CANCER PROFILE IN AN URBAN HOSPITAL OF THE EASTERN CAPE PROVINCE

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A mini-thesis submitted in partial fulfillment of the requirements for the degree of Master in Public Health at the School of Public Health, University of the Western Cape

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LIST OF ABBREVIATIONS AND ACRONYMS

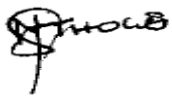
NCR	National Cancer Registry
SAMRC	South African Medical Research Council
EC	Eastern Cape
IT	Information Technologist
PROMEC	Programme on Mycotoxins and Experimental Carcinogenesis
IARC	International Agency for Research on Cancer
CI5	Cancer Incidence in 5 Continents
ICD	International Classification of Diseases
ASRs	Age Standardised Rates
IRR	Incidence Rate Ratio
BFC	Buffalo City
Stats SA	Statistics South Africa
GHS	General Household Survey
HPV	Human Papilloma Virus

Declaration

I hereby declare that *Cancer Profile in an Urban Hospital of the Eastern Cape Province*, is my own work, that it has not been submitted for any degree or examination at any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Nomfuneko Sithole **Date**

26 August 2014



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ABSTRACT

Background: The availability of information on profile and trends of cancer in South African populations is important for the development of appropriate cancer control strategies, as well as monitoring the efficacy of the existing cancer control programmes. Yet, generally there is a scarcity of systematically analysed reports on hospital cancer cases in South Africa, even for urban hospitals. The aim of this study was to describe the cancer profile of patients diagnosed at Frere Hospital's Oncology and Radiation Department and estimate the incidence of cancer among Buffalo City (BFC) urban area residents, for the 19-year period 01 January 1991 to 31 December 2009 based on the clinical administrative data system maintained by the department.

Methodology: The study was a descriptive case series study based on a retrospective review of Frere Hospital's Oncology and Radiation Department patient records from 1991 to 2009. Permission was obtained to retrieve records of cancer cases for the 19-year period from the database. Data were extracted from the customized administrative system to an excel spread sheet. Variables for each case retrieved included: socio-demographic details; age at diagnosis, sex, race, place of residence and medical aid information, tumor information; site and date of diagnosis. Data cleaning incorporated techniques such as checking of completeness and accuracy of patient information details. Dates were formatted into month-day-year sequence and checked so that the date of birth precedes the date of diagnosis of the patient and the date last seen. Age less than zero and greater than ninety nine was replaced as missing. Geographical areas were coded according to the South African Population Census. Duplicates and cases with missing diagnosis were excluded.

STATA 12.0 analysis software was used to determine the proportion of cancer cases by age, sex and site. Frequency distribution tables and graphs were drawn and minimal cancer incidence rates were estimated based on population estimates from the 2007 Community Survey and the 2011 Population Census. The rates were regarded as "minimal" and "working" estimates as the database reviewed was from only one of the two public hospitals in the study area and private hospitals' databases were not used. The other public hospital, Cecilia Makiwane, does not have an oncology department and private hospitals in the study area with radiology departments have issues of patient

information confidentiality. Age standardized rates were calculated using the World Standard Population generally applied to cancer incidence data. Poisson regression analysis model was used to assess trends in selected cancer rates over time adjusted for age and sex.

Results: 19 737 (89.0%) of the 22 173 records retrieved were malignant cases. A total of 7 656 (38.8%) were males and 12 081 (61.2%) were females. The average age at diagnosis for males was 56 years and for females 54 years. In males the top 5 cancers were lung (18.6%), larynx (8.3%), mouth (7.7%), prostate (7.1%), tongue (5.2%) whereas in females were cervix (36.6%), breast (22.0%), lung (3.5%), ovary (2.8%) and corpus uteri (2.7%). A total of 360 childhood (≤14 years) cancers was observed which accounted for 1.8% of all cancers. The leading childhood cancers were brain (20.8%), kidney (19.8%), eye (16.1%), Hodgkin's disease (7.8%) and lymphoid leukaemia (7.3%) in boys. Brain (21.4%), kidney (18.5%), eye (14.9%), bones, joints & articular cartilage (12.5%) and lymphoid leukaemia (10.1%) were leading cancers in girls. Estimates of cancer incidence rates for the BFC urban area sub-population showed that the overall age standardised rates (ASRs) for males were 83.2 per 100 000 population and for females 83.3 per 100 000 population. Leading cancers in males were lung [22.5%, ASR 21.0 per 100 000], prostate [14.7%, ASR 9.2 per 100 000], larynx [5.8%, ASR 5.0 per 100 000], mouth [4.4%, ASR 3.7 per 100 000] and colon [3.1%, ASR 2.9 per 100 000]. In females cervical [20.9%, ASR 23.0 per 100 000], breast [23.6%, ASR 20.2 per 100 000], lung [3.4%, ASR 4.7 per 100 000], ovary [2.1%, ASR 3.0 per 100 000] and corpus uteri [3.4%, ASR 2.8 per 100 000] were the leading cancers.

Poisson regression analysis results showed an overall decreasing trend over the period in selected common cancers: lung, prostate and cervical with an exception of breast cancer trends which were observed as stable over the period. Compared to males, females were 0.37 [95% CI: 0.05-0.40] less likely to have lung cancer. Analysis of race distribution of the cancers showed that lung, prostate and breast cancer incidence rate ratios were higher in the White population compared to the Black African population. White males were twice more likely to have lung cancer and almost five times more likely to have prostate cancer compared to Black African males. White females were almost three times more likely to have breast cancer but 0.57 [95% CI: 0.12-0.66] less likely to have cervical cancer when compared to Black African females.

Conclusion: This study demonstrates that data retrieved at Frere Hospital's Oncology and Radiation Department were useful for describing the cancer characteristics of patients presented at this department, as well as in estimating the cancer incidence in an urban population of the Eastern Cape (EC) Province. However, the observed cancer pattern in BFC urban area was strikingly different from the profile which was previously reported for this area when oesophageal cancer was the leading cancer and lung cancer did not feature. Therefore, further studies to investigate oesophageal cancer cases that might not have been referred for radiotherapy in this hospital should be done.

KEY WORDS

Cancer profile

Malignant cases

Hospital records

Cancer trends

Case series study

Cancer incidence rates

Cancer registry

Buffalo City urban area

Frere Hospital

Eastern Cape Province

CHAPTER I

Introduction

Cancer is emerging as a major public health problem in developing countries and strongly contributes to the observed epidemiological transition. The increase in cancer incidence is attributable to increasing population aging, as well as the adoption of lifestyle choices such as smoking, physical inactivity and westernized types of diet (Bello, Fadahun, Kielkowski & Nelson, 2011; Jemal, Bray, Center, Ferlay, Ward & Forman, 2011). Cancer incidence reports in South Africa are produced by the pathology-based National Cancer Registry (NCR) and the population-based Eastern Cape (EC) Province Cancer Registry, formerly known as the PROMEC Cancer Registry. The NCR was established in 1986 to provide information on cancer incidence nationally, based on histologically diagnosed cases in both public and private laboratories (Sitas & Isaäcson, 1992). The EC Province Cancer Registry was established in 1981 by the South African Medical Research Council to follow trends in the incidence of oesophageal cancer in two rural areas with high incidence and other two with low incidence (Somdyala, Marasas, Venter, Vismer, Gelderblom & Swanevelder, 2003). The registry has been expanded to cover all cancer sites that occur in the population living in 8 magisterial areas of the former Transkei region of the EC Province (Somdyala, Bradshaw, Gelderblom & Parkin, 2010).

According to the NCR, the annual number of new cancer cases reported by public and private pathology laboratories increased from 38 027 in 1987 to 45 570 in 1988 as well as from 60 172 in 1998 to 60 343 in 1999 (Sitas & Isaäcson, 1992; Sitas, 1994; Mqoqi, Kellett, Sitas & Musa, 2004). However these were minimum numbers as pathology laboratories are located in cities and this means clinically diagnosed cases from the rural areas were excluded. NCR last reported cancer incidence rates in 2004 as a result of being held back by patient confidentiality issues and a lack of supportive legislation. The EC Province Cancer Registry reported cancer incidence in a rural population of the EC. The registry reported that the average annual number of new cancer cases increased from 500 cases per year for the period 1998-2002 to 561 for 2003-2007 (Somdyala *et al*., 2010; Somdyala, Bradshaw & Gelderblom, 2013). It is therefore clear that cancer is not rare in South Africa.

In recognition of the growing awareness of the burden of cancer in South Africa, important initiatives to prevent and control cancer have been implemented. These include the

amendment of the Tobacco Products Control Act as early as 1993 to restrict the advertising of tobacco products, prohibit smoking in public places and tobacco manufacturers' sponsorships, as well as raising the legal minimum age for purchasing tobacco from 16 to 18 (Stefan, Elzawawy, Khaled, Ntaganda, Asiimwe, Addai, Wiafe & Adewole, 2013). This was a government effort to reduce lung cancer and other upper respiratory tract conditions associated with tobacco smoking. The introduction of a cervical cancer screening programme in 2000 was proposed for screening women over the age of 30 years and offer asymptomatic women 3 free smears in a lifetime, 10 years apart (Denny, 2010). However, the uptake and impact of this policy on cervical cancer incidence in South Africa has been poor due to its fragmented and unco-ordinated implementation (Denny, 2010; Stefan *et al*., 2013).

Additional cancer control initiatives include the establishment of a new regulation on cancer registration in April 2011 to enhance cancer reporting, revitalization of the NCR by the South African Department of Health and the establishment of a Ministerial Advisory Committee on the prevention and control of cancer in year 2012 (Stefan *et al*., 2013; South African Government, 2011). Cancer registration regulation makes it compulsory for every health facility to record and notify every cancer case that is diagnosed. However as imperative as it is to prevent and control cancer and henceforth strengthen cancer surveillance in health facilities, there remains the need to review previous cancer cases where routine patients' records are available so as to make the data informative.

Problem Statement

Frere Hospital is a large provincial government-funded hospital situated in East London, Eastern Cape Province in South Africa. It is a tertiary teaching hospital which was established in 1881 and forms part of the East London Hospital Complex with Cecilia Makiwane Hospital. The East London Hospital Complex departments include trauma and emergency department, orthopaedic surgery, paediatrics, obstetrics/gynecology, surgery, internal medicine, antiretriviral clinic for HIV/AIDS in adults and children, anaesthetics, family medicine, dermatology and burns unit. Of the two hospitals, Frere Hospital is the only hospital which has in addition to its departments an oncology department for adult and paediatric patients which offer oncology services such as medical, radiation and surgical care and an endoscopy theatre outpatient facility (EC Department of Health, 2012).

Endoscopy can be used for many procedures, but relevant to this study is its use in the investigation of symptoms in the digestive system and in the confirmation of a diagnosis, most commonly by performing a biopsy to check for cancers of the digestive system as well as in palliative care to widen narrow oesophogus. Patients visiting the oncology department at Frere Hospital are routinely recorded and their information is systematically maintained whereas those using the endoscopy facility in particular with oesophogus cancer are not systematically recorded. There is only one available systematically analysed report on cancer cases seen at Frere Hospital and this was prepared in 1957. The report was based mainly on the work of clinicians who reported case series of patients with oesophageal cancer encountered during their professional lives (Burrell, 1957).

Generally in South Africa descriptive epidemiology data on cancers are limited. There are no available data on cancer trends for the past 10 years as the South African NCR last reported data on a spectrum of cancers in 2004. In the EC Province specifically, detailed information on cancer cases that occur in rural populations is available through the EC Province Cancer Registry. However, information about cancers in urban population of the province is not available. Therefore, this study will be the first attempt in estimating cancer incidence in an urban population of the EC Province using clinical administrative data system which are generated and maintained by Frere Hospital's Oncology and Radiation Department.

CHAPTER II

Literature review

Hospitals and oncology units that routinely record and systematically keep patient information serve as good observation sites for cancer case monitoring (Jensen & Storm, 1991; dos Santos Silva, 1999). Cancer incidence data generated from these sources are important as they inform research, health care planning, primary and secondary prevention and for planning/evaluation of programmes for cancer control. However, in some countries, particularly in Africa, routine recording of cancer patient information is sparse as cancer is under-emphasised due to the overwhelming burden of communicable diseases and this limits the availability of cancer incidence data (Parkin, Sitas, Chirenje, Stein, Abratt & Wabinga, 2008). Therefore, regular estimates of cancer incidence in broad areas of the world have been made available by the International Agency for Research on Cancer (IARC) (Ferlay, Shin, Bray, Forman, Mathers & Parkin, 2010).

Parkin, Pisani and Ferlay (1999) reported a total of 8.1 million new cancer cases in the world during the year 1990, with just over half occurring in developing countries. The authors estimated cancer incidence rates by age groups and sex for as many countries as possible and combined the estimates to produce weighted averages. They calculated age-standardised incidence rates using the weight of the "world standard" population. National incidence data for each country were preferred sources of data and the principal source was "*Cancer Incidence in Five Continents*; Volume VII" (CI5VII) (Parkin *et al*., 1999). Lung cancer was reported as the most common cancer in the world, accounting for 18% of all cancers of men worldwide followed by cancer of the stomach which was almost 10% and breast cancer among women 21%. In developed countries these were followed by colo-rectal and prostate cancers whilst in developing countries cervical and oesophageal cancers (Parkin *et al*., 1999).

Most recently, through the GLOBOCAN series which began in year 2002, the IARC published cancer incidence estimates at country level using national cancer data sources where possible with local data and statistical modelling where data are absent (Ferlay *et al*., 2010). Ferlay *et al*., (2010) used GLOBOCAN 2008 to summarise global patterns for the eight most common cancers: lung, breast, colorectal, stomach, prostate, liver, cervical and oesophageal cancers. The authors rated oesophageal cancer as the eighth most common cancer in the world with 83% of the cases occurring in developing countries. Southern Africa

was observed to have the highest oesophageal cancer [ASR 22.3 in men compared to West Africa 14.1 and 11.7 in females compared to 0.6 in Micronesia per 100 000 population] and mortality rate in both sexes (Ferlay *et al*., 2010). In Uganda for the period 1991-2006, oesophageal [ASR 16.0 during 1991-1995, 12.5 during 1996-2001 and 15.4 during 2002-2006 per 100 000] cancer formerly the most common cancer in men and second in frequency in women, is reported to have remained relatively constant, whereas the incidence of cancer of the cervix [ASR 38.1 during 1991-1995, 44.9 during 1996-2001 and 52.4 during 2002-2006], the most common malignancy in women, continues to increase (Parkin, Nambooze, Wabwire-Mangen & Wabinga, 2010). The Malawi National Cancer Registry for the period 1996-2005 reported oesophageal cancer [ASR 22.3 for males and 14.6 for females] as the third most common cancer after Kaposi sarcoma [ASR 50.5 per 100,000 for males, 26.4 for females] and cervical cancer [ASR 49.3 per 100 000] (Misiri, Dzamalala, Edriss, Parkin & Bray, 2012). According to the latest series GLOBOCAN 2012, an estimated 14.1 million new cancer cases occurred in 2012, compared to the 12.7 million in 2008 and the most diagnosed cancers were lung (13.0%), breast (11.9%) which had a sharp increase in incidence of more than 20% and colorectal [9.7%] (IARC, 2013).

Cancer incidence in South Africa

In South Africa attempts to describe the occurrence of cancer began as early as 1925, looking at the prevalence of cancer amongst the native races of the then Natal and Zululand during the period 1906-1909 (Pitchford, 1925). Later on, population-based cancer registries were established using standardised methods, first in Johannesburg and in the former Transkei region of the Eastern Cape, then in Cape Province and in Natal (Berman, 1935). In 1986, a national pathology-based cancer registry was established that covered the whole country.

