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The Cancer Burden in Sarawak, Malaysia: Sarawak Cancer Report

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ABSTRACT

Background and Aims: Malaysia, like many developing countries, is undergoing epidemiologic transition where non-communicable diseases, including cancer, are emerging as a prevalent health burden. Sarawak is the largest state in Malaysia, located on the island of Borneo. Compiling region-specific cancer statistics is crucial for future planning and implementation of effective cancer management strategies.

Methods: This study utilized cancer data reported to the Sarawak State Health Department with a cancer notification form. Data was obtained from the State cancer database. Incidence, Age-Standardized Rate, frequency, cumulative rate, and lifetime risk were calculated. The population included Sarawak residents only who were defined as Malaysian citizens as well as permanent residents living in Sarawak at the time of diagnosis.

Results: Between years 2011–2015, there were a total of 10,320 cancer cases (47.3% male). The incidence rate was approximately 16.6 persons per 100,000 population per year. An increasing trend was observed in cancer incidence with increasing age. Ethnic distribution reported the highest incidence among the Chinese (male cases:36.2% and female cases:36.4%), followed by the Iban (male cases:26.9% and female cases:24.5%), and Malay (male cases:18.3% and female cases:22.0%). The three most common cancers in male were colorectal (15.4%), nasopharyngeal (14.8%), and trachea, bronchus, lung (14.0%) cancer. In females, the first three common cancers were breast (27.9%), cervix uteri (11.6%), and colorectal (9.8%). There were wide disparities among common cancers across genders, different age groups and ethnic groups.

Conclusion: The lifetime risk of a Sarawakian to develop cancer by age 75 is 1 in 11 in females and 1 in 10 in males. This present study provided a framework for the status and trend of cancer in Sarawak. These findings will provide additional information to guide strategy and resource planning in improving cancer care in Sarawak.

1 | Introduction

The World Health Organisation (WHO) in its Global Cancer Statistics 2020 report has underscored a critical global health concern. It indicates approximately 19.3 million new cancer cases and nearly 10 million cancer deaths worldwide. Globally, one in five individuals will experience a cancer diagnosis in their lifetime, while one out of every six deaths worldwide can be attributed to cancer. This underlines an urgent need to accelerate global initiatives towards cancer control, inclusive

of early diagnosis, prevention and effective therapeutic interventions.

According to the report, the most frequently diagnosed cancer include female breast cancer (11.7%), followed by lung (11.4%), colorectal (10.0%), prostate (7.3%) and stomach (5.6%) cancers [1]. Extrapolating these rates to 2040, global cancer burdens are predicted to rise to approximately 28.4 million cases, with the assumption that the national rates in 2020 remain constant. The anticipated increase, representing a 47% rise in comparison to 2020, is expected to hit low-to-middle-income countries (LMIC) the hardest, where over two-thirds of global cancers are currently reported.

The report further indicates that nearly half of the reported cancer cases (49.3%), were located in Asia, where 59.5% of the global population resides, and this region contributed to 58.3% of global cancer deaths. Europe accounted for 22.8% of the total cancer cases but only 19.6% of cancer-related deaths, while the Americas, with 20.9% of cancer cases, were responsible for 14.2% of cancer deaths. This distribution highlights the significant global diversity in cancer incidence and mortality rates, largely driven by socioeconomic disparities. The international approach to cancer management remains fragmented, as underscored by the fact that approximately 70% of all cancer fatalities occur in LMICs, where a significant percentage of these deaths could have been preventable [2]. It is estimated that one-third to half of all cancer cases could be prevented by reducing exposure to risk factors, with tobacco use being the leading culprit, accounting for 25% of all cancer deaths worldwide [3].

According to Globocan 2020, Malaysia reported a total of 48,639 cancer cases within a population of 32 million, with an age-standardized rate (ASR) of 143.9 (137.8 for males and 151.4 for females). It is projected that one in seven individuals will encounter a cancer diagnosis by the age of 75 years.

Although the pattern of leading cancers remained similar, notably, there has been a rising trend in cancer incidences and mortality rates in 2020 compared to the period of 2012–2016, as per the Malaysian Cancer Registry [4]. At diagnosis, approximately two-thirds (63.7%) of patients were presented with cancer at least stage III and above, highlighting the importance of early detection strategies.

Data from the Malaysian cohort could not be extrapolated to the Sarawak population due to significant ethnic biodiversity [5]. The Malaysian cohort comprised mostly Malays (55.6%), followed by Chinese (23.4%), Bumiputera (13.0%), Indians (7.0%) and others (1.0%) [6]. While in Sarawak, the majority ethnic group was Iban (46.4%), followed by Malay (19.1%), Chinese (16.5%), Bidayuh (9.8%), Orang Ulu (7.7%), and others (0.5%). This critical aspect emphasizes the need for a more region-specific approach to cancer control in Malaysia.

Over 70% of the Malaysian population relies on the public healthcare system, especially primary care facilities. and access to cancer care is significantly limited by the capacity and distribution of oncology services across public and private healthcare facilities in the country.

Approximately 25% of the Malaysian population lives more than 100 kilometers from radiotherapy facilities [7, 8]. According to the Ministry of Health, there were only 167 oncologists in the country as of 2022, with a ratio of 0.5 to 100,000 people. Of this total, 60% worked in private healthcare facilities and only 30% were found in public healthcare facilities in Sarawak. In Sarawak with a population of 3.2 million spread across an area of approximately 125,000 km^2, cancer care is primarily provided by a single public hospital and three private hospitals. Sarawak General Hospital, situated in Kuching in the north-western part of the Island of Borneo, serves as the only public tertiary referral centre in the entire state with 5 oncologists who are periodically mobilized to the district hospitals [9].

