- Blood cancer: Currently no screening tests for blood cancer (PROMISE study)
- Availability: On-island availability of screening, diagnosis and treatment
- Awareness: Patient understanding, physician understanding, awareness of funding for screening and treatment
- Affordability: Co-pays for clinical services (for example, very high co-pays for dermatology) are a key gap to accessing services
- Acute oncology: Gaps in diagnosis, treatment, and patient management
- Disparities in cancer screening:
    - Prostate screening in men with lower levels of education attainment
    - Pap screening in women with lower levels of education attainment, unemployed women
    - Potential financial barriers to Pap screening
    - Mammography in unemployed women (need for increased awareness of the Equal Access Fund)

4.4 Data collection and reporting

Gaps in data collection and reporting:

- Need for mandatory reporting of cancer cases (requires legislation)
- Need for data capture of patients (particularly children) seeking diagnosis and treatment overseas (data exchange agreements in progress with US state registries)
- National electronic medical records (in progress for hospital only)
- Hospital-based cancer registry: Multi-institution registry that maintains data on all patients diagnosed, treated for cancer
- Routine reporting and publication of Tumour Registry data
- Online/open access to cancer incidence data to facilitate use of the data
- Bermuda cancer incidence data inclusion in CI5 (Cancer Incidence in Five Continents)
- National Tumour Registry gaps in data collection:
    - Stage at diagnosis should be accurately captured. The current default is to assign Stage 1 if stage at diagnosis is not recorded. Unknown stage of diagnosis should be captured as "unknown".
    - Race categories need to be collected and reported in alignment with Census categories so that rates can be calculated and reported by race grouping.
    - Cancer survival: Routine data capture and reporting of 1-year survival, 5-year survival would support monitoring of survival outcomes
    - Paediatric cancer cases: Often missing from due to accessing care overseas
- Cancer expenditure: BHB cancer expenditure unknown outside of chemotherapy
- Socioeconomic data collection (income level) could further inform cancer disparities

4.5 Health services, human resources and programme gaps

- Guidelines
    - Currently no formal guidelines for screening, clinical care, treatment
    - No use of evidence-based guidelines (e.g., NICE, NCCN)
- Human resources
    - Turnover and succession planning
    - Surgical gaps – head and neck, gynaecology, urology, thoracic
    - Gynaecology – patients sent off-island for services
    - Additional use of nurses, advanced practitioners (advanced radiographers)

- Standardised care pathways
- Alignment with allied health, including “prehab”, linkage with speech therapists, dieticians, other therapists
- Technology gaps
    - PET scanner (half-life of radioactive material presents a logistical challenge and this will impact cost-effectiveness)
- Health promotion
    - Men’s health
    - Colorectal cancer
- Data use for decision making: To inform human resources, financial needs, programme needs, services, equipment. Need for routine, standardised reporting and use of this information.
- Research: No cancer research programmes, participation in clinical trials, or contribution of data to international research projects.

5 Recommendations

- Recommendations on possible strategies
    - Targeted focus on prostate, breast, colorectal and lung cancers
        - Improved patient care pathways for these cancers
    - Elimination of cervical cancer
    - Standardised guidelines for screening
    - Standardised guidelines for treatment
    - Acute oncology
        - Need for improved diagnostic and patient care pathways, and improved outcomes (reduced hospital stays, improved survival)
        - Consider specific objectives and indicator(s) for acute oncology as part of NCCP

- Recommendations to address cancer risk factors
    - Set HPV and HBV vaccination targets as part of NCCP, consider linkage with vaccine hesitancy strategy[3]
    - Align with chronic disease initiatives
    - Diet and health promotion campaigns for children

- Recommendations for surveillance, data collection, reporting
    - Legislation to make cancer reporting to a central registry mandatory
    - National electronic medical records
    - Standardised reporting criteria for Tumour Registry
        - Consider hospital-based cancer registry (i.e. capturing clinical care data)
        - Stage at diagnosis: Accurately captured, coding unknown stage at diagnosis as “unknown”
        - Race:Standardised capture of race in groupings which align with Census
    - Survival outcomes (routinely capture and report 1-year, 5-year survival)
    - Cause of death (COD)
        - COD manager training (routine)
        - Audit of COD for quality of death certification