The Johannesburg Cancer Survey was conducted by the South African Institute for Medical Research and covered the metropolitan area of Johannesburg, consisting of the municipal area, and the peri-urban townships, notably Alexandra Township in the north-east and a cluster of townships in the south-west (Higginson & Oettle, 1966). Liver [ASR 19.3 per 100 000] and oesophageal cancers [ASR 12.4 per 100 000] were reported to be high for the period 1953-1955 while lung was low [ASR 7.5 per 100 000]. In females, cervical [ASR 51.0 per 100 000] and breast [ASR 14.9per 100 000] cancers were high, whilst oesophageal cancer was less than in males (ratio 10:1) (Higginson & Oettle, 1966).

The Cape Province cancer registry was a project of Cancer Research Unit of Groote Schuur Hospital in Observatory, and was mainly supported by the National Cancer Association of South Africa. The registry reported cancer cases for Black Africans, Coloureds and Whites for the period 1956-1958 (Muir Grieve, 1967). Even though the number of cases was less in Black Africans, oesophageal cancer [ASR 26.9 per 100 000] was reported more often followed by stomach [ASR 26.5 per 100 000] and liver [ASR 25.6 per 100 000] cancers. The Coloured population had high oesophageal [ASR 53.4 per 100 000] and lung [ASR 42.7 per 100 000] cancers in men and high cervical [ASR 34.4 per 100 000], breast [ASR 25.8 per 100 000] and oesophageal [ASR 25.5 per 100 000] cancers in women (Higginson & Oettle, 1960). In the White population lung [ASR 44.8 per 100 000], stomach [ASR 32.9 per 100 000] and prostate [ASR 24.2 per 100 000] cancers were reported as high in men whilst breast [ASR 57.6 per 100 000], stomach [ASR 22.9 per 100 000] and cervical [ASR 22.6 per 100 000] cancers were high in women (Muir Grieve, 1967).

The Natal Cancer Survey registered all new cancer cases of Black African and Indian populations for the period 1964-1966. Areas covered were the Metropolitan Area of Durban as well as the Magisterial District of Pietermaritzburg and case-finding for the Black Africans of Pietermaritzburg District was mainly based on pathology records (Schonland & Bradshaw, 1968). In men, very high incidence of lung [ASR 43.4], oesophageal [ASR 40.1] and liver [ASR 27.6] cancers were reported whilst in females the cancer of the cervix was very high [ASR 48.5]. Oesophageal [ASR 12.0] and lung [ASR 10.1] cancers in females were about one quarter of those in men. In the Durban Indian group the overall incidence of cancer in males was low 7.3% compared to 13.8% in females and these were found by analysis of death certificates only. The incidence of gastro-intestinal tract (oral cavity and pharynx, oesophagus, stomach, colon, rectum) cancers was higher in Indian females than in males. In males, only stomach cancer [ASR 20.9 per 100 000] was high, while in females the highest incidence rates were for cervix uteri [ASR 34.7 per 100 000], stomach [ASR 29.1 per 100 000], breast [ASR 19.4 per 100 000], oesophageal [ASR 12.7 per 100 000] and corpus uteri [ASR 12.8 per 100 000] (Schonland & Bradshaw, 1968).

The South African National Cancer Registry (NCR) was established at the South African Institute for Medical Research; now the National Health Laboratory Service (NHLS) as a collaborative venture with the Cancer Association of South Africa (CANSA) and the Department of Health (DoH) (Berman, 1935). The registry provided national cancer

incidence rates based on the information of cancer cases diagnosed in both private and public laboratories. NCR results were published in series of publications (Sitas, Terblanche & Madhoo, 1996; Sitas, Blaauw, Terblanche, Madhoo & Carrara, 1997; Sitas, Madhoo & Wessie, 1998; Mqoqi *et al*., 2004). In males prostate [ASR 37.6 & 34.1 per 100 000], lung [ASR 15.2 & 13.6 per 100 000] and oesophageal [ASR 12.6 & 11.3 per 100 000] cancers were reported as the leading cancers for the years 1998 and 1999 respectively. In females, cervical [ASR 34.4 per 100 000] was the leading cancer in 1998 followed by breast [ASR 32.7 per 100 000] and colorectal cancer [ASR 5.8 per 100 000]. In 1999 breast cancer [ASR 33.4 per 100 000] was the highest, followed by cervical [ASR 28.7 per 100 000] and colo-rectal cancer [ASR 6.6 per 100 000] (Mqoqi *et al*., 2004).

Cancer incidence in the Eastern Cape Province

In the Eastern Cape Province, an apparent increase in oesophageal cancer was observed in Black African patients at Frere Hospital in East London in 1956 and this initiated an investigation into the cause of the disease (Burrell, 1957). Burrell (1957) reviewed Frere Hospital's in-patient register for the period 1952-1956 and found that oesophageal cancer was diagnosed in approximately one of every 3, 500 general Black patients in the hospital. This incidence rate was believed as one of the highest ever recorded (Burrell, 1957). Furthermore, Burrell's report showed that top cancer sites during the period were cervix (20.6%), oesophagus (14.7%), tongue (10.0%), breast (8.9%) and mouth (6.9%), highlighting that a large number of patients with oesophageal cancer were males. In relation to which third of the oesophagus was affected, 70% of Black urban males predominantly had lesions in the middle of the oesophagus.

Follow up enquiries into the *bona fides* of oesophageal cancer patients at Frere Hospital showed that an unexpected large number of the patients were from the Transkei region (Burrell, 1957). Subsequently, records of nearby hospitals together with those of hospitals in Transkei were checked and they also showed a similar situation (Rose, 1965; Rose, 1973). During this period a cancer register was established in East London in which information on oesophageal cancer and other cancers was collected with the enthusiastic reporting from doctors of the former Transkei (Rose, 1973). Even though the registry was in East London, the former Transkei was the main focus of cancer registration and studies.

In order to describe the geographical variation and temporal trends in the incidence of oesophageal cancer, Burrell and Rose made further investigations (Rose, 1975). In a preliminary survey for the period 1955-1959 in twenty six districts of Transkei, Burrell (1962) observed that oesophageal cancer incidence was high particularly in Butterworth and Centane; the south-western districts of the former Transkei and was the most common form of cancer in males and second to cervical cancer in females. Thereafter, Rose (1973) did a 15-year survey (1955-1969) and particularly increased checks for cases in the north-eastern hospitals. In this survey, Rose reported that the incidence rates in south-western districts were much higher than the rates in north-eastern districts.

Due to marked variation in the reported incidence of oesophageal cancer, data quality was improved by instituting field services on a house-to-house visiting basis (Rose & McGlashan, 1975). Rose and McGlashan (1975) presented data on the incidence of cancer of the oesophagus for the period 1965-1969, discussed age-specific rates for the sexes and further demonstrated the special relationship of well-defined regions of high and low incidence. Elsewhere in South Africa, Transvaal and Natal, increased oesophageal cancer incidence was continuously reported in urban hospitals (Higginson & Oettle, 1960). Rose (1973) believed that the increase in urban incidence in Transvaal was due to the increase in migration from the former homelands of Transkei and Ciskei to Transvaal and this was supported by several reports on the patterns of cancer in African gold miners (Berman, 1935; Harington, McGlashan, Bradshaw, Geddes & Purves, 1973; Robertson, Harington & Bradshaw, 1971a).

The South African Medical Research Council restructured the registry since 1986 and all cancer sites were included (Jaskiewicz, Marasas & Van de Walt, 1987). The population included residents in Butterworth and Centane; the so-called hot spots of oesophageal cancer which are in south-western area and Bizana and Lusikisiki, the so-called low incidence areas. An active method was used in case finding and hospitals in the registration area were visited where information on new cancer cases was obtained from hospital records. The results showed oesophageal cancer as the leading cancer, accounting for 41.3% of all reported cancer cases with an overall ASR of 28.4 per 100 000 and 17.8 per 100 000 males and females respectively (Jaskiewicz *et al.,* 1987). The comparison of rates in the four districts during the periods 1955-1959, 1965-19695 and 1981-1984 revealed progressive increases among both sexes in both the north-eastern districts; and decreases among both sexes (but particularly among males) in the south-western district of Butterworth. Rates in Centane

remained high, with increasing trends in both sexes during 1981-1984. During the period 1965-1984 the population increase was similar (approximately 30%) in the three rural districts of Bizana, Lusikisiki and Centane, whereas the population of the industrialised Butterworth district doubled during the same period (Jaskiewicz *et al.*, 1987; Makaula, Marasas, Venter, Badenhost, Bradshaw, Swanevelder, 1996).

The changes on incidence trends of oesophageal cancer and other cancers in the four districts of Transkei were further reported by Somdyala *et al*., (2003). Somdyala *et al*., 2003 reported oesophageal cancer as the most frequently reported cancer in both males and females with high incidence rates in Centane. For males oesophageal cancer was the lowest in Bizana whilst for females it was the lowest in Butterworth. Liver cancer was reported as the second most common cancer in males whilst cervix and breast cancers were the second and third most common cancers in females (Somdyala *et al*., 2003). High incidence rates of cervical cancer in Lusikisiki were reported. These rates were reported to be comparable to the rates reported by the NCR, based on information collected from pathology laboratory records, from 1990-1995 (Somdyala *et al*., 2003; Sitas *et al*.,1996; Sitas *et al*.,1997; Sitas *et al*., 1998).

Population-based cancer registration in the Eastern Cape Province became stable in 1998. The following eight magisterial areas were covered; Butterworth, Centane, Idutywa, Nqamakwe, and Willowvale in the South West; Bizana, Flagstaff, Lusikisiki in the North East) of the former Transkei region (Somdyala *et al.*, 2010). Sources of data included 15 hospitals; 8 district hospitals, 6 referral hospitals and a pathology laboratory under the NHLS. Somdyala *et al*., (2010) reported overall cancer age standardised incidence for this rural population as 72.4 for males and 63.7 for females with oesophageal cancer during this period still the most frequently reported cancer in males and second-most common cancer in females. Other common cancers in males were lung, prostate and liver cancers. Cervical and breast cancer were the most frequently reported cancers in females in this population (Somdyala *et al*., 2010). Mqoqi *et al*., (2004) reported oesophageal and cervical cancer as common among Black South African females, with prostate and lung cancers remaining high in South African males.

In conclusion, a number of attempts have been made to estimate the burden of cancer in South Africa. The methodologies used in these various attempts have differed but produced a

picture of the cancer status in different parts of the country. Various reports showed that South Africa, especially the former Transkei region of the Eastern Cape Province experienced a high incidence of oesophageal cancer. So far cancer registration done in the former Transkei still remains the only work established in a rural population in the Eastern Cape Province and in South Africa and has managed to contribute comparative information that can assist in tracking the diversity of cancer patterns (Somdyala *et al*., 2010). It is therefore worthwhile to determine the present profile of cancer in an urban hospital of the Eastern Cape Province and provide working estimates of the incidence of cancer in an urban population of the province.

CHAPTER III

Methodology

Aim

The aim of the study was to describe the profile of cancer cases presented at Frere Hospital's Oncology and Radiation Department and to estimate cancer incidence rates of Buffalo City (BFC) urban area residents for the period 1991-2009.

Objectives

1. To determine the number of cancer cases seen at Frere Hospital's Oncology and Radiation Department and the proportion by cancer site
2. To describe the population characteristics (age, sex, race, geographic profile) of individuals who presented at this Oncology and Radiation Department with cancers
3. To estimate minimal cancer incidence rates of BFC residents by age, sex and cancer site
4. To determine cancer trends in patients treated at this department in terms of cancer site from January 1991 to December 2009

Study Design

This a descriptive case-series study. This method was used to describe the pattern of cancer occurrence in relation to variables such as person, place and time (Grimes & Schultz, 2002). This was an initial enquiry into what is the burden of cancer at Frere Hospital and the profile of cancers in an urban population of BFC urban area (Beaglehole, Bonita & Kjellstrom, 1997). It was anticipated that results from this kind of study would provide knowledge about which racial groups are most or least affected by the disease and generate a hypothesis to identify descriptive characteristics of patients with cancer at this hospital. This constitutes an important first step in search for determinants or risk factors and trends analysis (Grimes & Schultz, 2002). Sampling was based on the presence of a specific outcome which was cancer (Dekkers, Egger, Altman & Vandenbroucke, 2012).

Study population

EC Province is the second largest province in South Africa and has the third largest population, approximately 6.5 million people, which is 12.7% of South Africa's population

(Statistics South Africa, 2012). The demographic profile of the residents indicates that the population aged 14 years or below decreased from 36.6% in 2001 to 33.0% in 2011 whilst between ages 15 and 64 years increased from 57.1% to 60.2% (Figure 1). The proportion of females in the province is 52.9% whilst males are 47.1%. Black Africans constitute the largest group of the population at 86.3%, followed by Coloureds (8.3%), Whites (4.7%), Asians (0.4%) and the remaining 0.3% are other. Trends in the unemployment rate indicate a decrease from 54.3% in 2001 to 37.5% in 2011. Proportions of households with electricity and piped water increased significantly across all the districts of the province from 2001 to 2011(Statistics South Africa, 2012).

There are two major urban areas within the EC Province, namely Nelson Mandela Metropolitan and Buffalo City (BFC). BFC is the key urban area of the eastern part of the EC. It consists of several urban areas, stretching from the port city of East London to the east, through to Mdantsane and reaching Dimbaza in the west. According to census 2011 the size of BFC population is 755 198 (Statistics South Africa, 2012). Frere Hospital, situated in East London, forms part of the East London Hospital Complex which offers specialist medical care to the largest population in the province. This hospital is a major referral hospital for patients from Amathole, Chris Hani, OR Tambo, Ukhahlamba and Alfred Nzo Health Districts. The study population was all cancer patients who visited Frere Hospital Oncology and Radiation Department.