Compiling cancer statistics is crucial for future planning and implementation of effective cancer control strategies and identifying gaps in cancer control efforts. In Malaysia, national cancer statistics have been collected through a cancer notification form. Since January 1, 1996, Sarawak has been diligently collecting information about cancer in the state.

In this current study, we aimed to:

1. Describe the cancer incidences in Sarawak.
2. Describe the cancer incidences of different ages and ethnicity.
3. Describe the trend of cancers over the past 20 years.

2 | Methods

2.1 | Data Sources

All cancer cases are reported to the Sarawak State Health Department with a cancer notification form (refer Appendix A). Cancer case registration is based primarily on voluntary notifications. Using the state's cancer registry database, annual cancer statistics in Sarawak were calculated. The data was published in national and state cancer registries. This current study obtained data from the state cancer database. The data analysis included Sarawak residents only who were defined as Malaysian citizens as well as permanent residents living in Sarawak at the time of diagnosis. This study obtained ethics approval from the Malaysian Medical Ethics Committee (NMRR ID – 22-01151-6KI).

2.2 | Statistical Analysis

2.2.1 | Age-Standardized Rate (ASR)

The age-standardized incidence rate is a summary measure of the rate that a population would have if it had a standard age structure.

It is calculated by summing the products of the age-specific rates applied to the world standard population; the calculated

incidence rate is then called the world standardized incidence rate. It is also expressed per 100,000.

$$ASR = \sum(ARix\ Pi.std)/total\ world\ standard\ population$$

AR_i – Age-specific rate in the i^{th} age class; $P_{i.std}$ – The number in the i^{th} age class of the world standard population.

2.3 | Cumulative Risk of Developing Cancer From Birth to Age of 74

Cumulative rate (CR74) [6, 10]

Cumulative rate is the weighted sum of age-specific incidence rates until completion of 74 years of age. The weighting used in this calculation is based simply on the widths of the age groups, i.e. multiplying the 5-year age-sex specific rates per person by 5 and summing over age groups from 0–4 to 70–74. CR74 is necessary to ascertain the cumulative risk and is expressed in percentages.

$$\mathbf{CR74 = 5 \times \Sigma i\,(di/yi) \times 100}$$

i – 5-year age groups; di – Number of cases in age class i; yi – Person-years at risk of age class i.

2.4 | Cumulative Risk (CumR) [6]

Cumulative risk is defined as a probability that an individual would develop cancer during a certain age period, in the absence of any competing cause of death. The age period over which the risk is accumulated in this report is 0–74 years. The precise mathematical relationship between the cumulative rate and the cumulative risk is:

$$\mathbf{CumR = 100 \times [1 - exp\,(-CR74/100)]}$$

exp - exponential.

2.5 | Lifetime Risk [6, 10]

Lifetime risk is defined as the likelihood that a person who is free of a certain type of cancer will develop or die from that type of cancer during his or her lifetime. Lifetime risk estimates are usually expressed as the odds of developing cancer ('1 in x') or as a percentage.

3 | Results

3.1 | Trend in Cancer Incidence Over 20 Years

Table 1a,b depicts the trend of all cancers combined over the span of 20 years in Sarawak for each gender. Notably, there was an upward trend in female breast cancer incidences from 1996 to 2015.

3.2 | Cancer Incidence 2011–2015

Between 2011 and 2015, 10,320 new cancer cases were diagnosed in Sarawak., with 47.3% of cases in males, and 52.7% in females (Table 2). An increasing trend was observed in cancer incidences as the population aged. The age distribution showed

TABLE 1a | Trend of all cancers combined for 20 years (1996–2015) in Sarawak (ASR/100,000) in males.