[3] *https://www.gov.bm/sites/default/files/Vaccine%20Hesitancy%20Strategy%20Report%20%28electronic%20version%29_0.pdf*

        - Audit of prostate cancer deaths
    - Cancer expenditure
        - Need for annual reporting of expenditure on cancer from BHB
        - Quantify annual expenditure on cancer in Bermuda (overseas, local, BHB, BCHC)

- Recommendations to address disparities
    - Health literacy
    - Access to services (awareness, affordability)
    - Understanding of beliefs (social/health/religious)

- Recommendations for human resources
    - Cancer care coordinator

- Recommendations for research
    - Data-sharing: Standardized data collection (consider hospital-based registry data) that can be used for international data-sharing
    - Public health interventions: Lifestyle, linking with NCDs
    - Joining international trials
    - Implementing formal screening programmes

Other considerations:

- Increase capacity of nurse-led services, to free-up oncologist capacity for other areas (emergency, inpatient, complex cases)
- Prepare for increasing need for cancer care – ageing population combined with increased on-island service provision (and perhaps increased use of telehealth for overseas specialist consultation but local provision of care)
- Think towards the future - innovations in telehealth, electronic medical records, leveraging technology for new ways of providing care.

Appendix

I. New cancer registrations by site and sex, 2008-2019

Number of new cancer registrations in Bermuda across the ten most common sites, 2008-2019. Registrations include invasive, in situ and non-melanoma skin cancers.

Data source: Bermuda National Tumour Registry

Table Appendix-I New cancer registrations in Bermuda by major site and sex, 2008-2019

	Both sexes		Males		Females	
Cancer	**Cases**	**% of total**	**Cases**	**% of total**	**Cases**	**% of total**
All cancers	4968		2,379		2,589	
Skin*	927	19%	538	23%	389	15%
Breast	834	17%	8	<1%	826	32%
Prostate	555	11%	555	23%	-	-
Colon	301	6%	148	6%	153	6%
Trachea, bronchus and lung	278	6%	180	8%	98	4%
Cervix uteri	231	5%	-	-	231	9%
Melanoma of skin	164	3%	91	4%	73	3%
Bladder	137	3%	103	4%	34	1%
Non-Hodgkin lymphoma	107	2%	57	2%	50	2%
Rectum	105	2%	64	3%	41	2%
Corpus uteri	103	2%	-	-	103	4%
Others	1226	25%	635	27%	591	23%