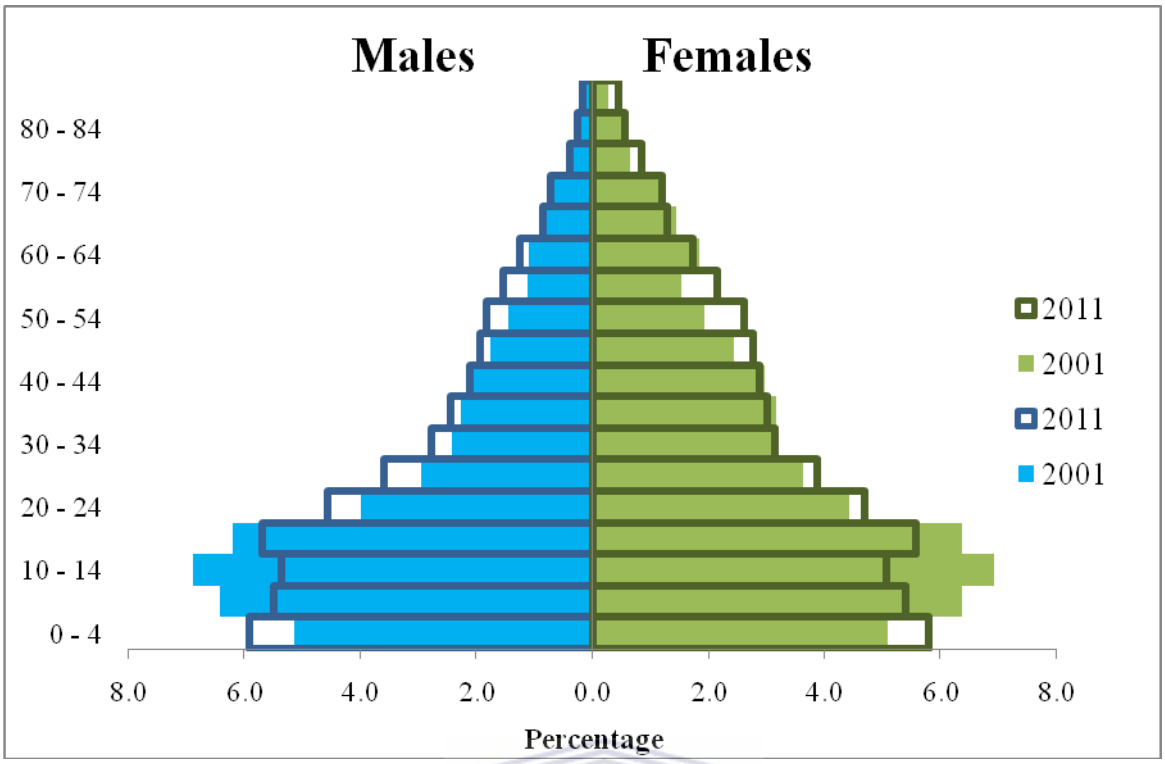

Figure 1. Eastern Cape Province population distribution by age and sex (Statistics South Africa, 2012)

Sampling

Two sampling strategies were adopted. The first sampling strategy was for examining the burden of cancer in the hospital and covered objectives 1 to 2. It was an inclusive time-delimited sampling of all patients presenting with malignant cancers who visited the Oncology and Radiation Department between 01 January 1991 and 31 December 2009. This was the most recent period for which data were available and appeared up-to-date. The second sampling strategy was a sub-sample to estimate the minimal cancer incidence rates for a population of a defined geographical area and covered objectives 3 and 4. Since this was a 19-year review, case recurrences and metastasis in the same individuals were excluded. A commonly regarded conclusion was that most cancer cases would have been attended to at this hospital as it is the only public hospital with an oncology specialist and provides oncology services in the region.

Data collection

Frere Hospital's Oncology and Radiation Department's database dates back to the year 1990. The database is generated by continuously recording of each patient visiting the facility on a

daily basis. Recording into a Radiotherapy (RT) programme is done by the departmental data clerks using pre-defined variables. The database was reviewed retrospectively for a period of 19 years, from 01 January 1991 to 31 December 2009. An Information Technology (IT) specialist assisted with extracting data from the department's database software and transfer them into an excel spread sheet in order to prevent alterations to the database. IT specialist was necessary for his specialty in transferring data from a non-user friendly to user-friendly software (which was Excel in this study). Key variables that were extracted included patient demographics (including first name, surname, sex, age, address and racial group), tumor information; site and date of diagnosis.

Data analysis

Data cleaning

Data cleaning incorporated techniques such as checking of completeness and accuracy of patient information details. Mandatory variables such as demographic information, diagnosis and the date of diagnosis were checked if they were available and complete for each patient. Clerks at Frere Hospital's Oncology and Radiation Department were contacted to verify and correct identified errors. The accuracy of information was checked by performing validation and consistency checks. Validation checks were carried out on International Classification of Diseases (ICD-10) codes. Codes which were in ICD-9 format were converted into ICD-10. Consistency checks were carried out to ensure the concordance of specified data items against other recorded items e.g. prostate cancer in a female or cervical cancer in male.

Dates were formatted into month-day-year and sequence checked so that the date of birth precede the date of diagnosis of the patient and the date last seen. Age less than zero and greater than ninety nine was replaced as missing. Geographical areas were coded according to the South African Population Census. Data were further cleaned for inclusion in the analysis. Cases which were excluded from the analysis included duplicate cases, non-malignant cases, as well as cases with missing diagnosis and age.

Analysis

Data were subsequently analysed using STATA 12.0 analysis software to determine the proportion of cancer cases by age, sex and site. The number of cancers diagnosed are presented by year, sex, race, area together with top 10 cancer types from 1991-2009. Minimal cancer incidence rates for the BFC sub-population were estimated using population estimates

from the 2007 Community Survey and the 2011 population census. The direct method of standardization was used. ASRs were calculated by applying the age-specific rates in the BFC population to the fixed reference population which is the World Standard Population generally applied to cancer incidence data (Parkin, Whelan, Ferlay, Raymond, & Young, 1997). Poisson regression model was used to assess trends in cancer rates for 2 most common cancers in males and females over time adjusted for age and sex and interactions between time and race. Establishing the uninsured population of the study was considered but was not possible according to the available information in the database. This would have provided a better denominator especially for interpreting the cancer trends by race.

Validity and reliability

The validity of this study depended on how accurately data clerks recorded the information. All the cases in the oncology department's database were assumed to follow the same pattern, that of pre-defined variables. In this study validity of cases in the database was verified by checking the number of cases with all pre-defined variables. The study was accepted to be valid as 92.5% of the cases had all the pre-defined variables.

Reliability is the repeatability of study methods. In this study it was achieved by randomly selecting 50 cases which were collected from patient folders in Frere Hospital Oncology and Radiation Department by the Eastern Cape Province Population-Based Cancer Registry for the period 1998 to 2002 using cancer notification forms (Appendix A). A comparison of these cases together with the cases in Frere Hospital Oncology and Radiation Department database was done to check the accuracy of the information in both sets. In addition, a standard protocol was defined before commencement of the study - it was applied consistently.

Ethical considerations

General ethical principles when dealing with patient information include the respect of patient information and maintenance of confidentiality. Ethical approval was obtained from the University of the Western Cape Ethics Committee before commencement of the study (ethics reference number: 13/2/26 [Appendix B]). Furthermore, permission was obtained from the Director of Clinical Governance of Frere Hospital and the Research Committee of the Eastern Cape to access patient records and perform the study (Appendix C). Careful

measures on confidentiality regarding patient information were exercised. Data were stored in a computer database which was password-protected, accessible only to the principal researcher. Anonymity was also exercised during reporting as no patient names or identifiers were included. Vulnerability of the study population was not an issue and no harm was done during the performance of the study.

CHAPTER IV

Results

Records retrieved

Eighty nine percent (n = 20 350) of the 22 173 records retrieved were malignant cases and had all the variables for analysis as shown in Figure 2. The trend in the annual number of records retrieved for the period 1991 to 2009 is shown in Figure 3. Records of non-malignant case 8.2% (n = 1 823) were for patients who visited the department for further investigations on non-neoplasm disorders, events of undetermined intent, complications of medical and surgical care, treatment of neoplasm of unknown behaviour of endocrine glands and thyrotoxicosis as defined by the ICD-10 codes in the records. The remaining 2.8% (n = 613) of cases were excluded because the respective ages of the patients had not been recorded.

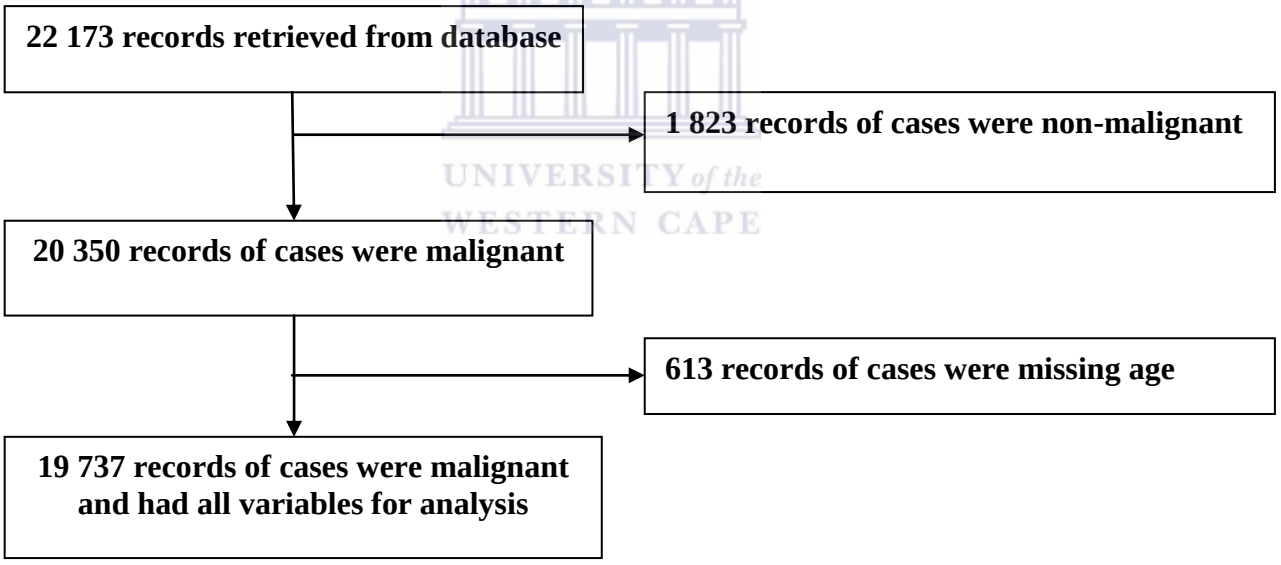

Figure 2. Data exclusion steps

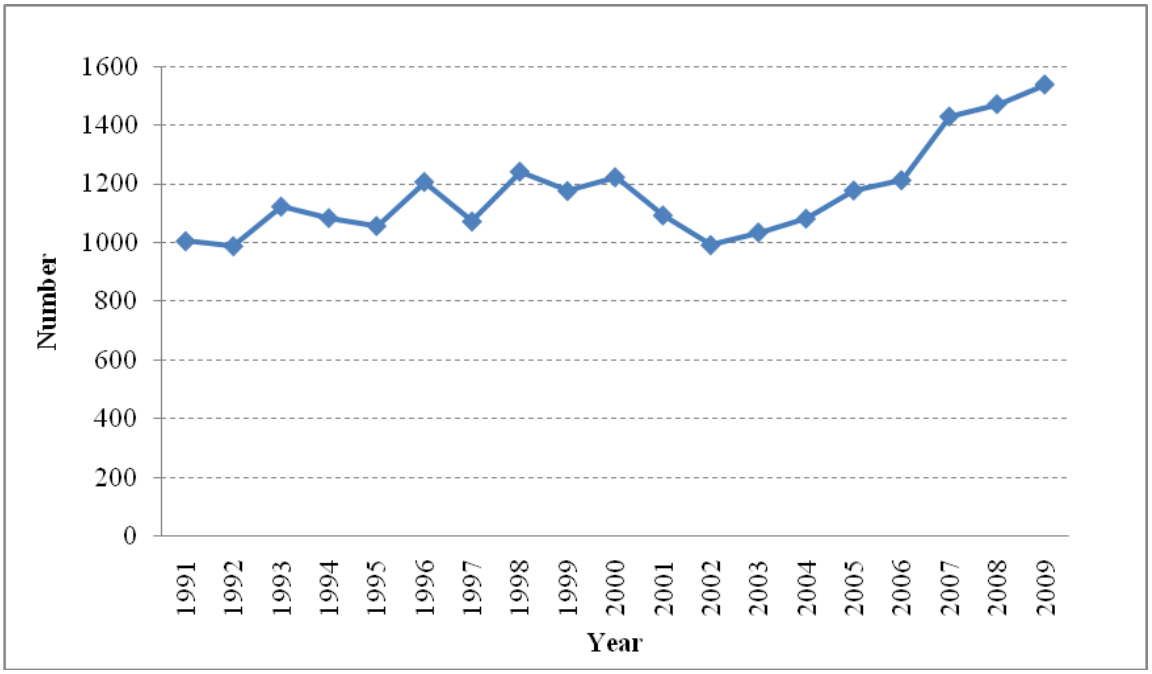

Figure 3. Annual number of records retrieved from Frere Hospital, 1991-2009

Characteristics of cancer patients

The annual number of malignant cases was consistent for the 19-year period with a slight rise in number of cases observed in years 2007 and 2009 (Figure 4). A total of 7 656 (38.8%) were males and 12 081 were females (61.2%). The distribution of the cases by sex is shown in Figure 5. The frequency of both male and female patients remained stable for the first half of the study period, then increased in the last half for the females whilst that of males decreased. The mean age at diagnosis for males was 56 (+/- 17.0) years and for females 54 (+/- 16.5) years. Figure 6 shows that the majority of patients were Black Africans (81.5%), followed by Whites (13.5%), Coloureds (4.5%) and Asians (0.5%). The geographical distribution of patients within the EC is shown in Table 1. A proportion of 45.9% of the patients was from BFC district. Other patients were from the rest of Amathole (17.8%), OR Tambo (14.4), Chris Hani (14.2%), UKhahlamba (3.7%), Alfred Nzo (2.0%), Cacadu (0.5%) and Nelson Mandela (0.4%) Health Districts whilst 1.1% were from areas outside the Eastern Cape Province (Table 1). Figure 6 also shows that the total number of cancer patients with available medical aid information dropped to zero by year 2009.