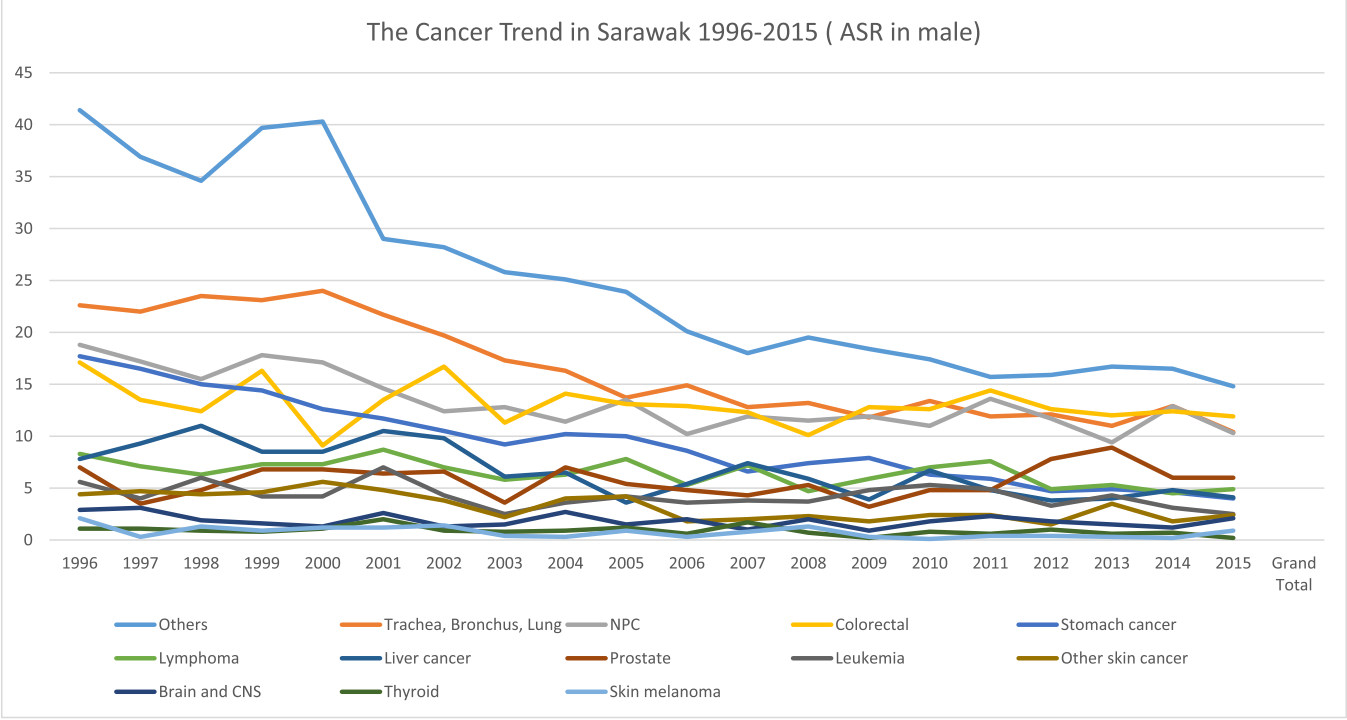
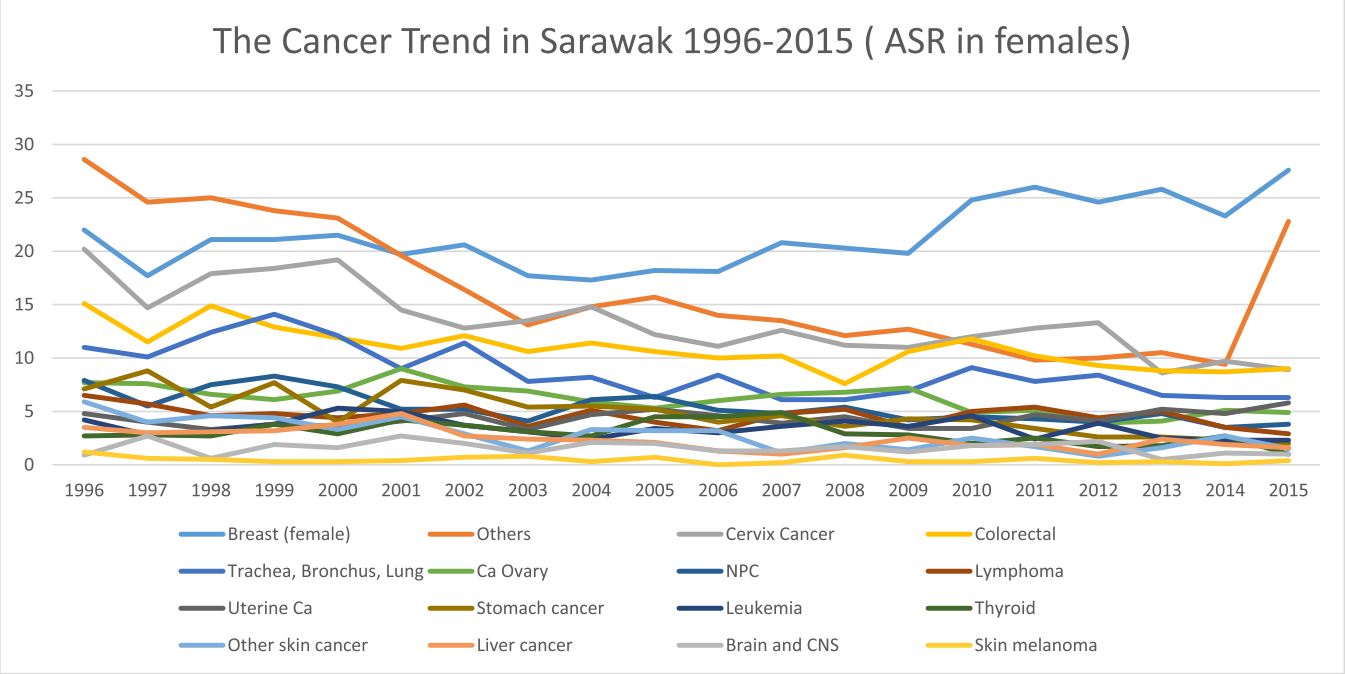


TABLE 1b | Trend of all cancers combined for 20 years (1996–2015) in Sarawak (ASR/100,000) in females.



the highest incidence of cancer in the 25–59 age group for both males and females, accounting for 43.8% and 60.8% of the cases respectively. The next most affected group was age group 60–74. Ethnic distribution of cancer cases revealed the highest incidence among the Chinese population (36.2% of male cases and 36.4% of female cases), followed by the Iban (26.9% of male cases and 24.5% of female cases), and Malay (18.3% of male cases and 22.0% of female cases). The Crude Rate (CR) and Age Standardized Ratio (ASR) for the top 10 common cancers in Sarawak are detailed in Table 3a,b. The total population for this period was 12,452,500 people, yielding an incidence rate of 82.9 per 100,000 population over 5 years; which equated to 16.6 per 100,000 population per year.