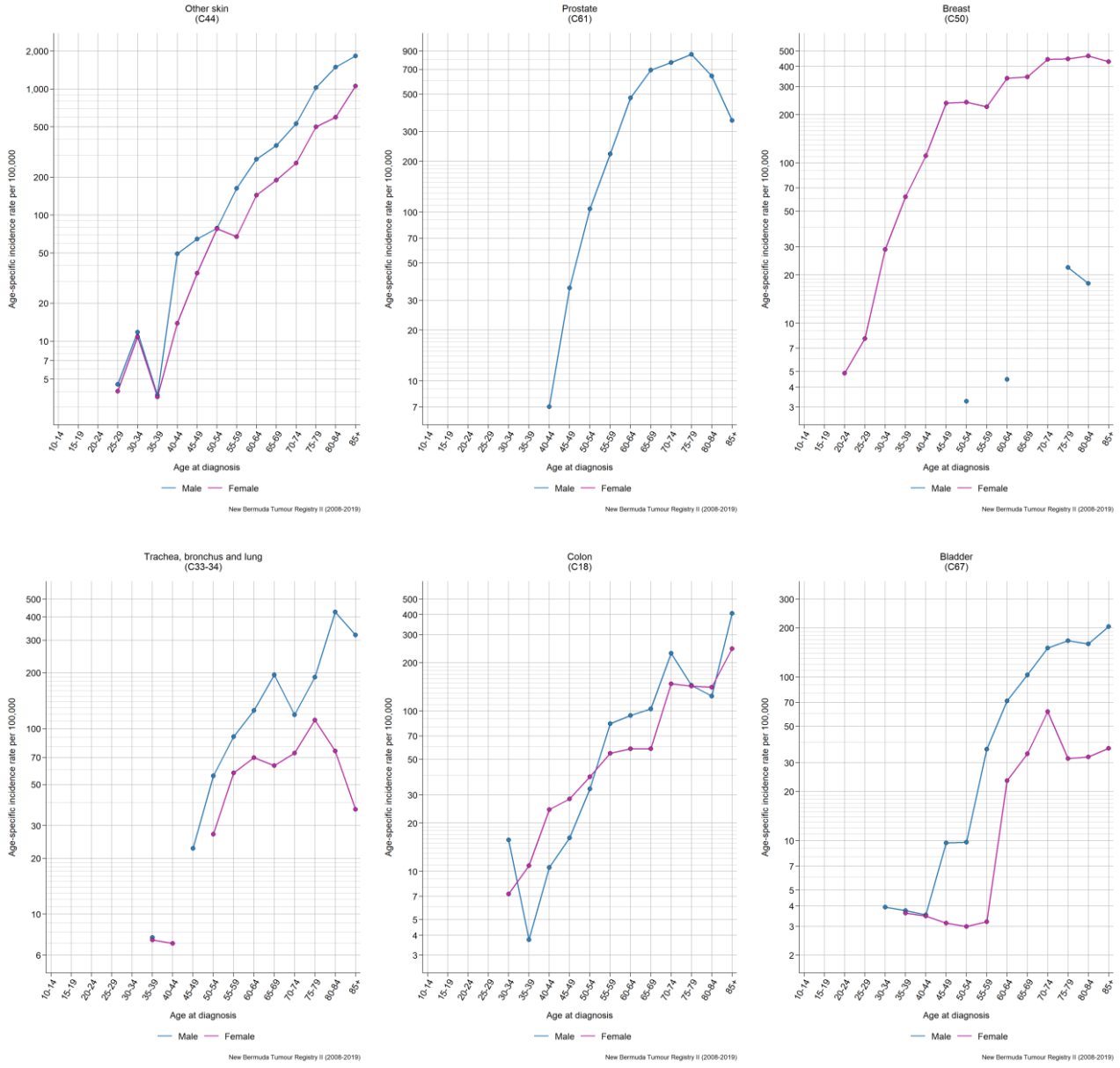
Data source: Bermuda National Tumour Registry, Bermuda Hospitals Board.

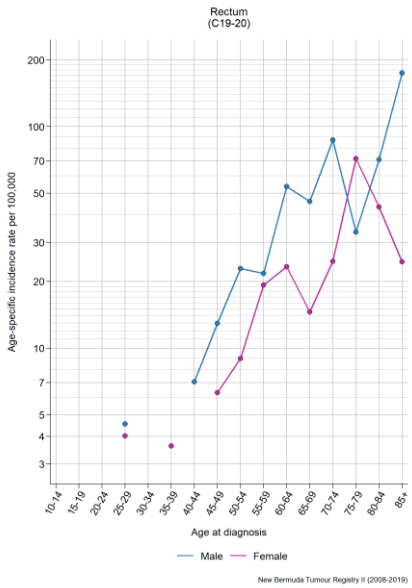
II. Age-specific incidence rates of cancer for major diagnosis groups (2008-2019 average)

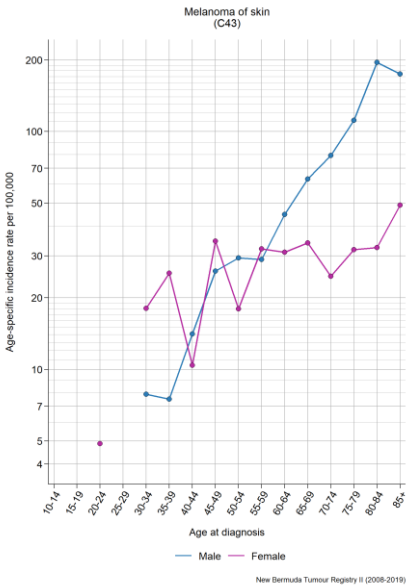
Age-specific incidence rate per 100,000 of invasive cancer by sex in Bermuda, 2008-2019 average. The y-axis is a logarithmic scale.