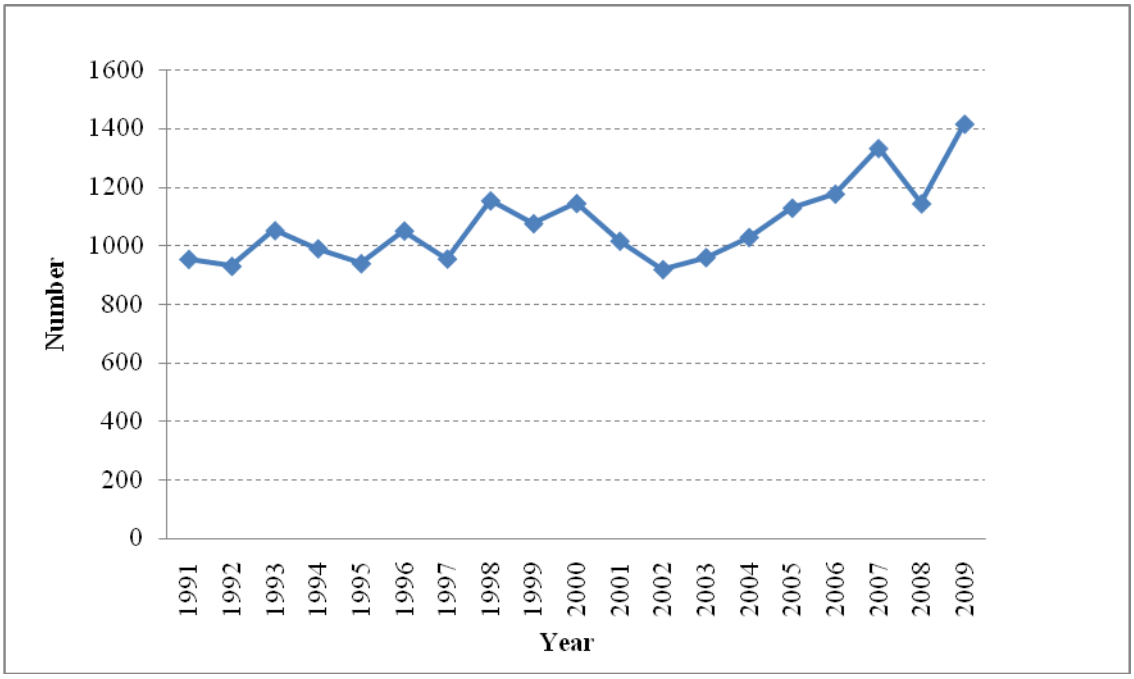

Figure 4. Annual number of malignant cases from Frere Hospital, 1991-2009

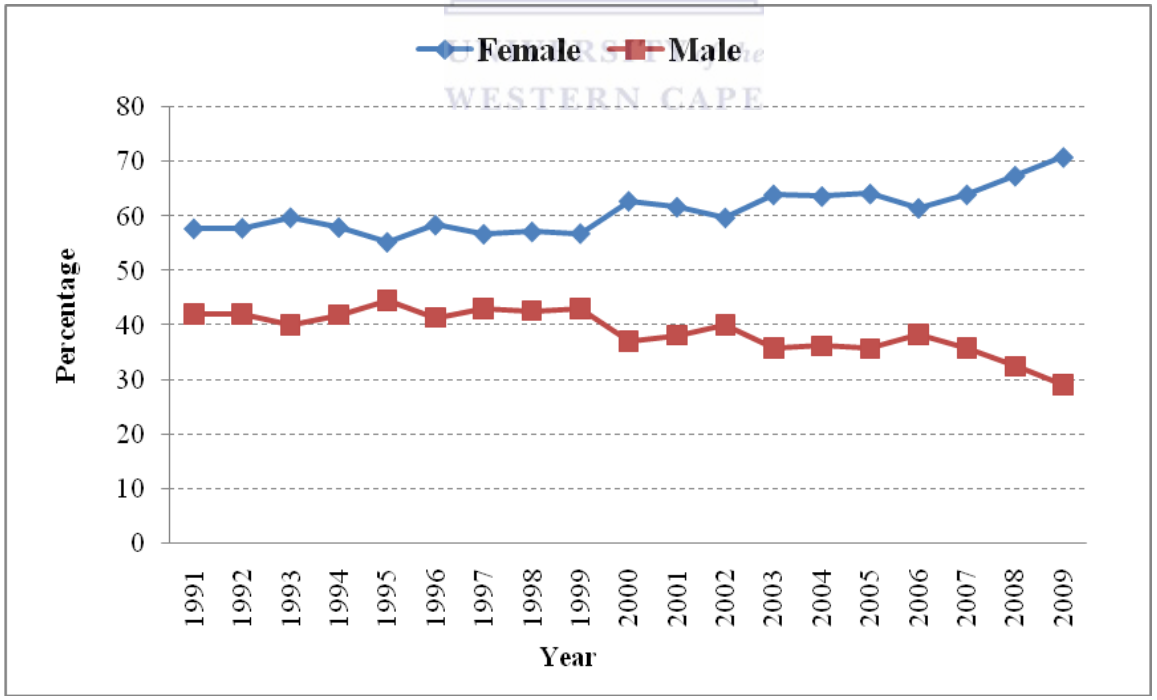

Figure 5. Proportion distribution of malignancy cases by sex, Frere Hospital 1991-2009

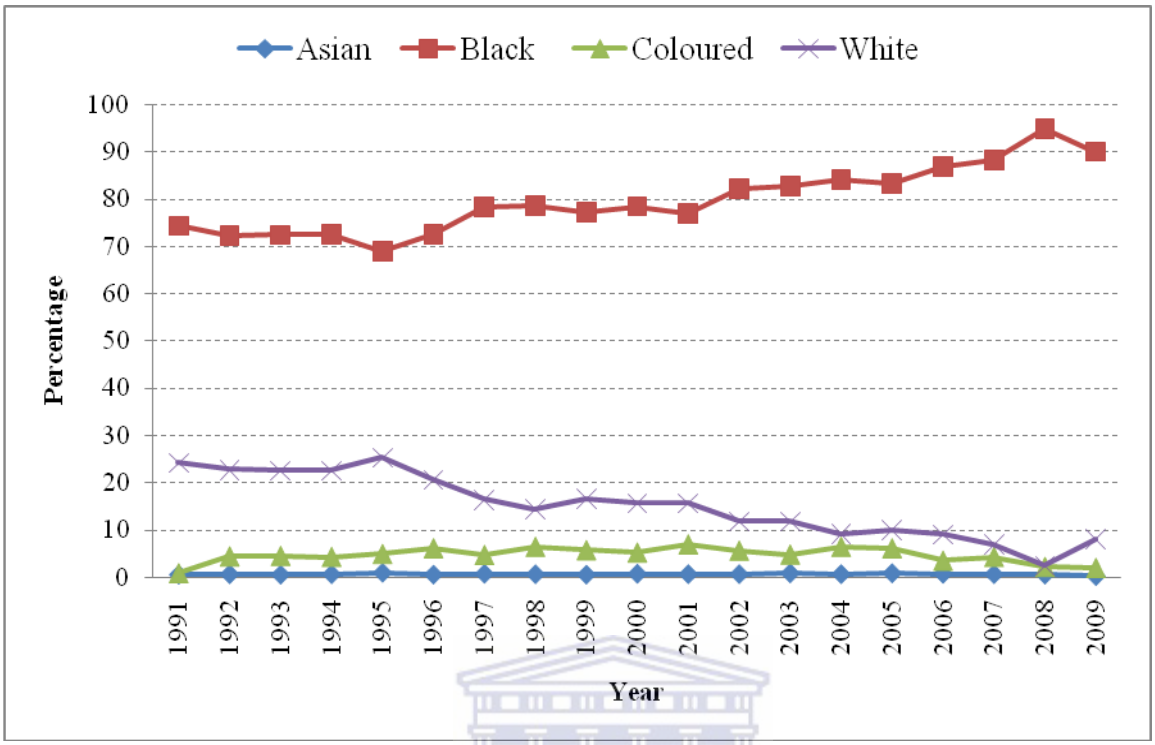

Figure 6. Proportion distribution of malignant cases by race, Frere Hospital 1991-2009

Table 1. Geographical distribution of malignant cases in the EC Province Districts, Frere Hospital 1991-2009

EC Health Districts	Number of cases	% of cases
Buffalo City	10 176	45.90
Amathole	3 954	17.83
OR Tambo	3 195	14.41
Chris Hani	3 140	14.20
UKhahlamba	828	3.73
Alfred Nzo	436	1.97
Cacadu	110	0.50
Nelson Mandela	97	0.44
Outside EC	237	1.07
Total	22 173	100

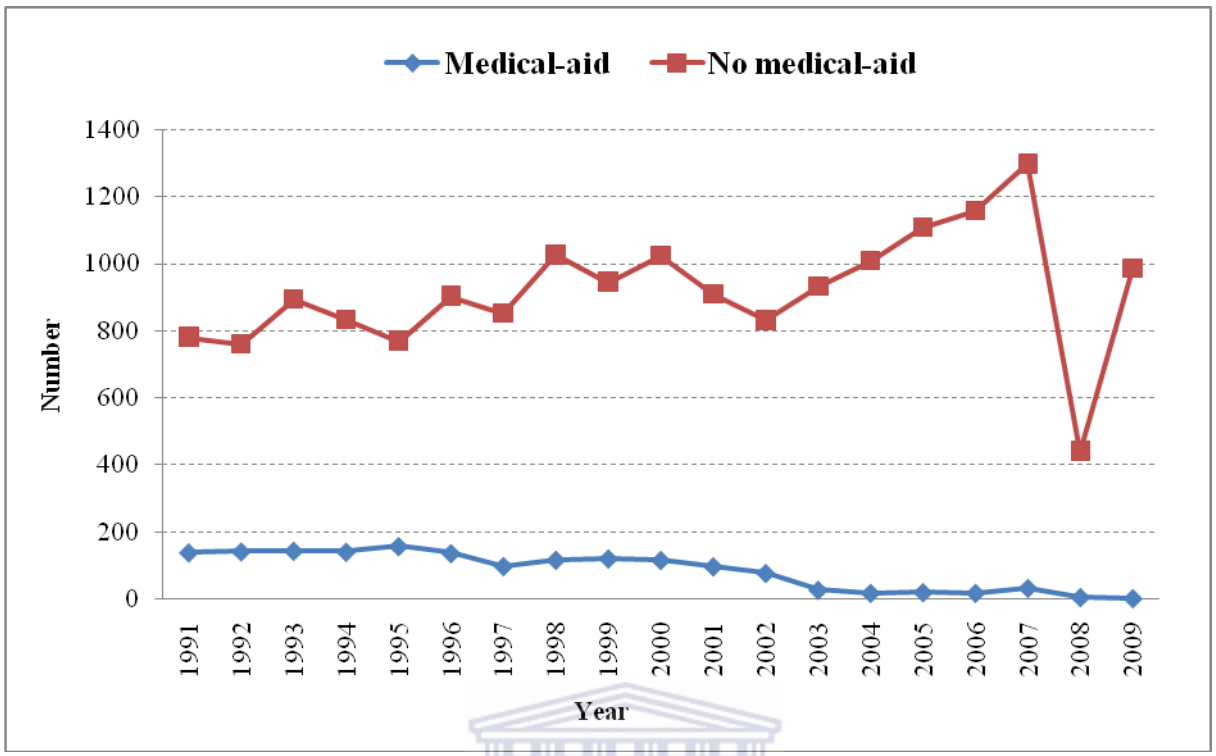

Figure 7. Annual number of patients with medical aid and those without, Frere Hospital 1991-2009

Appendix D shows the total number and the percentage frequency of malignant cases by cancer site, age and sex from 01 January 1991 to 31 December 2009. The majority of cancer sites were concentrated within the older age groups in both males and females with fewer cases in younger age groups. A high number of unknown primary site cases (2.9% in males and 1.2% in females) and ill-defined cases (2.0% in males and 1.2% in females) was observed in both males and females. Figure 9 shows the ranking of the leading 10 cancer sites by sex and compared the percentages between males and females. Leading cancer sites which were common in both sexes were greater in males compared to females. In males the top-5 common cancers were lung (18.6%), larynx (8.3%), mouth (7.7%), prostate (7.1%), tongue (5.2%) whereas in females were cervix (36.6%), breast (22.0%), lung (3.5%), ovary (2.8%) and corpus uteri (2.7%). A total of 360 childhood (children less than 14 years) cancers was observed during this period (Figure 10) and these accounted for 1.8% of all cancers recorded for the period 1991-2009. The top-3 cancers were that of the brain (21.1%), kidney (19.2%) and eye (15.6%).