3.3 | Cancer Burden 2011–2015

In males, the five most frequently diagnosed cancers in Sarawak were Colorectal (15.4%), Nasopharyngeal (14.8%), Trachea, Bronchus, Lung (14%), Prostate (7.7%), and Lymphoma (6.8%) (Table 3a). Whereas in females, the five most frequently diagnosed cancers were Breast (27.9%), Cervix Uteri (11.6%), Colorectal (9.8%), Trachea, Bronchus, Lung (7.4%), and Ovary (5.2%) (Table 3b). The top five cancers in each gender accounted for 58.7% and 61.9% of all cancer cases in each gender, respectively. Between 2011 and 2015, the ASR for males is 80.9 and females 93.0 respectively. The lifetime risk of a Sarawakian being diagnosed with cancer by age 75 was 1 in 11 for males and 1 in 10 for females.

3.4 | Ethnicity-Based Variations

There was a large variability of cancer incidences across different ethnic groups (Tables 4a,b). In males, NPC was the most commonly diagnosed cancer among the Iban (18.9%) and Bidayuh (24.2%). Whereas in Chinese males, colorectal cancer (20.8%) was the most common, followed by trachea bronchus lung (14%) and prostate (11.1%). In Malay males, trachea, bronchus, and lung (16.9%) was the most common, followed by colorectal (13.5%) and NPC (10.3%). In Melanau males, both trachea bronchus and lung (14.5%) and colorectal cancers (14.5%) were the most common, followed by NPC (12.8%). In females, breast cancer was the most common diagnosis across all ethnic groups. Among Iban, Malay, Bidayuh, and Melanau females, the second most common cancer was cervix uteri with rates of 16.9% and 9.8%, 11.2% and 10.9% respectively. In Chinese females, the second most common cancer was colorectal (13.2%),

3.5 | Age-Related Variations

The incidence of different types of cancer varied widely across different age groups, as evident from Tables 5a,b. Among children aged 0–14 years, leukemia was the most common cancer in both genders, representing 37.1% of cases in each group. The pattern of cancer incidences shifted as the population ages. In males aged 15–24 and 25–59 years, NPC was the most frequently diagnosed cancer, with rates of 23.1% and 23.0%, respectively. The second most common cancer in males aged 25–59 years was colorectal cancer (15.1%), followed by trachea, bronchus, and lung cancer (12.9%). In males aged 60–74 years, trachea, bronchus, and lung cancer (17.5%) were most common, followed by colorectal cancer (17%) and prostate cancer (12.9%). In males aged 75 and above, colorectal cancer was the most prevalent (19.5%), followed by prostate cancer (18.2%) and trachea, bronchus, and lung cancer (15.7%). In females, the most frequently diagnosed cancer varied by age group. Among those aged 15–24 years, lymphoma was most common (27.4%). Among females aged 25–59 years and 60–74 years, breast cancer

TABLE 2 | Demographic data for Cancer at all sites in 2011–2015.

Age, mean (SD)	2011–2015 (Male: *n* = 4,885)	2011–2015 (Female: *n* = 5,435)
Ethnicity, *n* (%)		
Iban	1312 (26.9)	1334 (24.5)
Chinese	1775 (36.2)	1978 (36.4)
Malay	895 (18.3)	1194 (22.0)
Bidayuh	500 (10.2)	437 (8.0)
Melanau	117 (2.4)	165 (3.0)
Others	286 (5.9)	327 (6.0)
District, *n* (%)		
Kuching	1512 (31.0)	1675 (30.8)
Samarahan	402 (8.2)	426 (7.8)
Sri Aman	147 (3.0)	158 (2.9)
Betong	148 (3.0)	208 (3.8)
Sarikei	178 (3.6)	148 (2.7)
Sibu	561 (11.5)	538 (9.9)
Mukah	128 (2.6)	132 (2.4)
Bintulu	269 (5.5)	240 (4.4)
Miri	570 (11.7)	619 (11.4)
Limbang	91 (1.9)	130 (2.4)
Kapit	129 (2.6)	124 (2.3)
Cancer at all sites, *n* (%)	**Male: 750 (14.4)**	**Female: 1037 (19.1)**
Age group, *n* (%)		
Age 0–14	186 (3.8)	143 (2.6)
Age 15–24	160 (3.3)	146 (2.7)
Age 25–59	2138 (43.8)	3307 (60.8)
Age 60–74	1851 (37.9)	1468 (27.0)
Age 75 +	550 (11.3)	371 (6.8)

was the most common (34.9% and 21.3%, respectively). In females aged 75 and above, colorectal cancer (18.9%) was the most prevalent, followed by trachea, bronchus, and lung cancer (13.7%) and breast cancer (12.4%).