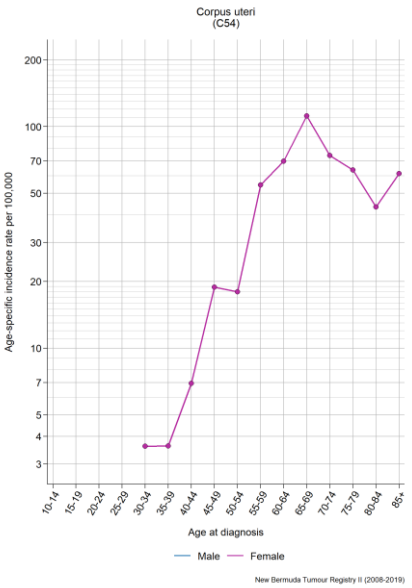
Data source: Bermuda National Tumour Registry

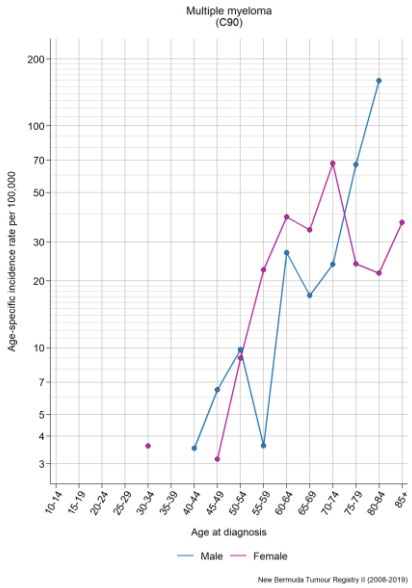
Figure Appendix-II Age-specific incidence rates of cancer for major diagnosis groups (2008-2019 average)