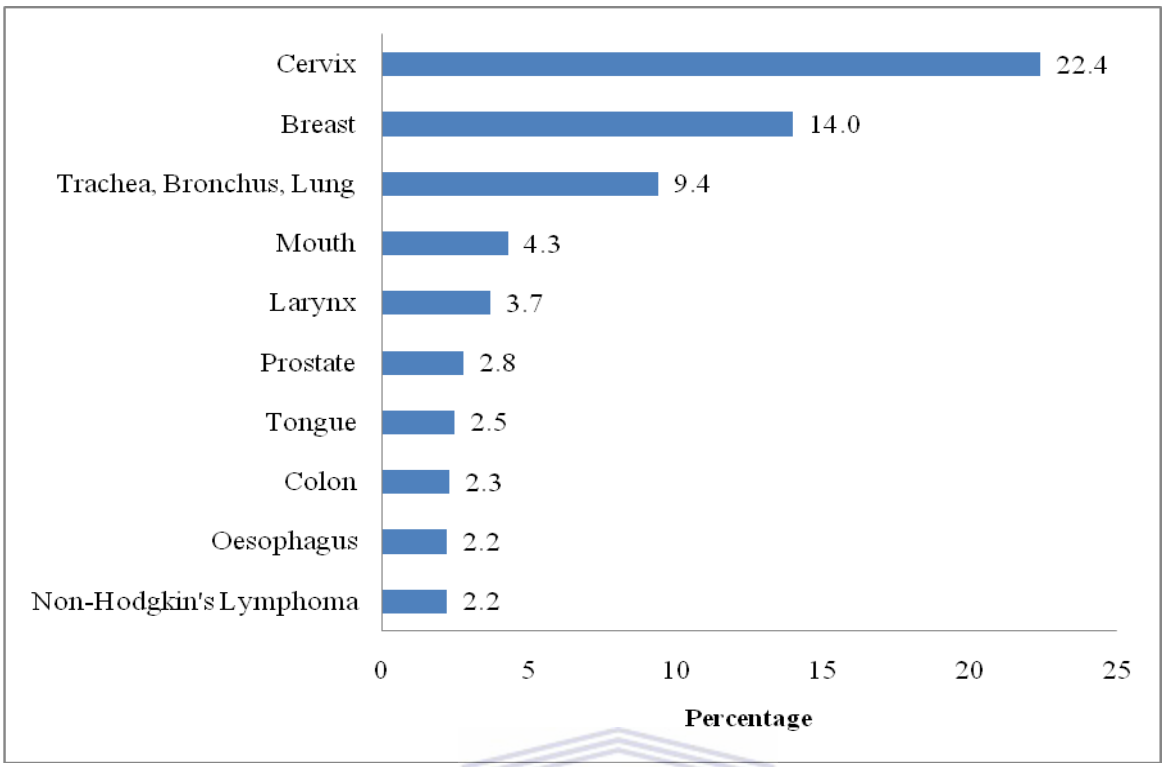

Figure 8. Overall top-10 cancer sites from Frere Hospital, 1991-2009

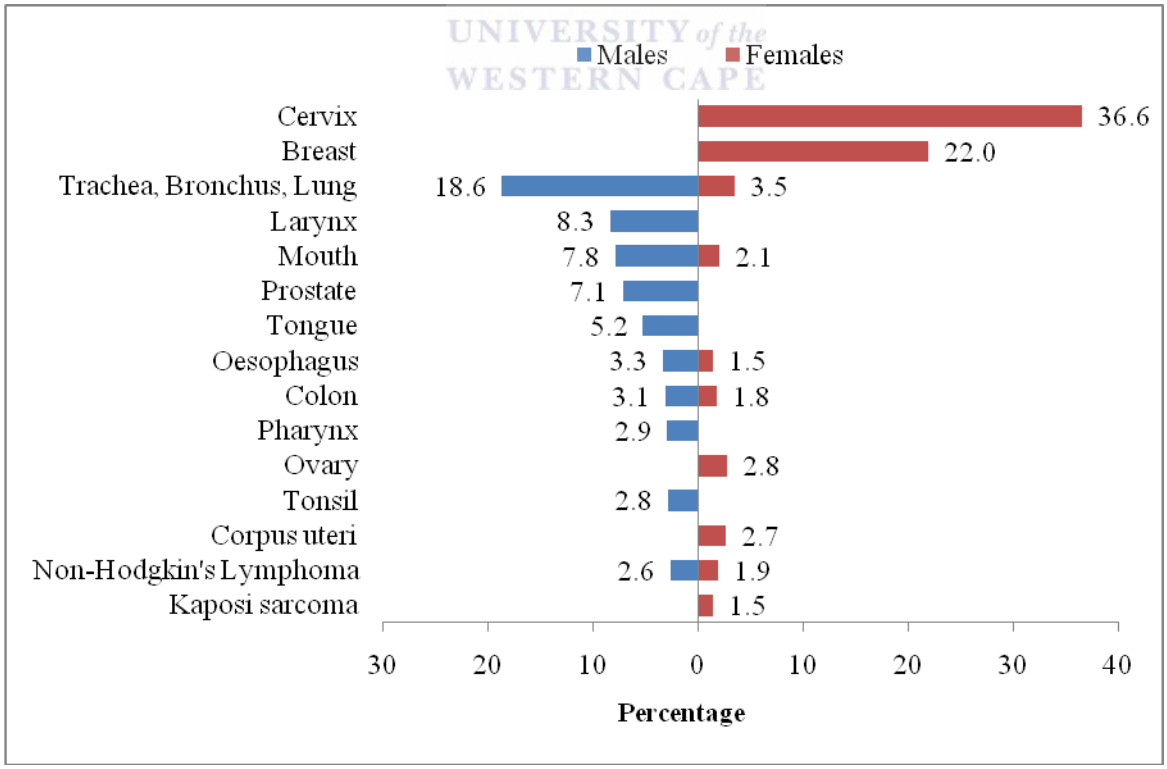

Figure 9. Top-10 cancer sites by sex from Frere Hospital, 1991-2009

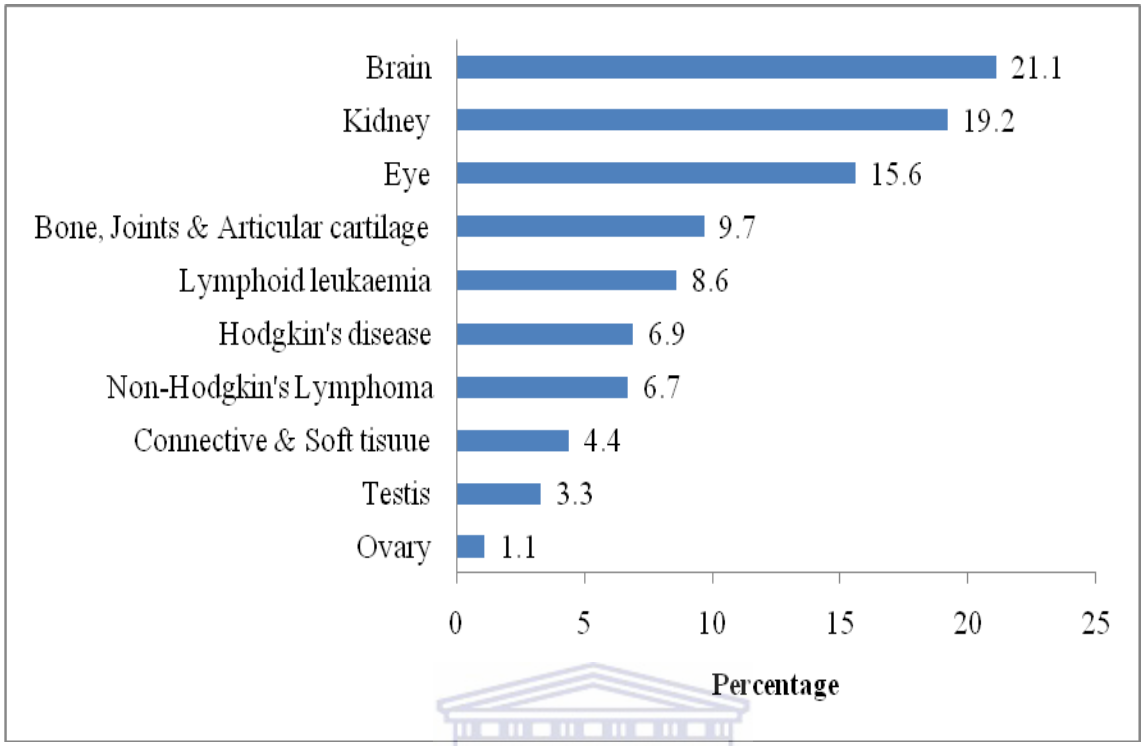

Figure 10. Top-10 leading childhood (0-14 years) cancers for boys and girls, Frere Hospital 1991-2009

Age standardised incidence rates

The estimated age specific cancer incidence rates by site, age group and sex together with the percentage frequency, crude rates and ASRs for BFC sub-population, 1991-2009. The overall ASRs for males was 83.2 per 100 000 population and for females it was 83.3 per 100 000 population as shown in Appendix E. Age distribution of cancer incidence rates is shown in Figure 11 with rates peaking from middle age and more females compared to males were observed . Figure 12 shows the ranking of the top-10 canncer sites by sex. In males the top-5 cancer sites were lung [22.5%, ASR 21.0 per 100 000], prostate [14.7%, ASR 9.2 per 100 000], larynx [5.8%, ASR 5.0 per 100 000], mouth [4.4%, ASR 3.7 per 100 000] and colon [3.1%, ASR 2.9 per 100 000] whilst in females were cervix [20.9%, ASR 23.0 per 100 000], breast [23.6%, ASR 20.2 per 100 000], lung [3.4%, ASR 4.7 per 100 000], ovary [2.1%, ASR 3.0 per 100 000] and corpus uteri [3.4%, ASR 2.8 per 100 000].

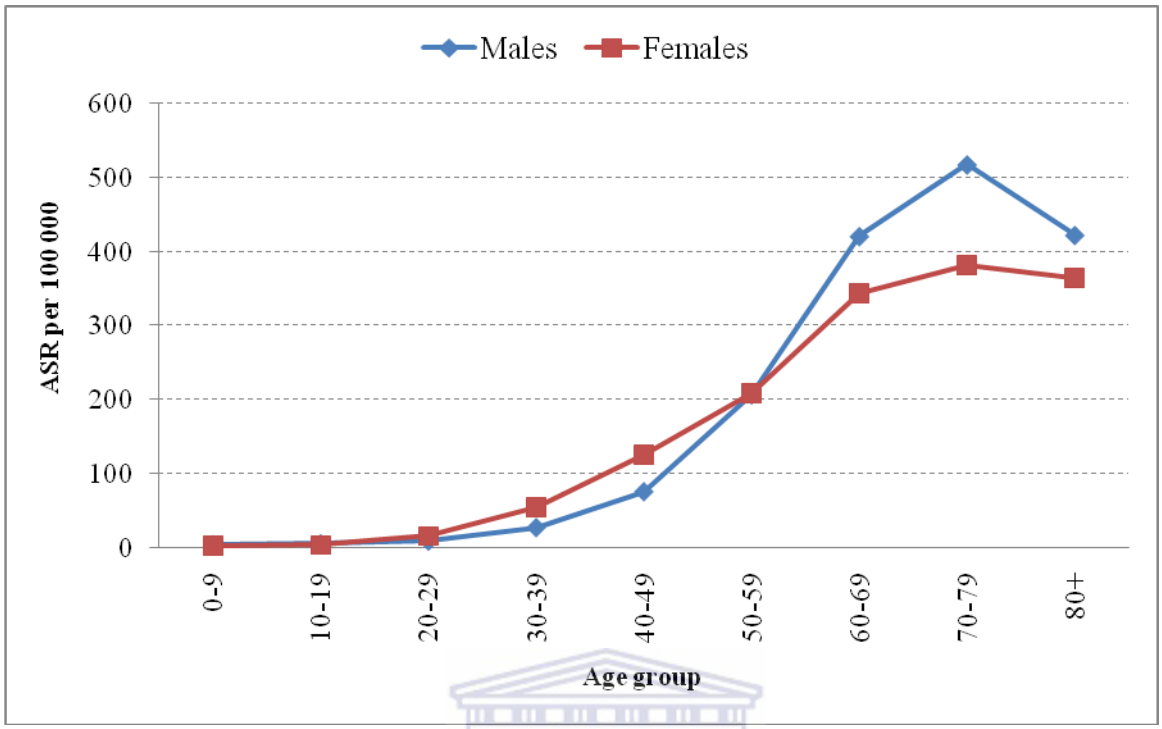

Figure 11. Age Standardised Incidence Rates per 100 000 population by sex, Frere Hospital 1991-2009

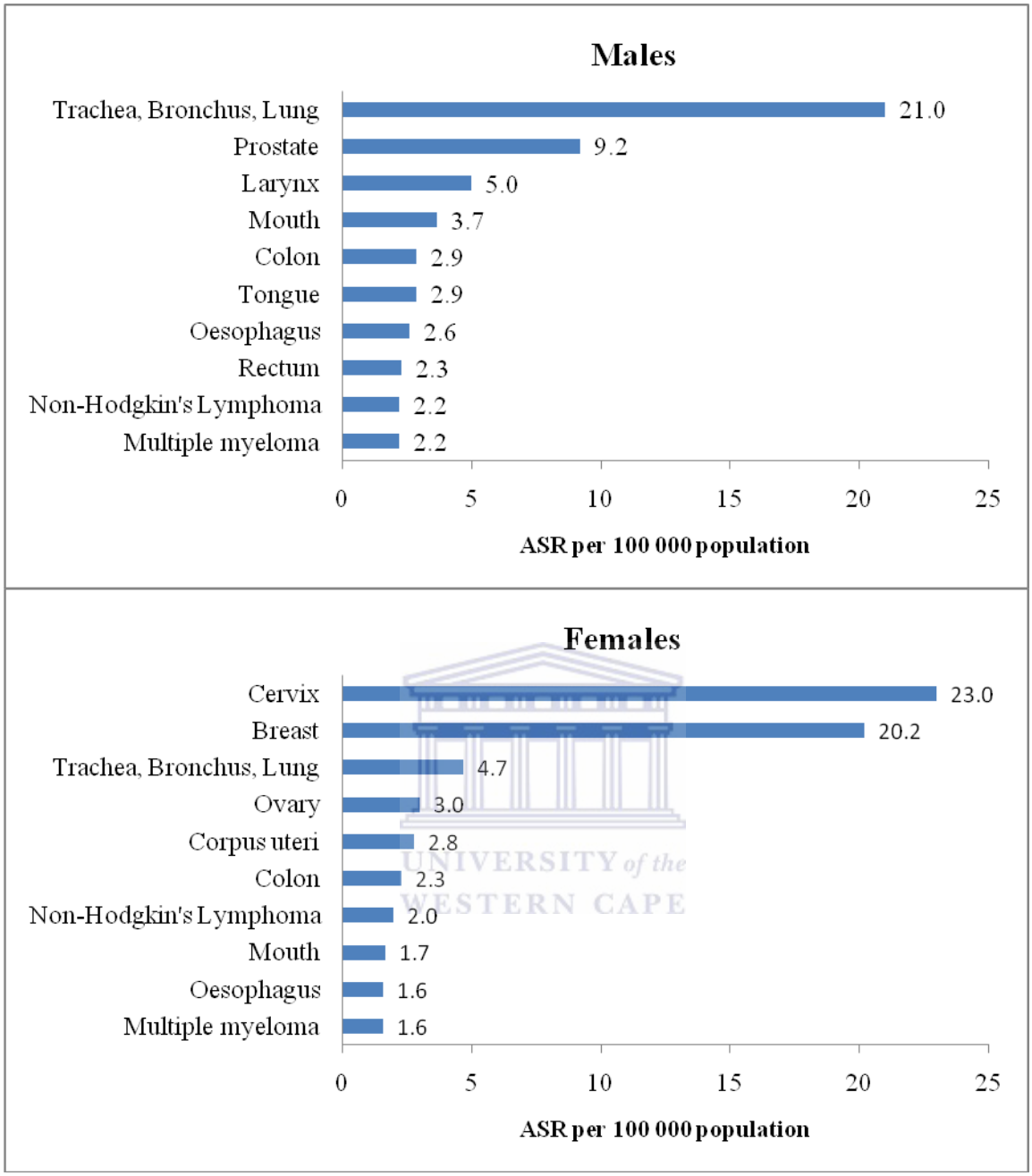

Figure 12. Leading cancer incidence rates by sex, Frere Hospital 1991-2009

Cancer trends and differentials, BFC 1991-2009

ASRs of leading cancers in males and females are shown for each year for the 19-year period in Figure 13. When looking at the two leading cancers in males, prostate cancer decreased considerably from year 1999 onwards while lung cancer decreased between 2000 and 2003 as well as from 2006 onwards. In females cervical and breast cancer incidence rates remained stable over the period.

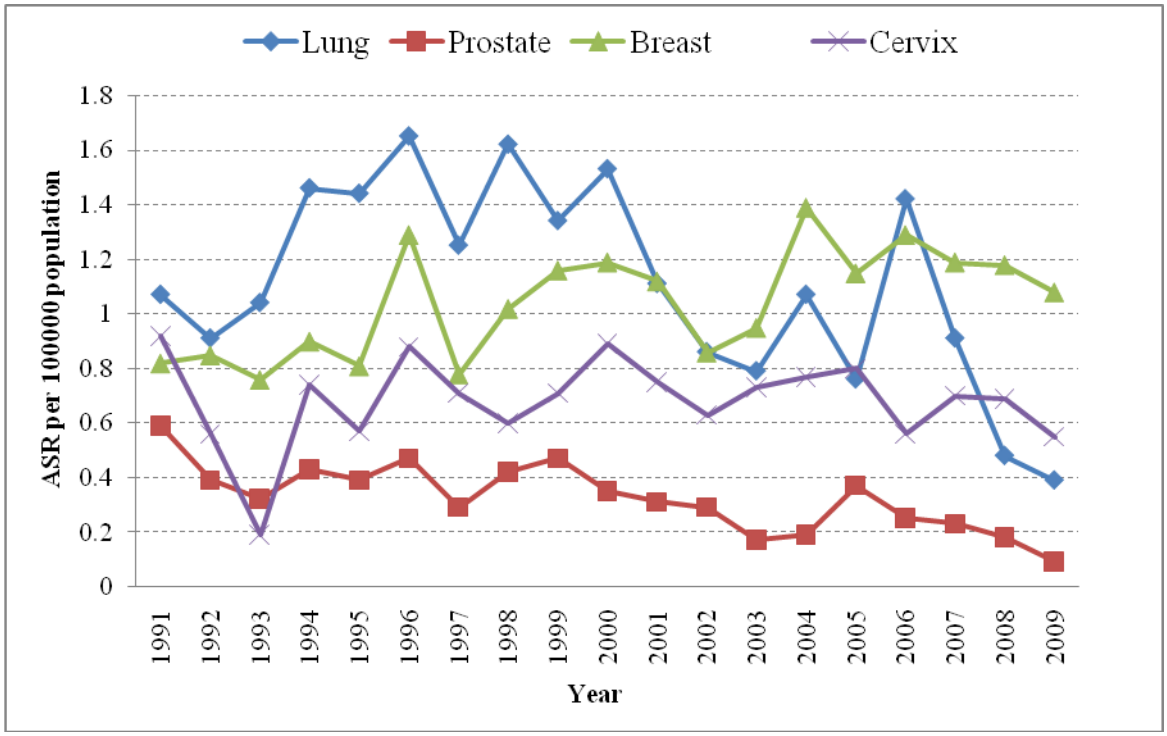

Figure 13. Age standardised rates trends of the leading cancers in males and females, Frere Hospital 1991-2009

Poisson regression analysis was applied to the incidence rates to assess the trends over time adjusted for age. Females were 0.63 less likely to have lung cancer compared to males. The comparison of incidence rates showed that White males were two times more likely to have lung cancer and five times most likely to have prostate cancer than Black African males. White females, on the other hand, were three times more likely to have breast cancer and were 0.43 less likely to have cervical cancer compared to Black African females. Incidence rate ratios are shown for four 5-year periods in Figure 14 and 15. Although the rates tended to decrease over this period, there were no significant changes over time in the leading cancers.

Figures 16 and 17 show age-specific incidence rate ratios with a 95% confidence interval (CI) for the selected cancers in males and females, all cancers were observed to be increasing with age. Race distribution of the selected cancers is shown in Figures 18 and 19. Lung, prostate and breast cancer incidence rate ratios were higher in the White population compared to the Black African population. White males were twice more likely to have lung cancer and almost five times likely to have prostate cancer compared to Black African males. White females were almost three times more likely to have breast cancer but 43% (95% CI: 0.12-

0.66) less likely to have cervical cancer when compared to Black African females.