3.6 | Comparison With Other Registries [11]

The data used in the supplement table on the comparison 2008–2012 between the five continents was retrieved from the Global Cancer Observatory, cancer Incidence in Give Continents volumes I–XI. For both men and women, Seoul, Korea had the highest ASR, followed by the United Kingdom. This could suggest a higher prevalence of cancer risk factors in these areas, or it could reflect differences in diagnosis and reporting practices. The types of cancer exhibiting the highest incidence varied across regions, influenced by factors such as genetics, lifestyle, and environmental conditions. A case in point is the elevated incidence of NPC among males in Sarawak, Malaysia, aligning with increased prevalence of this cancer type in Southeast Asia due to specific dietary habits and Epstein-Barr virus exposure. Conversely, in the United Kingdom, prostate cancer led the statistics among males, reflecting the global trend of higher incidence rates in Western nations. As for females, breast cancer was universally the most common type, with the exception of Seoul, Korea, where thyroid cancer prevalence took precedence.

3.7 | Leading Cause of Deaths in Sarawak

Neoplasms had consistently ranked the third leading cause of death in Sarawak for most years, and in 2022, after death of diseases of the circulatory system and diseases of the respiratory system.

4 | Discussions

This comprehensive study offered valuable insights into the trends, distribution, and burden of cancer in Sarawak over the past two decades. The data illustrated a significant shift in the incidence and type of cancer cases diagnosed based on gender, age and ethnicity. Cancer patterns and trends in Sarawak markedly deviated from national and global trends, necessitating tailored interventions.

4.1 | Trend and Gender

The cancer epidemiology in Sarawak demonstrated some similarities with the ASEAN region. Similarly, among woman, the most commonly diagnosed cancers included breast cancer, followed by cervical cancer and colorectal cancer. Furthermore, the data exhibited that breast cancer was the most common diagnosis in females across all ethnic groups, and this high prevalence of breast cancer in women aligned with global trends, underscoring the universal importance of breast cancer screening and early detection programs. The heterogenecity of breast cancer characterized by unique molecular subtypes with varied prognostic and therapeutic implications, reinforces the necessity for implementing precision medicine, tailored to molecular types. It is concerning that the 5-year survival rate for metastatic breast cancer with chemotherapy remains below 30 percent [12]. Conversely, patients diagnosed at stage 0 or stage 1 have a 5-year survival rate of nearly 100%, emphasizing the significant impact of early detection and personalized therapeutic approaches [13]. A cross-sectional study on breast cancer screening in Malaysia revealed persistent gaps in awareness of breast cancer [14].

Meanwhile, the cancer epidemiology among men in Sarawak shows considerable heterogeneity within the ASEAN region. According to the Globocan Fact Sheet for Southeast Asia, the most prevalent cancers among men in ASEAN include lung, liver, and colorectal cancer (CRC) [15]. In Sarawak, CRC was the first most common cancer in males and the third most common cancer in females. A review conducted by Veettil et al. highlighted that a significant proportion of colorectal cancer patients in Malaysia were diagnosed at advanced stages. This resulted in a 5-year relative survival rate that is notably lower

TABLE 3a | Sarawak burden of cancer 2011–2015–first 10 common cancers for males in Sarawak.

ICD-10	Cancer	Incident cases	%	CR	ASR	CR74	CumR	Lifetime risk	
C18-20	Colorectal	752	15.4	12.1	12.7	1.5	1.49	1 in	67
C11	Nasopharynx	723	14.8	11.5	11.4	1.2	1.19	1 in	84
C33-34	Trachea, Bronchus, Lung	685	14	10.9	11.5	1.4	1.39	1 in	72
C61	Prostate	377	7.7	6	6.6	0.9	0.90	1 in	112
C81-85	Lymphoma	330	6.8	5.2	5.4	0.5	0.50	1 in	201
C16	Stomach	277	5.7	4.4	4.7	0.6	0.60	1 in	167
C22	Liver	251	5.1	3.9	4.2	0.5	0.50	1 in	201
C91-95	Leukemia	213	4.4	3.3	3.5	0.3	0.30	1 in	334
C44	Other Skin	136	2.8	2.1	2.3	2.2	2.18	1 in	46
C70-72	Brain, Nervous System	111	2.3	1.7	1.8	1.7	1.69	1 in	59
	Others	1030	21.1	—	—	—	—	—	—
	All	**4885**	**100**	**77.7**	**80.9**	9.49	9.05	1 in	11

TABLE 3b | Sarawak burden of cancer 2011–2015—first 10 common cancers for females in Sarawak.

ICD-10	Cancer	Incident cases	%	CR	ASR	CR74	CumR	Lifetime risk	
C50	Breast	1516	27.9	25	25.7	2.8	2.76	1 in	36
C53	Cervix Uteri	628	11.6	10.3	10.7	1.1	1.09	1 in	91
C18-C21	Colorectal	534	9.8	8.9	9.4	1.1	1.09	1 in	91
C33-C34	Trachea, Bronchus, Lung	400	7.4	6.6	7.1	0.9	0.90	1 in	112
C56	Ovary etc	280	5.2	4.6	4.7	0.5	0.50	1 in	201
C54	Corpus Uteri	261	4.8	4.3	4.5	0.5	0.50	1 in	201
C81-C85; C96	Lymphoma	252	4.6	4.1	4.2	0.4	0.40	1 in	251
C11	Nasopharynx	246	4.5	4	4.1	0.4	0.40	1 in	251
C91-C95	Leukemia	149	2.7	2.4	2.7	0.2	0.20	1 in	501
C16	Stomach	146	2.3	2.4	2.6	0.3	0.30	1 in	334
	Others	1022	18.9	—	—	—	—	—	—
	All	**5434**	**100**	**89.6**	**93**	**10.3**	9.76	1 in	10

compared to those reported in developed Asian countries. A significant gap in public awareness regarding the rising incidence of colorectal cancer was evident, and participation rates in screening programs remained alarmingly low [16].