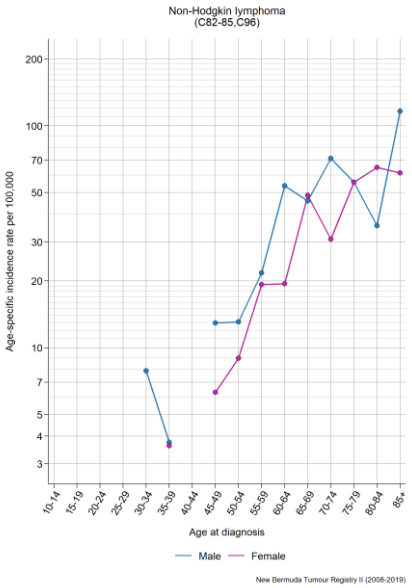


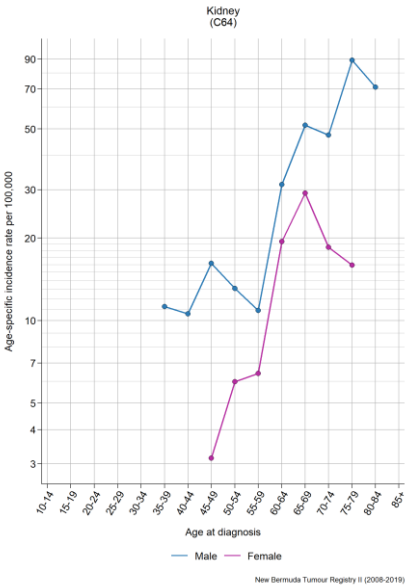

Rectum
(C19-20)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

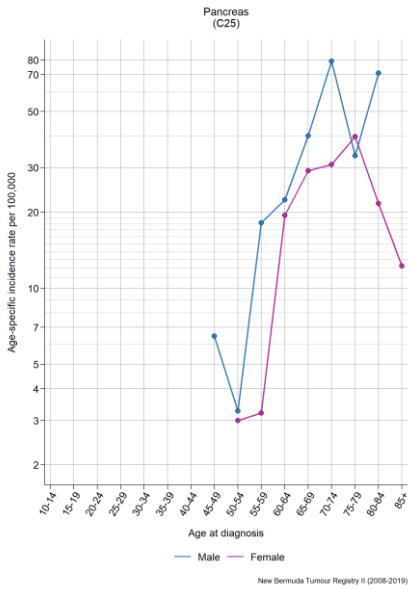

Melanoma of skin
(C43)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

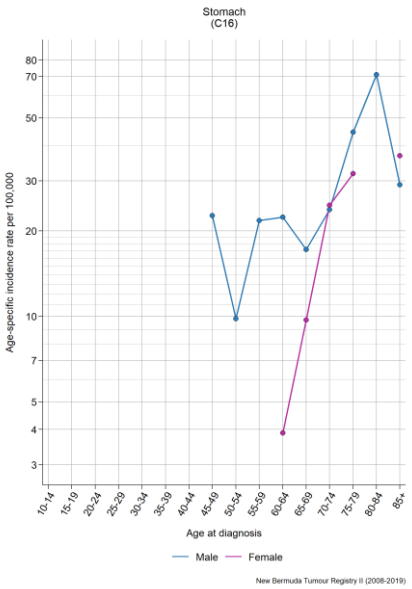

Corpus uteri
(C54)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

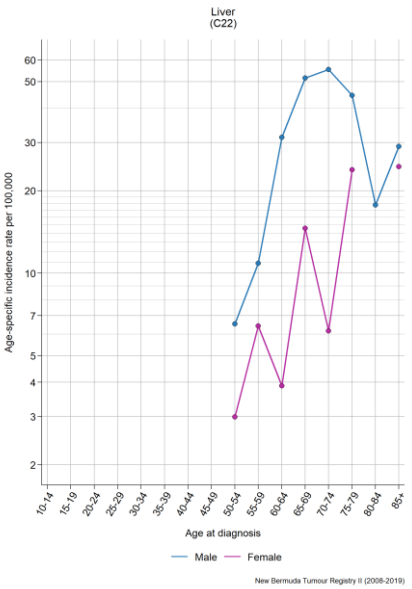

Multiple myeloma
(C90)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

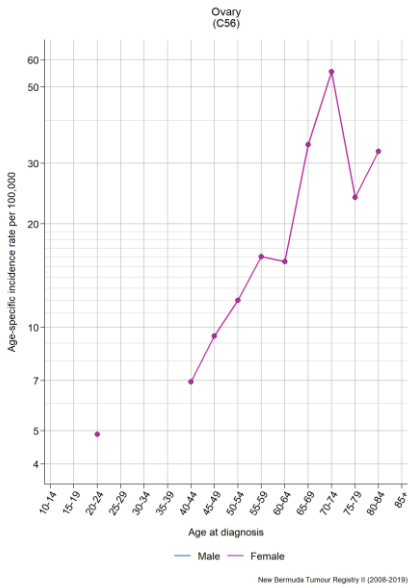

Non-Hodgkin lymphoma
(C82-85,C96)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