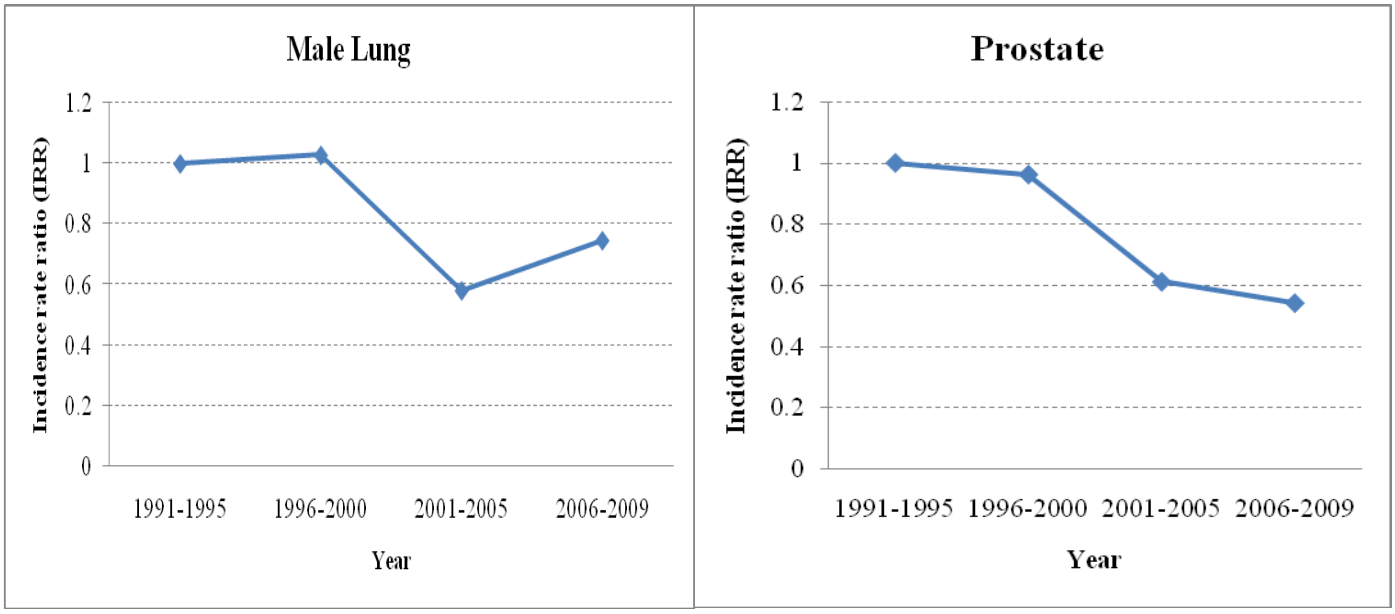

Figure 14. Trends in incidence rate ratios of selected cancer sites in males, Frere Hospital 1991-2009

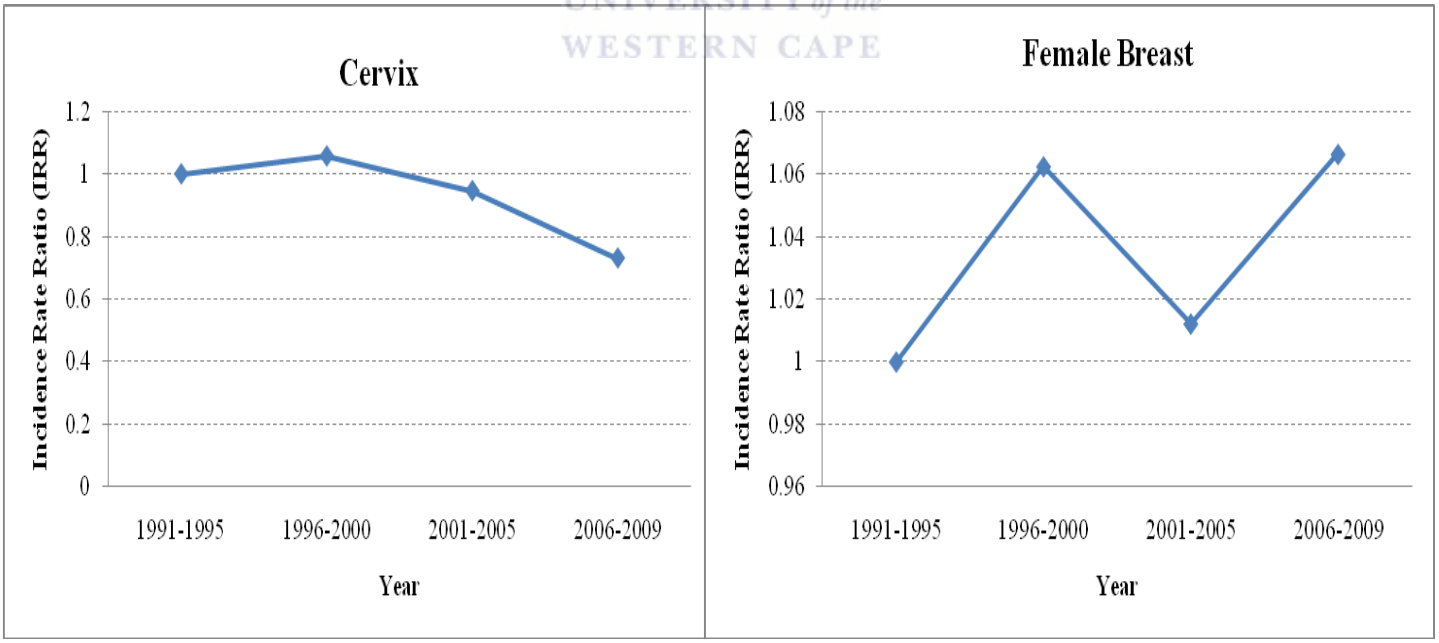

Figure 15. Trends in incidence rate ratios of selected cancer sites in females, Frere Hospital 1991-2009

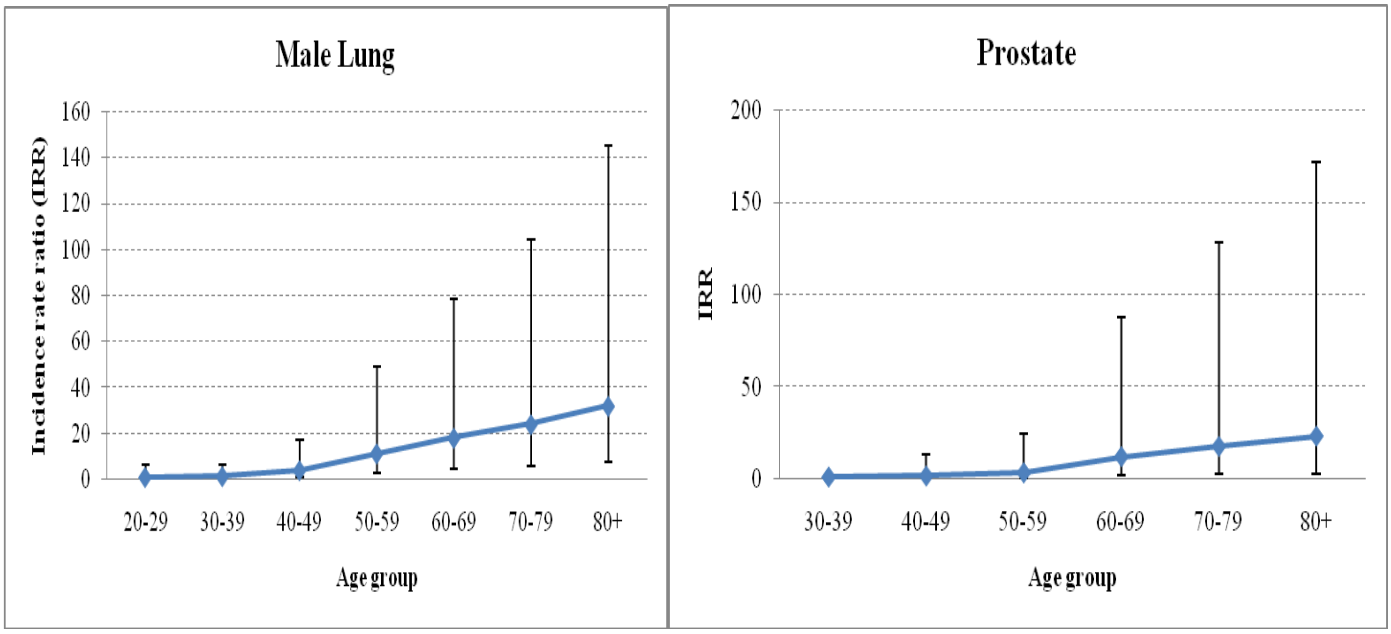

Figure 16. Age-specific incidence rate ratios of selected cancers in males, Frere Hospital 1991-2009

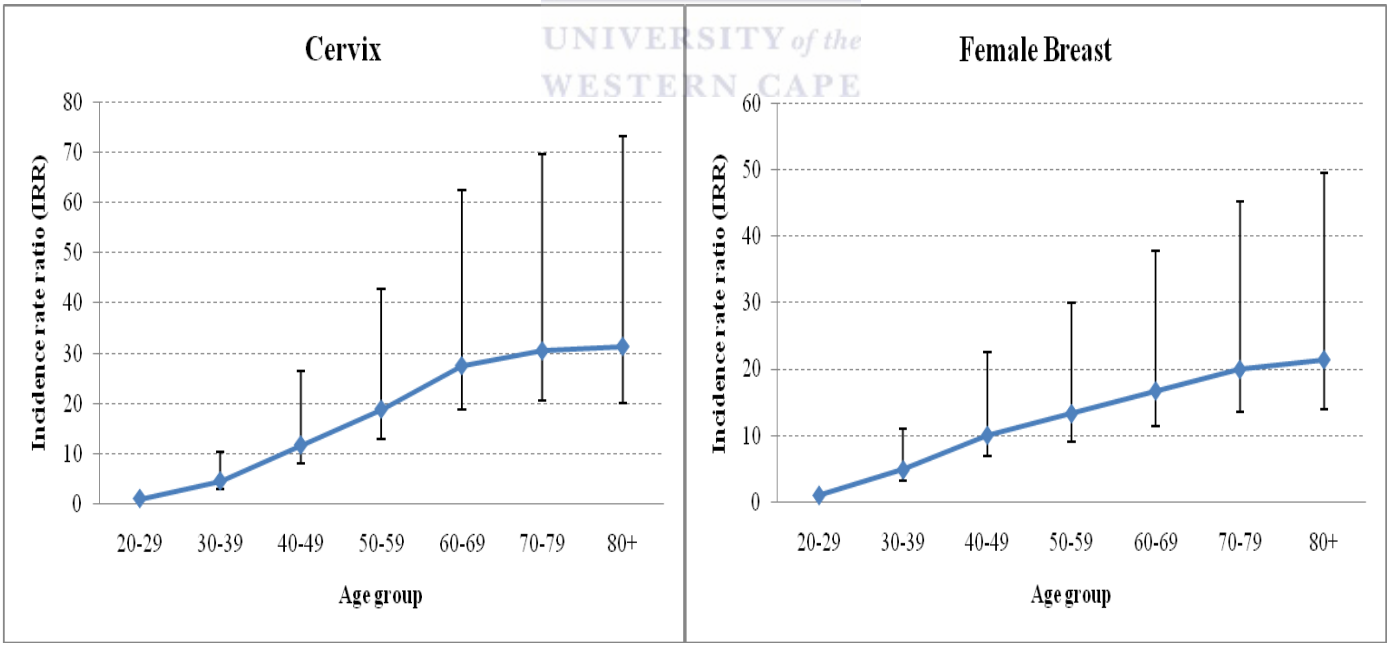

Figure 17. Age-specific incidence rate ratios of selected cancers in females, Frere Hospital 1991-2009

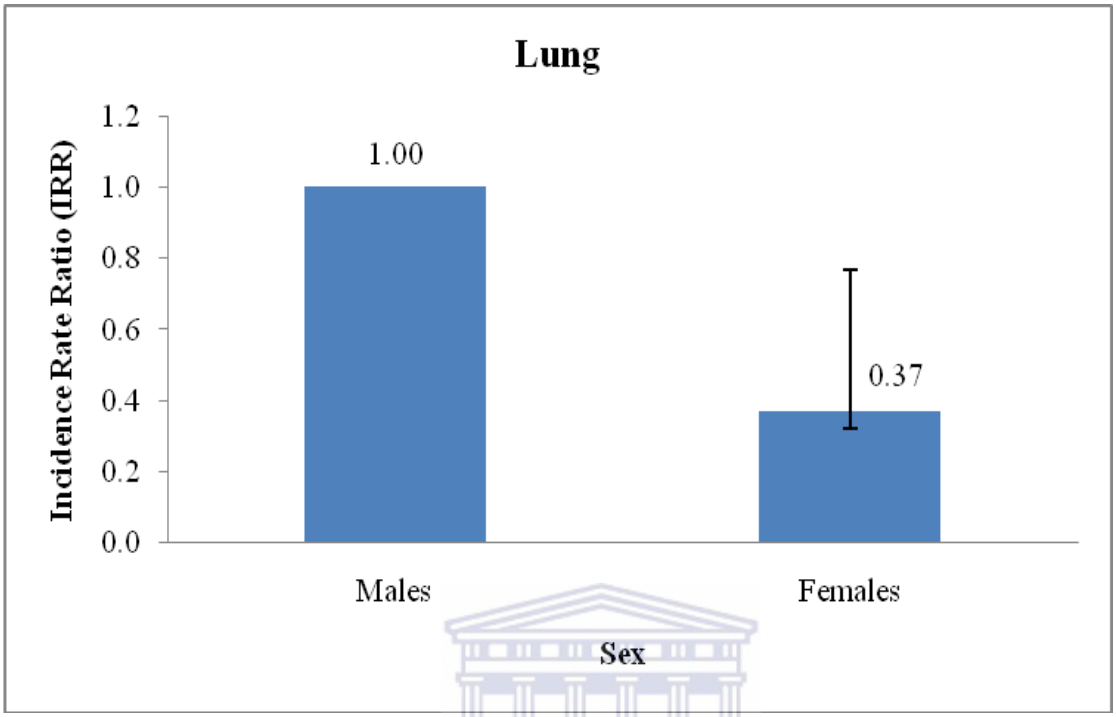

Figure 18. Lung cancer incidence rate ratios by sex, Frere Hospital 1991-2009

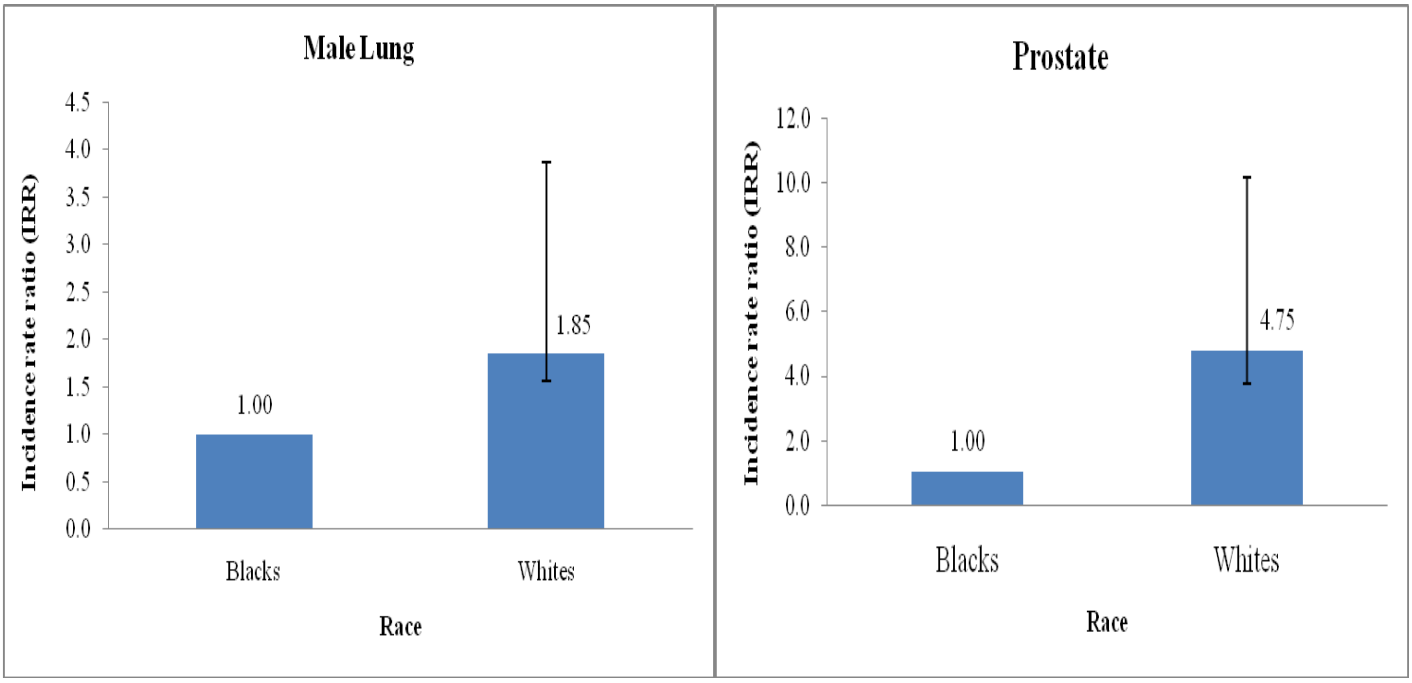

Figure 19. Male selected cancer incidence rate ratios by race , Frere Hospital 1991-2009