4.2 | Ethnicity

The variations in cancer types among different ethnic groups underlined the influence of genetic, lifestyle, and environmental factors on cancer incidence. The higher prevalence of CRC in Chinese males and trachea, bronchus, and lung cancer in Malay males underscored the importance of specific prevention strategies tailored to these populations.

These findings necessitated the formulation of public health strategies that considered the influence of demographic factors, such as age, gender, and ethnicity, on the incidence and types of cancers. The data should guide resource allocation for cancer prevention, detection, and treatment initiatives, ensuring the most effective and relevant strategies to be implemented for each demographic group.

A nationwide study centered on CRC incidence and mortality within Malaysia unequivocally demonstrated that Chinese ethnicity exhibited the highest incidence of CRC in Malaysia. This observation suggested the ethnicity-based disparities in colorectal cancer among Malaysia's diverse population [17].

Variations in the incidence of the second most common cancer across different ethnicities highlighted the potential role of genetics and lifestyle factors in disease etiology. For instance, the observed high incidence of NPC among males (second most common) in Sarawak aligned with Southeast Asian trends, suggesting the need for targeted preventive and early detection efforts in this population. The high prevalence of NPC among Iban and Bidayuh males, for instance, called for a more detailed study on genetic predispositions and lifestyle factors, such as dietary habits, in these ethnic groups [18].

Apart from that, cigarette smoking has been identified as a notable contributing factor to the development of NPC [19, 20]. This association could be attributed to the presence of carcinogenic compounds in cigarettes, that damage the mucosal lining of

TABLE 4a | The first 5 common cancer sites by ethnicity (male) 2011–2015.

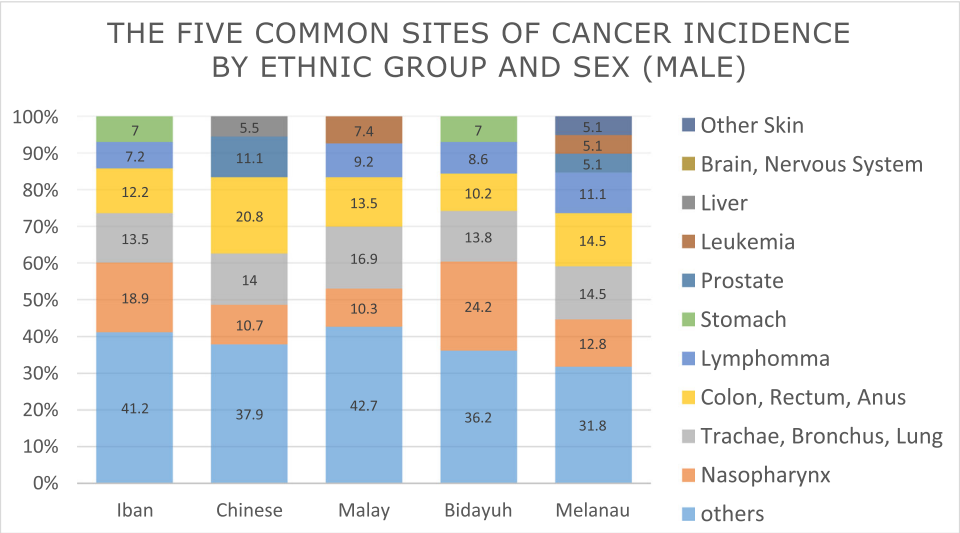
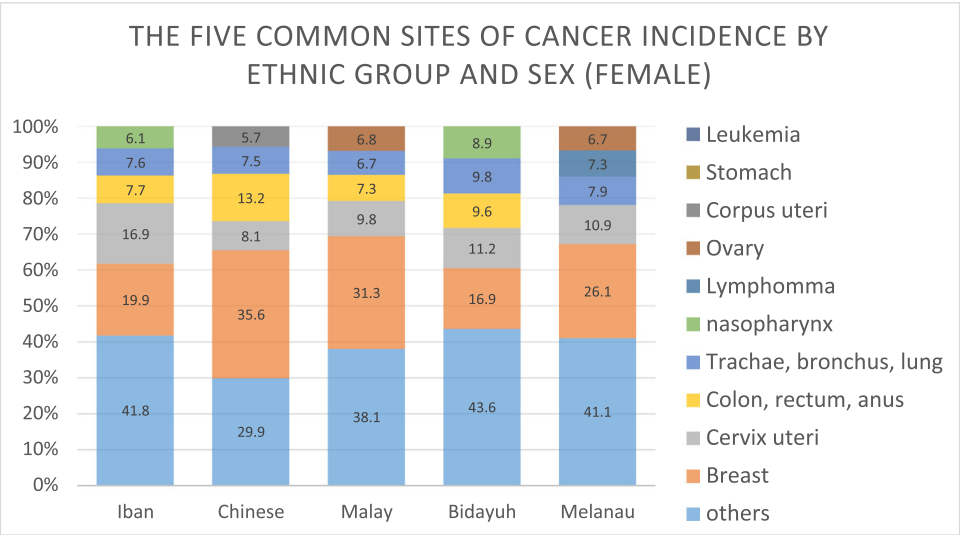


TABLE 4b | The first 5 common cancer sites by ethnicity (female) 2011–2015.



the airway. These findings underscored the detrimental effects of smoking on nasopharyngeal health and emphasized the need for tobacco control measures and smoking cessation interventions to reduce the risk of NPC.