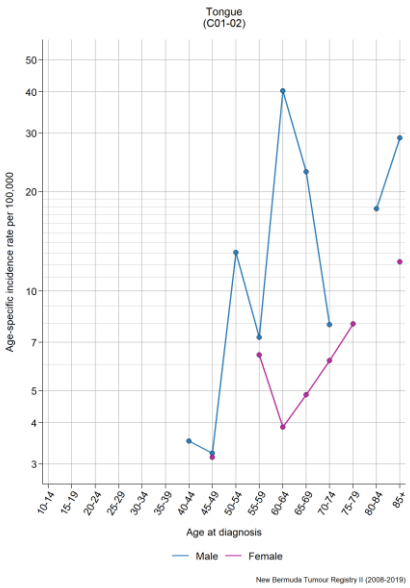

Kidney
(C64)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

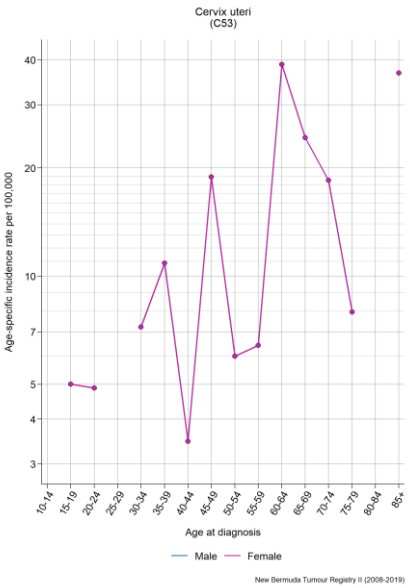

Pancreas
(C25)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

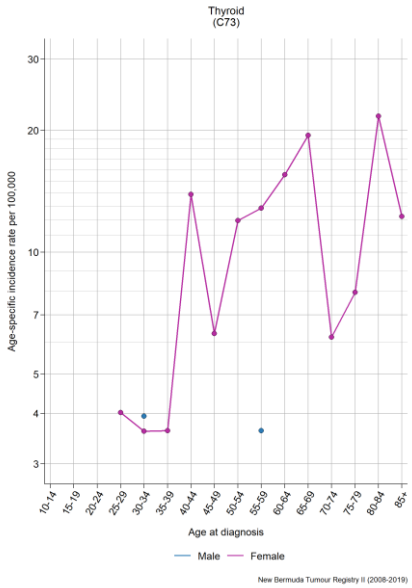

Stomach
(C16)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

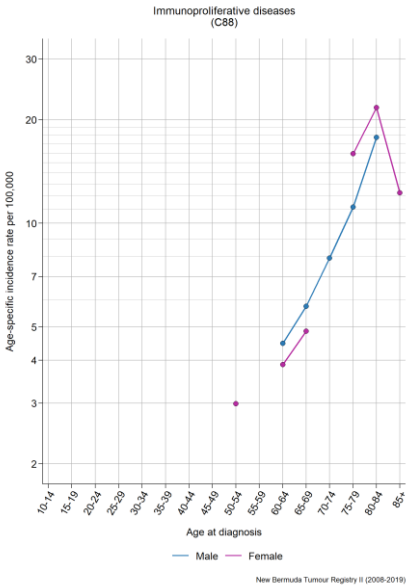

Liver
(C22)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

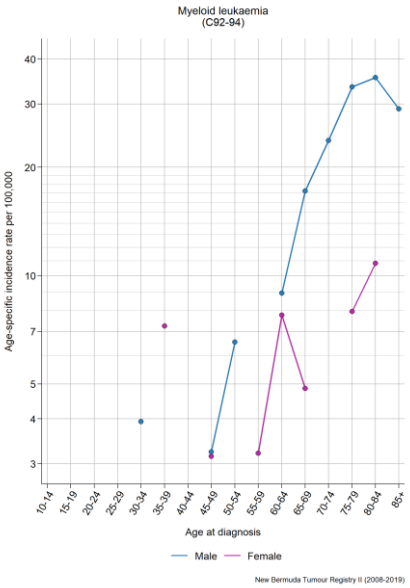

Ovary
(C56)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)


Tongue
(C01-02)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)


Cervix uteri
(C53)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)


Thyroid
(C73)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)


Immunoproliferative diseases
(C88)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)


Myeloid leukaemia
(C92-94)
Age-specific incidence rate per 100,000
Age at diagnosis
Male
Female
New Bermuda Tumour Registry II (2008-2019)

III. Prostate cancer in Bermuda

Prostate cancer statistics in Bermuda at a glance:

- Prostate cancer is the #1 cancer affecting men in Bermuda
- Prostate cancer accounts for one-third of the cancer diagnoses among men in Bermuda[1]
- 1 in 6 men in Bermuda will be diagnosed with prostate cancer[2]
- 98% of prostate cancer cases in Bermuda are diagnosed in men aged 50 and older
- Incidence rates for prostate cancer in Bermuda are highest in males aged 70-79 years