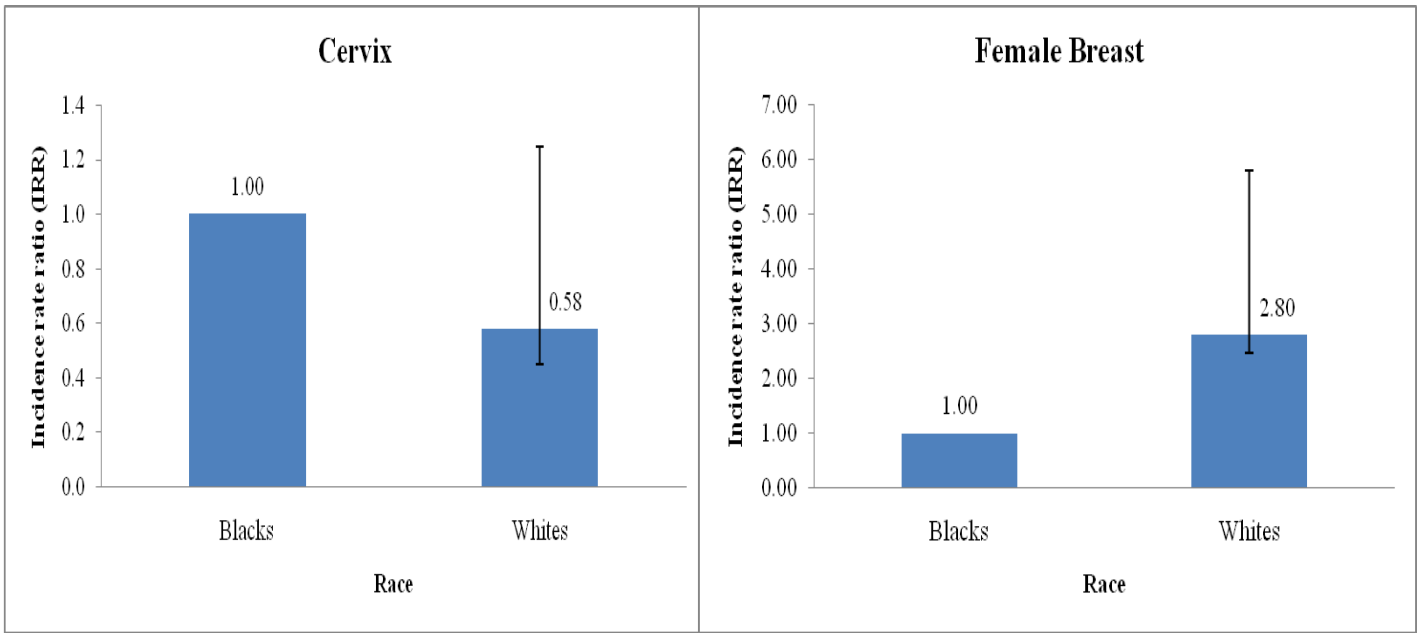

Figure 20. Female selected cancer incidence rate ratios by race, Frere Hospital 1991-2009

Breast and prostate cancers rate ratios observed in White population were higher than in Black Africans even though the annual race-distribution observed in Figure 6 showed that the White population decreased over the 19 year period. Poisson regression was used to further investigate the interaction between period and race for the subset of Black African and White patients. The analyses showed that the trend in the rates for the Whites contributed significantly to the overall decrease in all the three cancer site incidence rates over the period, whilst Black African male rates did not decrease for prostate cancer and Black African rates for female breast cancer increased over the same period (Figures 21-23).

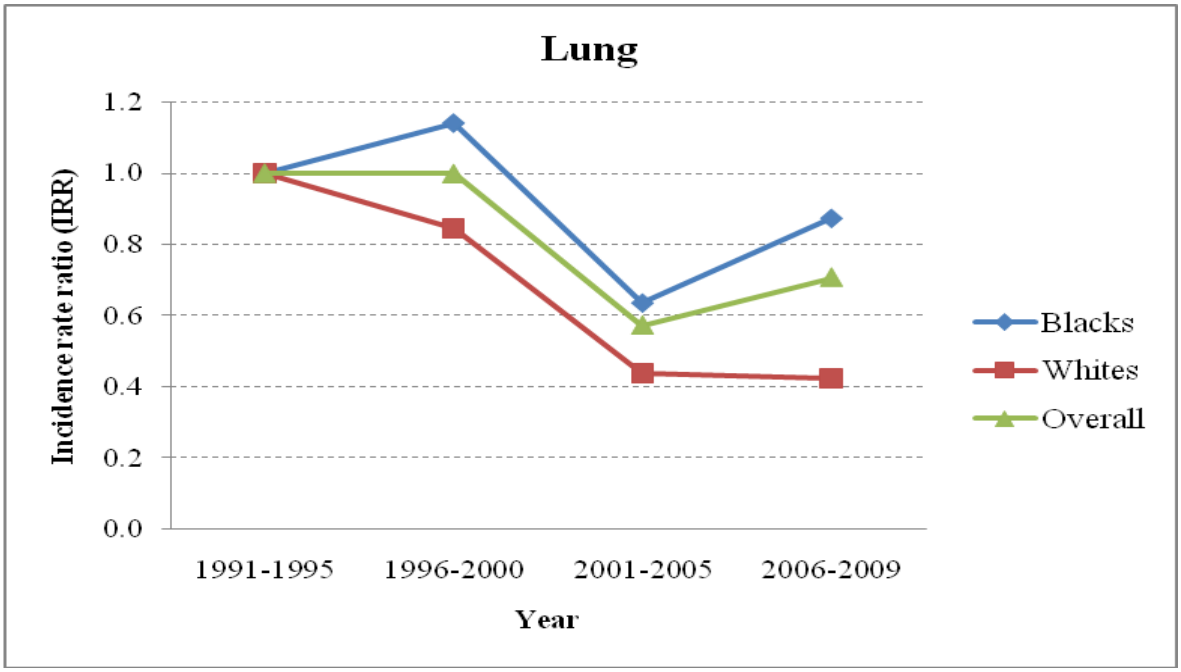

Figure 21. Lung cancer year and race interaction, Frere Hospital 1991-2009

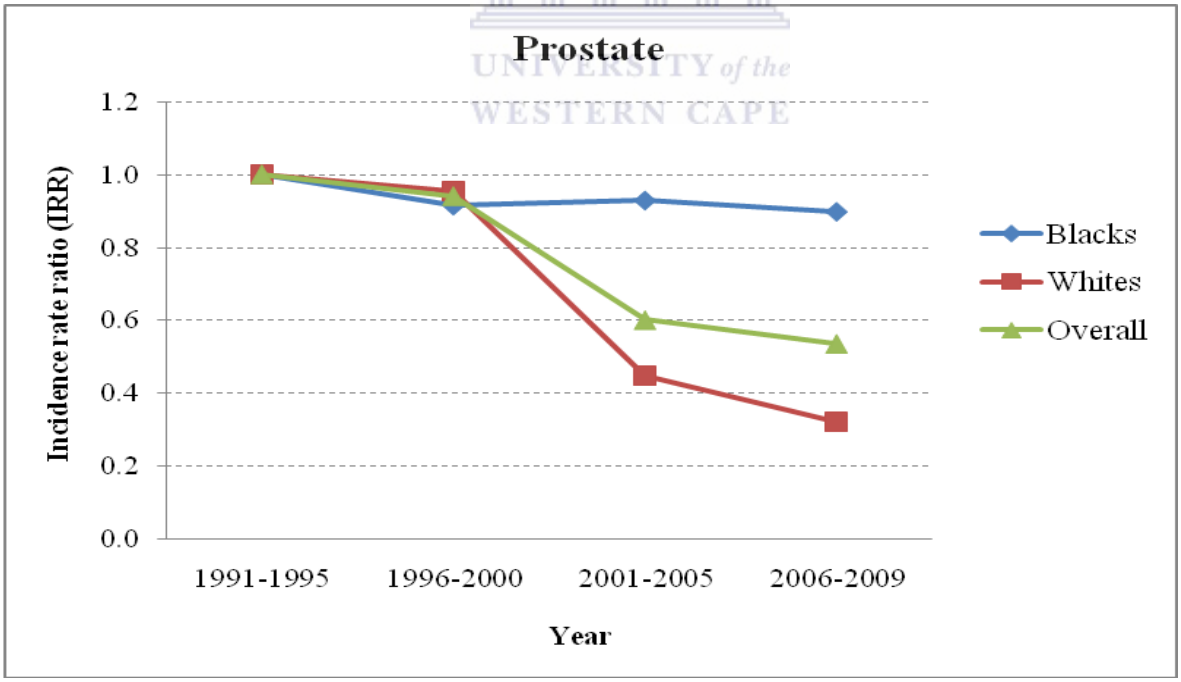

Figure 22. Prostate cancer year and race interaction, Frere Hospital 1991-2009

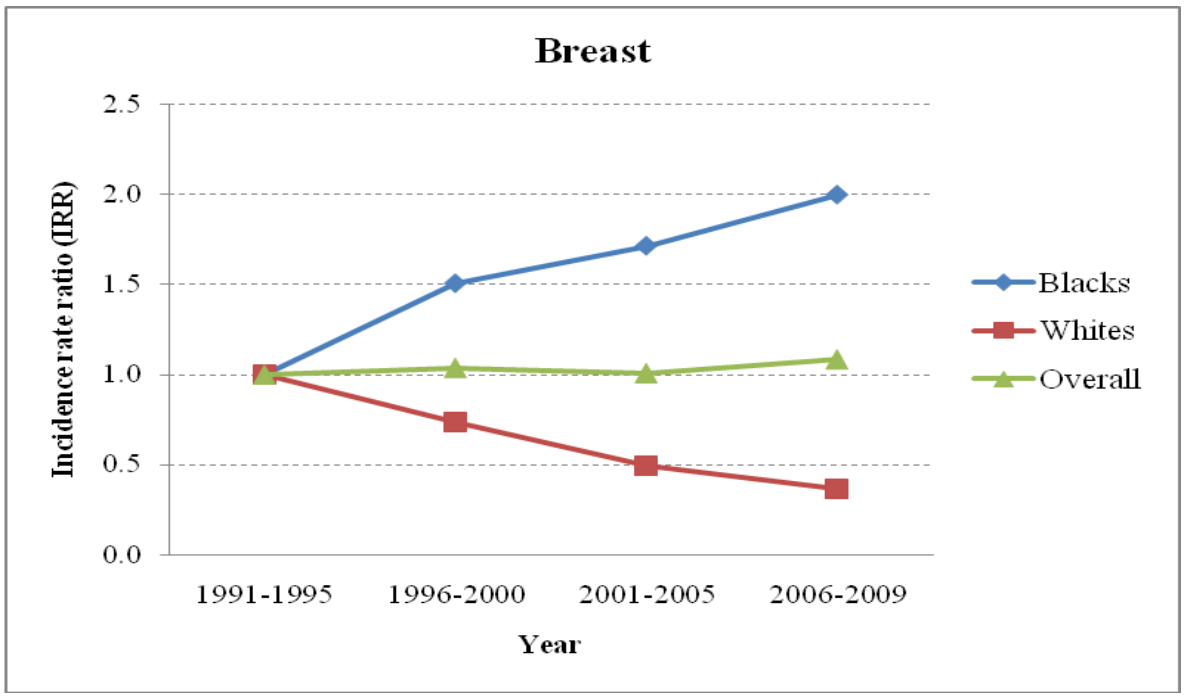

Figure 23. Breast cancer year and race interaction, Frere Hospital 1991-2009

CHAPTER V

Discussion

The annual number of malignant cases at Frere Hospital increased from 953 in 1991 to 1 414 in 2009. More than half of the malignant cases were observed in females (61.2%). Most importantly this pattern reflects the greater cancer burden in women from reproductive causes observed in this study with cervical and breast cancers being the two leading cancers in females. According to GLOBOCAN 2012 cancer trends world wide in developing countries going through rapid and economic changes, show that the shift towards lifestyles typical of industrialised countries lead to a rising burden of cancers associated with reproductive factors (IARC, 2013, McCormack & Schuz, 2011). The greater proportion of female cancer cases observed in this study could also be due to the well-known hypothesis that females are more likely to seek health care or are more compliant to therapeutic regimen compared to males (Norcross, Ramirez & Palinkas, 1996; Muriithi, 2013). However, this needs to be interpreted with care as this hypothesis was not explored in this study.

Black African population patients formed the majority of patients with cancer and showed an overall increase from 1991 to 2009 whereas the White population decreased. The high number of Black African patients was expected as Black Africans form the majority of the Eastern Cape Province population. The annual number of patients with medical aid information decreased from 144 in 1999 to zero in 2009. The medical aid information available in the data was thought to be unreliable even though it probably indicated a trend with fewer private sector patients at Frere Hospital. The majority of cancers were adult cancers, with a few childhood ones. Even though the study presented cancers by sites, unknown primary and ill-defined cancer site cases were included in the analysis and both had considerably high numbers in both males and females.