Our findings highlighted the substantial variability in cancer incidence across different ethnic groups and age groups. Tailored interventions that consider specific cultural, dietary, and lifestyle factors of each ethnic group could be more effective in reducing cancer incidence.

4.3 | Age

The cancer incidences increased with age, which aligned with global trends showing higher cancer incidence in older populations due to accumulated exposure to various risk factors over time. The prevalence of leukemia being the most common cancer among children, is consistent globally, indicating a potential focus area for pediatric oncology in Sarawak. Moreover, further research is warranted to identify the complex genetic, lifestyle, and environmental factors contributing to the different patterns of cancer incidence observed in the study. A more detailed understanding of these factors will aid in devising targeted prevention and intervention strategies, consequently enhancing the effectiveness of cancer control measures in Sarawak.

4.4 | Awareness and Prevention

A study by Teh et al. and team who estimated the Population Attributable Fraction (PAF) of the modifiable risk factors for cancer incidences in Malaysia, suggested that tobacco smoking and excess weight were the two predominant factors out of the

TABLE 5a | The first 5 common cancer sites by age group (male) 2011–2015.

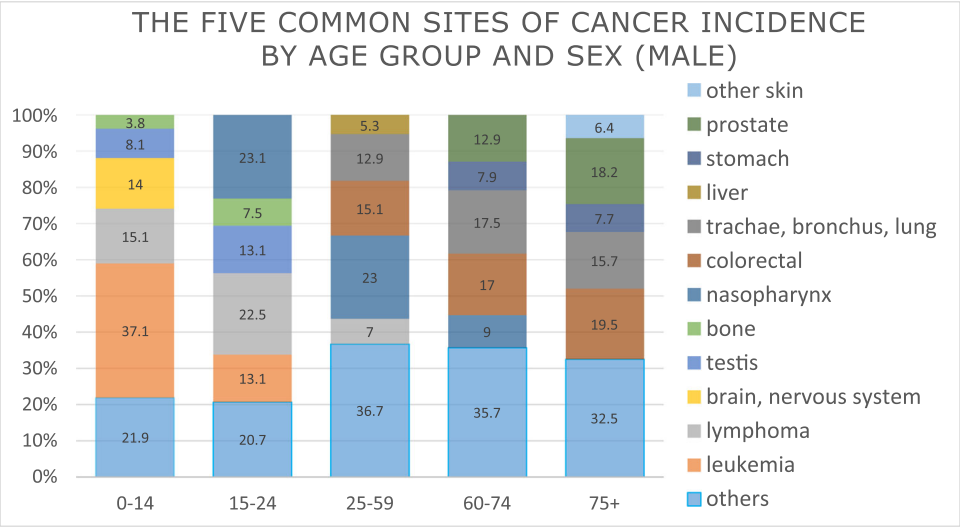
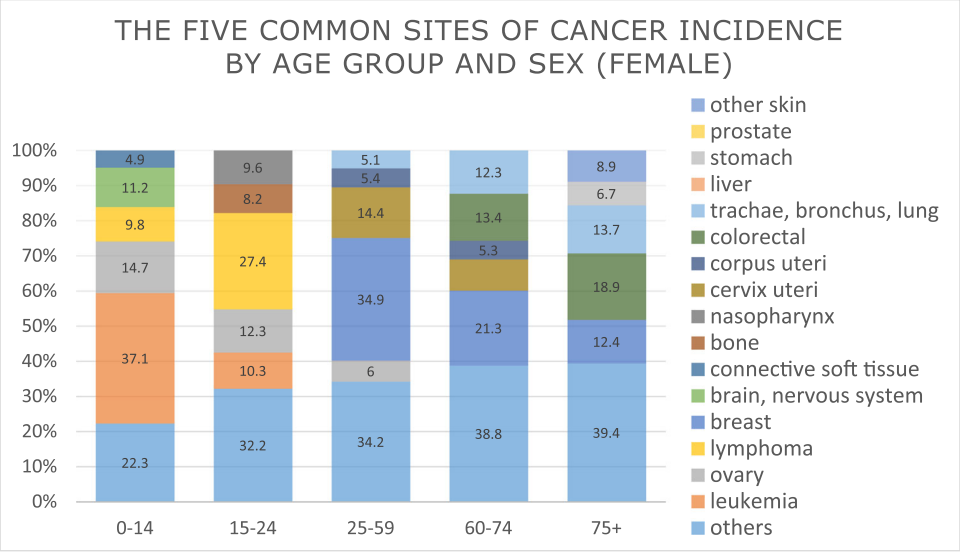


TABLE 5b | The first 5 common cancer sites by age group (female) 2011–2015.



four studied risk factors for cancer cases in Malaysia [21]. The National Health and Morbidity Survey (NHMS) 2015, conducted by the Ministry of Health Malaysia, showed that approximately one in two Malaysians was obese/overweight. Concerning smoking, approximately 22.8% are current smokers, and there were stark disparities across ethnicities, with 24.7% Malays, and 25.8% of other Bumiputeras, rates that markedly exceeded the Chinese, 14.2%. In relation to alcohol consumption, among individuals aged 13 and above, 7.7% were found to be current drinkers [22]. In fact, one-third of cancer mortality is attributable to five leading behavioral and dietary risks which include high body mass index, low fruits and vegetable intake, lack of physical activities, tobacco use and alcohol consumption. Tobacco use is the most common risk factor for cancers and is accounting for approximately 22% of cancer deaths. Between 30% and 50% of all cancer cases are preventable. This demonstrates that prevention remains the most economical and sustainable long-term strategy for cancer control. In line with WHO, we have to work towards raising awareness, and to reduce exposure to cancer risk factors (smoking, alcohol, obesity, physical inactivity, infections, radiation, environmental and occupational carcinogens), and for people to adopt healthy lifestyles [3].