Data source: Bermuda National Tumour Registry (2008-2019)

[1] 2008-2019 cancer registrations from Bermuda National Tumour Registry, excluding non-melanoma skin cancer

[2] Cumulative risk, men aged 40-84 years of age

IV. Cancer expenditure in Bermuda

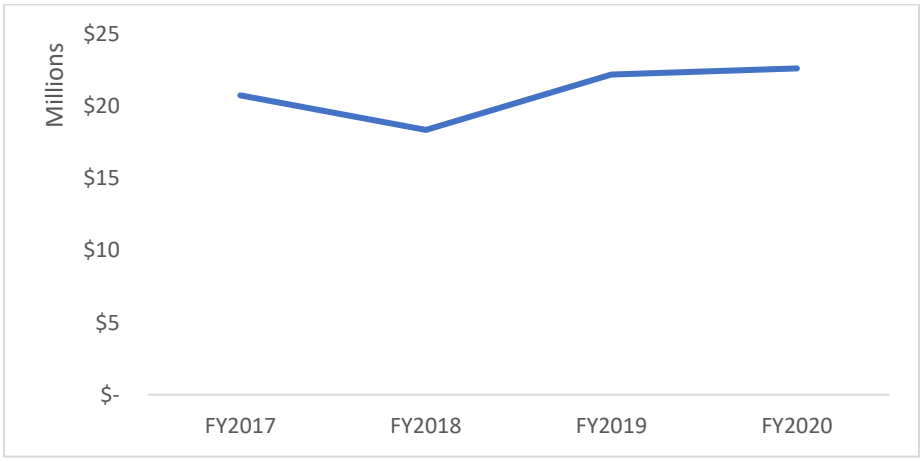
The cost of cancer in Bermuda is unknown. We triangulated the available data from Bermuda Health Council, Bermuda Hospitals Board (BHB) and Bermuda Cancer and Health Centre. Bermuda Health Council provided expenditure data for cancer-related services (identified through diagnosis codes) from claims submitted by insurers and paid out (41), Table Appendix-IV. Insurance claims exclude all cancer services provided by BHB. The costs of delivering chemotherapy only at BHB were obtained (42), but we were unable to obtain BHB expenditure data for all other cancer services provided by BHB. Bermuda Cancer and Health Centre subsidies for underinsured patients and donations for uninsured patients are included with the caveat the fiscal year is January 1 through December 31 while all other fiscal years reflect April 1 through March 31st. As the totals already reflect a rough approximation due to the data limitations, we have not reconciled this difference. Cancer expenditure ranged from between $18.3 million to $22.6 million per year between FY2017 – 2020, Figure Appendix-IV. Most cancer expenditure occurs on-island and overseas expenditure has declined compared to FY2017, Table Appendix-IV.

Table Appendix-IV Cancer expenditure FY2017 – FY2020

Cancer Expenditure	FY2017	FY2018	FY2019	FY2020
Insurance claims paid out - Local	$ 8,129,645	$ 7,920,565	$ 9,454,702	$ 8,432,825
Insurance claims paid out - Overseas	$ 6,241,088	$ 3,352,547	$ 5,031,418	$ 4,746,610
BHB Oncology (chemotherapy only)	$ 5,368,427	$ 5,203,203	$ 5,964,694	$ 7,465,329
BCHC clinical services subsidy for underinsured patients	$ 425,185	$ 1,414,086	$ 1,522,599	$ 1,348,067
BCHC donation for uninsured patients	$ 561,033	$ 448,369	$ 211,752	$ 607,563
Total*	**$ 20,725,377**	**$ 18,338,770**	**$ 22,185,165**	**$ 22,600,394**

**Excludes Bermuda Hospitals Board cancer expenditure outside of chemotherapy*

Figure Appendix-IV Cancer expenditure* FY2017 – FY2020



**Excludes Bermuda Hospitals Board cancer expenditure outside of chemotherapy*

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