The results of a recent study conducted by Desiree et al., the first national survey in Malaysia, highlighted significant gaps in the general population's understanding of symptoms and risk factors for various types of cancers. Despite a high incidence of cancer within the country, the study, which involved 1895 participants, revealed a significant disparity in cancer awareness compared to high-income nations. Specifically, in the context of breast cancer which is highly prevalent in Malaysia, only about 75% of the surveyed population could correctly identify pivotal symptoms such as unexplained lumps or swellings. This lack of awareness, affecting one in four Malaysians, posed a major public health

concern as the unrecognized symptoms could potentially delay the initiation of timely diagnostic measures and subsequent treatment. The study also showed a substantial lack of awareness of other cancer types, with the knowledge gap ranging between 35% and 75% among participants depending on the cancer type. This may resulted in possible delays in diagnosis and subsequently contributed to the poorer outcomes associated with late-stage presentations of the disease.

These findings underscored the urgent need for comprehensive public health interventions within Malaysia. To address the identified knowledge gap, initiatives such as nationwide awareness campaigns and robust education programs should be prioritized for specific groups. These efforts should aim to enhance the public's understanding of the common symptoms and risk factors associated with different types of cancers, thus facilitating early detection and timely therapeutic interventions. Moreover, the need for enhancing the skillset of healthcare providers in the effective communication of cancer-related information is apparent. Improved communications between healthcare providers, patients, and their families can greatly contribute to enhancing cancer literacy. While these results are specific to Malaysia, they may also reflect broader issues prevalent in many middle- and low-income countries. Therefore, the findings from this study should serve as a catalyst for efforts aimed at elevating cancer awareness and education at a global level [23].

Cancer is a significant health burden across Southeast Asia. Together with other countries, Malaysia is also undergoing an epidemiological transition, where non communicable diseases (NCD), including cancer, are a major contributor to morbidity and mortality [24]. In Brunei, Thailand, and Singapore, cancer is the leading cause of disability-adjusted life years, while in Cambodia, Malaysia, the Philippines, Vietnam, Indonesia, and Myanmar, it ranked second only to cardiovascular diseases [25]. This trend underscored the critical need for effective cancer control strategies that prioritize prevention, early detection, and quality treatment, tailored to the specific epidemiological profiles and available resources of our own state of Sarawak. By taking coordinated and evidence-based action, we can reduce the burden of cancer and improve the health outcomes and well-being of populations across the region.

4.5 | Barriers to Cancer Care

Addressing systemic barriers to cancer care in Sarawak is important. The distance to radiotherapy facilities, the limited number of oncologists, and the heavy reliance on a few public healthcare facilities make it challenging for many individuals to access timely cancer care. These could lead to delayed diagnosis, thus delayed treatment of patients. Sarawak General Hospital, is the only public tertiary hospital offering complete cancer care in the whole state of Sarawak, including surgery, chemotherapy, and radiotherapy, and the current facilities are inadequate to handle the existing patient load [26].

5 | Limitations

This study is based on a registry compiled from cancer cases diagnosed across various health centers, presenting several limitations. Firstly, the registry lacked survival and outcome data. Additionally, it had some missing data on some information such as the stage of cancer at diagnosis and the exact dates of diagnosis. Furthermore, there could be incidences of underreporting, potentially resulting in an underestimation of the true incidence of cancer. These limitations must be carefully considered, as they could influence the generalizability and accuracy of the study findings.

6 | Conclusion

In conclusion, our study provides a comprehensive analysis of the cancer burden of the multiethnic population in Sarawak, highlighting significant differences in cancer incidence and trends across different gender, age, and ethnicity. These findings underscore the importance of region-specific, tailored strategies for cancer control and management. Understanding cancer epidemiology specific to your region and applying a tailored cancer care approach can potentially improve the overall quality and effectiveness of cancer care, and optimize the use of healthcare resources. Future research should focus on identifying effective interventions to reduce the cancer burden in Sarawak and improve cancer outcomes for all residents.

Author Contributions

Shirley Siang Ning Tan: conceptualization, data curation, formal analysis, writing–original draft, writing–review and editing. **Lee Len Tiong:** conceptualization, data curation, formal analysis, writing–original draft, writing–review and editing. **Kung Yee Wong:** conceptualization, data curation, formal analysis, resources, validation. **Mastulu Binti Wahab:** formal analysis, methodology, resources, software, validation. **Alan Yean Yip Fong:** conceptualization, data curation, formal analysis, supervision, visualization, writing–original draft, writing–review and editing. **Choo Huck Ooi:** conceptualization, data curation, supervision, validation, visualization, writing–review and editing.

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Disclosure

The lead author Shirley Siang Ning Tan affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The authors confirm that the data supporting the findings of this study are available within the article. The data presented in this study was derived from a local registry collecting de-identifieddeidentified information. As such, the need for individual patient informed consent is not applicable.

All authors have read and approved the final version of the manuscript. The corresponding author had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.