This study showed that the top-10 leading cancers treated at Frere Hospital's Oncology and Radiation Department for the period 1991-2009 in males were lung, larynx, mouth, prostate, tongue, oesophageal, colon, pharynx, tonsil and Non-Hodgkin's lymphoma. In females cervical, breast, lung, ovary, corpus uteri, mouth, colon, Non-Hodgkin's lymphoma, oesophageal and Kaposi sarcoma were the top-10 cancers. Common childhood cancers in both boys and girls were brain, kidney, eye, bone, lymphoid leukaemia, Hodgkin's diseases, Non-Hodgkin's lymphoma, connective and soft tissue, testis and ovary cancer. The top-10

leading cancers for the BFC population males changed and were lung, prostate, larynx, mouth, colon, tongue, oesophageal, rectum, Non-Hodgkin's lymphoma and multiple myeloma, whereas in females they remained the same as overall cancers.

A comparison of the overall leading cancers observed in this study for the period 1991-2009 with those observed for the period 1952 to 1956 by Burrel is shown in Figure 24. The observed cancer pattern in BFC is strikingly different from the profile reported for this area by Burrell in 1957 when oesophageal cancer was the leading cancer and lung cancer did not feature. The absence of oesophageal cancer in the top three cancers in this data is also striking when compared with contemporary data reported by the rural population-based cancer registry in the former Transkei region of the Eastern Cape (Somdyala *et al*., 2013). Oesphageal cancer has been the leading cancer in the rural area with high rates observed for both males and females (Figure 25). It is possible that the clinical administrative data used in this study is missing oesophageal cancer cases that might not have been referred for radiotherapy in this hospital.

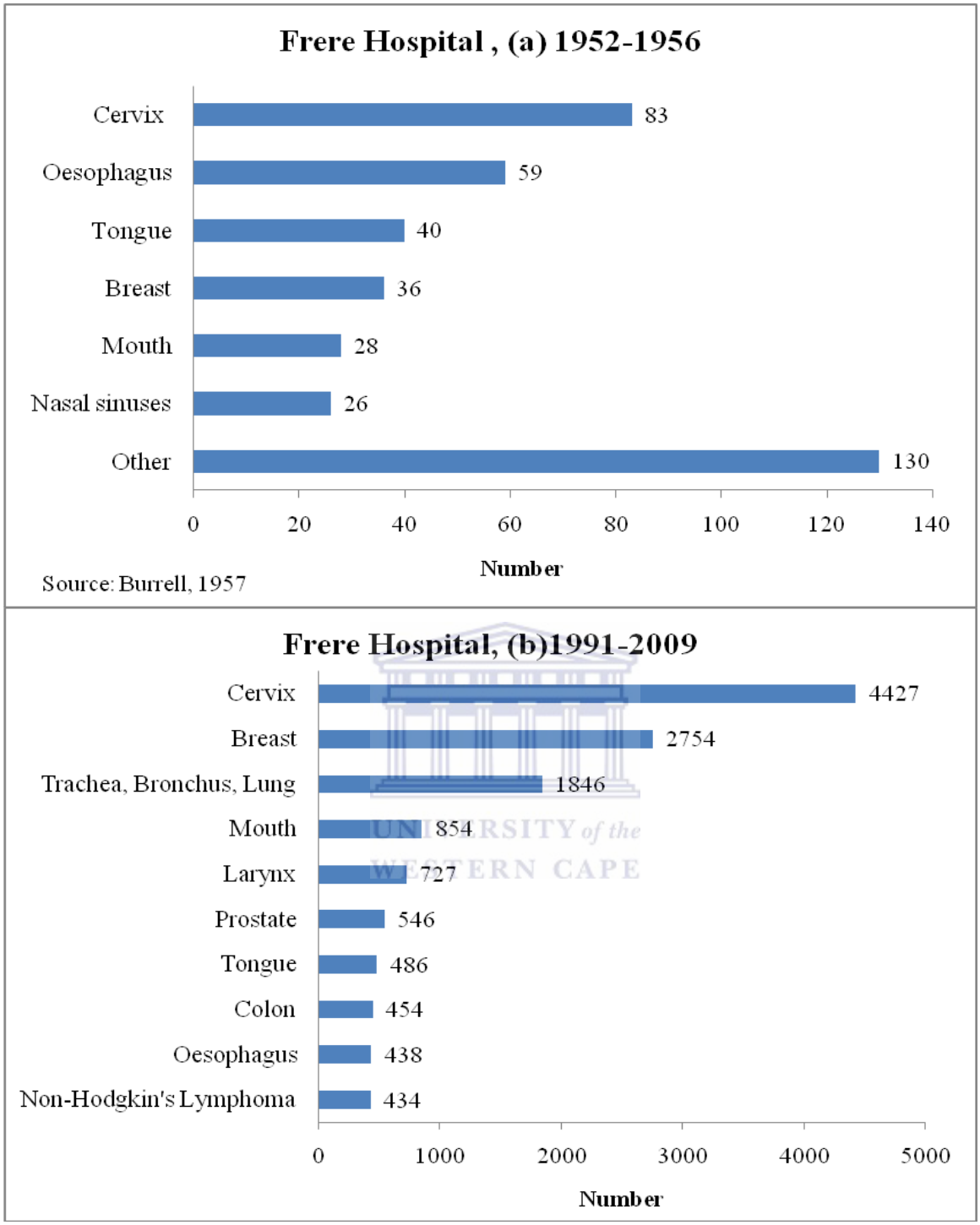

Figure 24. A comparison of leading cancer sites for the periods (a)1952-1956 and (b) 1991-2009

In this study lung cancer was the most common cancer in males accounting for 18.6% of all cancers whilst in females it was 3.5%. Tobacco smoking is reported to be one of the most important risk factors for lung cancer (Sitas, Parkin, Chirenje, Stein, Abratt & Wabinga, 2008; Mqoqi *et al*., 2004; Bello *et al*., 2011). This observed high pattern of lung cancer in males in this study is related to the deaths due to cigarette smoking in South Africa which were reported to be 61% in males and 48% in females (Sitas, Urban, Bradshaw, Kielkowski, Bah & Peto, 2004). This high lung cancer pattern was expected as the relative risk of tobacco-related cancers in males in urban areas of South Africa is reported to be 21 compared to rural smoking males, which is 13 (Sitas *et al*., 2008).

Trends in lung cancer over the period were observed to have decreased and this was comparable to the national decrease in prevalance of smoking amongst adults as well as in learners (from 23% in 1999 to 16.9% in 2011) reported in South Africa (Reddy, James, Sewpaul, Yach, Resnicow, Sifunda, Mthembu & Mbewu, 2013; Mayosi *et al*., 2009). The decline in reported smoking prevalance rates together with the incidence rates in this study could be expected as South Africa is reported to have been a leader in the development and implementation of an appropriate tobacco control plan (Mayosi et *al*., 2009). Other smoking-related cancers observed to be high in males in this study were mouth [ASR 3.7 per 100 000 population] and tongue [ASR 2.9 per 100 000 population] cancers.

Prostate cancer was one of the leading cancers in males in this study, accounting for 7.1% of all male cancers. This cancer which was reported as one of the less frequent cancers (1.7%) in males by Burell (1957) ranked as the second-most common cancer for the BFC population with an ASR of 9.2 per 100 000 population. South Africa is reported to have the highest incidence of prostate cancer [40.5 per 100 000] compared to other African countries. The incidence of histologically-verified prostate cancers is reported to be higher in the White population [40.5 per 100 000 population] compared to the Black African population [14 per 100 000 population] (Parkin *et al*., 2008). In this study prostate caner incidence rates were almost five times higher in the White population compared to the Black African population. An overall decrease in trends of prostate cancer over the 19-year period was observed. The interaction between race and time showed that this trend was due mostly to the decrease in number of the White male population cases whilst Black African male cases were stable. This could be attributable to White males moving to private practices as Frere Hospital is a public hospital.

In this study female reproductive system cancers (cervix and breast) were the leading in females. These are also reported to be the most common cancers in females in Africa as a whole. The incidence of cervical cancer [30-40 per 100 000] is reported to be highest in eastern and southern Africa whilst that of breast cancer [35 per 100 000] is the highest in South Africa (Parkin *et al*., 2008; Denny, 2010). The South African NCR reported cervical cancer ASR of 34.3 per 100 000 and 28.7 per 100 000 for the year 1998 and 1999 respectively. Over 80% of the women diagnosed with cervical cancer during the period were Black Africans (Mqoqi *et al*., 2004). The Eastern Cape Province Cancer Registry reported cervical cancer ASRs of 21.7 per 100 000 for the period 1998-2002 and 19.4 per 100 000 for 2003-2007 (Somdyala *et al*., 2010; Somdyala *et al*., 2013). In this study cervical cancer incidence accounted for 36.6% of all female cancers with an ASR of 23.0 per 100 000 for BFC population. The trend of cervical cancer incidence over the 19-year period was observed to have decreased with White females 43% less likely to have cervical cancer compared to Black African females. The natural history of cervical cancer has been studied and it has been concluded that the persistant infection of the cervix by the oncogenic types of Human Papilloma Virus (HPV 16 & HPV 18) is the necessary cause in 72% of cervical cancers in Africa (Sitas *et al*., 2008; Denny, 2010).

Breast cancer, on the other hand, is reported to be higher in the White female population compared to the Black African female population, with high incidence rates noted in South Africa, 35 per 100 000 (Verobiof, Sitas & Verobiof, 2001; Mqoqi *et al*., 2004; Parkin *et al*., 2008). Mqoqi *et al*., 2004 reported breast cancer as the leading cancer (20.0%) of all cancers reported in White South African females during 1998 and 1999 with an average ASR of 76 per 100 000. The Eastern Cape Province Cancer Registry reported a breast cancer incidence rate of 7.5 per 100 000 population for the period 1998-2002 and for 2003-2007 (Somdyala *et al*., 2010; Somdyala *et al*., 2013). In this study breast cancer accounted for 22.0% of all female cancers and had an ASR of 20.0 per 100 000 for the BFC population. White females were also observed to be almost three times more likely to have breast cancer compared to Black African females. Even though breast cancer trends over the 19-year period were observed to be stable, the interaction between race and year (Figure 23) showed that Black African female cases actually increased whilst White females decreased. In an African setting, the family history has been reported to be the indicator of breast cancer risk. Other risk factors for breast cancer are reported to be related to menstrual and reproductive factors,

high body mass index, high alcohol consumption, physical inactivity and exposure to exogenous hormones either as contraceptives or as postmenapausal hormon replacement therapy (Sitas *et al*., 2008).

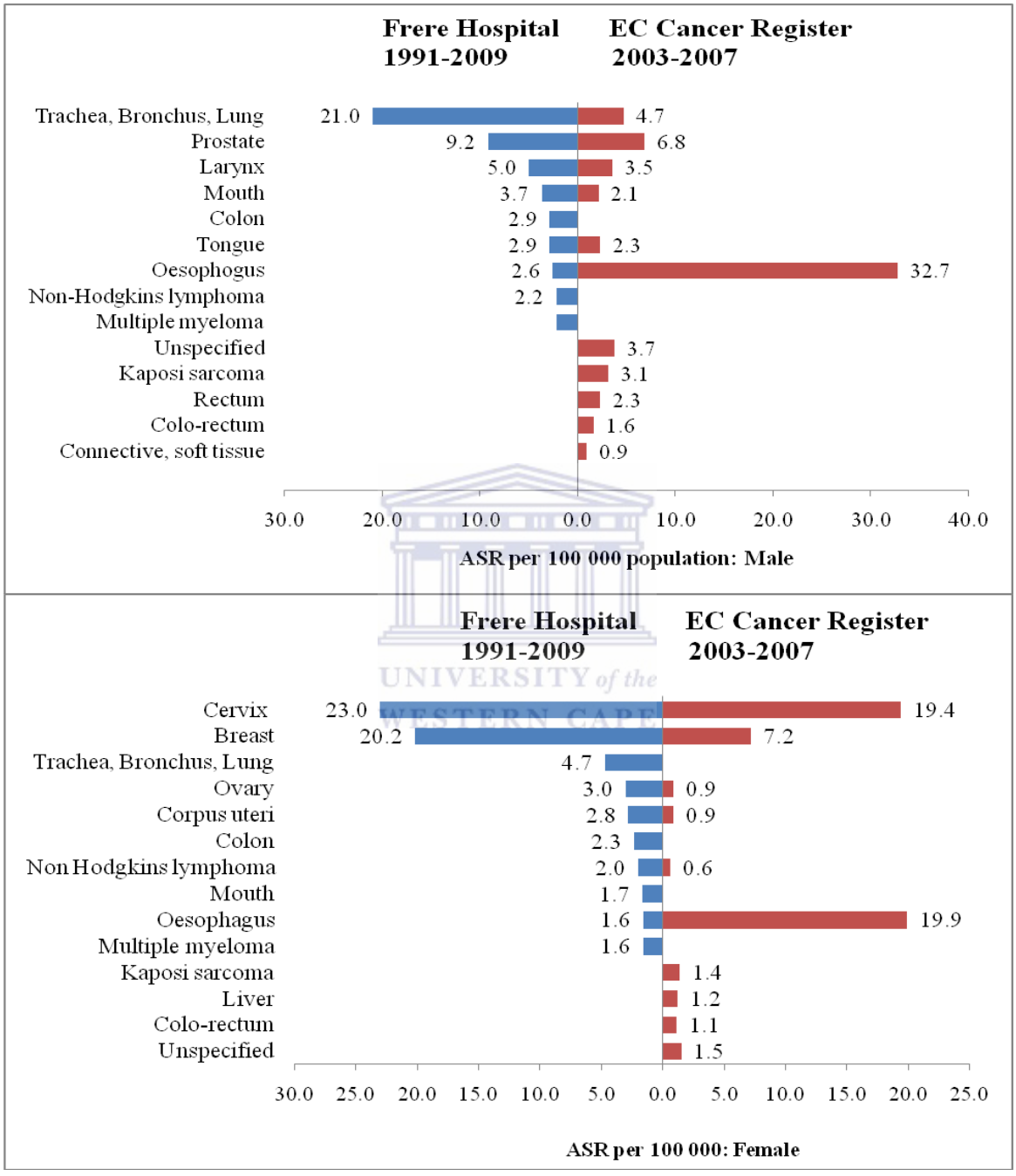

Figure 25. Comparison of the top-10 cancer sites by sex, Frere hospital 1991-2009 and Eastern Cape Province Cancer Registry, 2003-2007

Limitations

The use of hospital clinical administrative data system has limitations. A primary limitation of this study is its reliance on routine health records collected not primarily for research purpose. Routine data capture may not meet the rigorous standards of a focused study. An undeterminable level of inaccuracy may also be associated with these records. However, they are the only available data on cancer cases presented at Frere Hospital and are used routinely for clinical management and administrative purposes. This study had an under-counting of cancer cases in BFC urban area as patients attending the private sector were not included. However, such patients were thought to make a small section of the population as according to the General Household Survey (GHS) only 18.2% of households in the Eastern Cape Province prefer private sector health facilities (Statistics South Africa, 2013).

It could also be assumed that since this is a tertiary hospital, bias towards cases with higher survival opportunities existed. In addition, tertiary hospitals are known to have an increase in number of cancers in which certain specialist within the hospital have an interest in (Parkin *et al*., 2008). Despite these limitations, this initial analysis of cancer cases that occurred over a 19-year period provides useful descriptive background information on recorded cancer cases presenting at Frere Hospital.

CHAPTER VI

Conclusions and Recommendations

Despite the limitations of this study it is clear that efforts are in place to keep up-to-date cancer patient information at Frere Hospital Oncology and Radiation Department, as 89% of the records retrieved had all the variables for analysis. Retrieved data were useful in describing the increasing burden of cancer at Frere Hospital, as shown by the increase in number of cancer cases from 1991 to 2009. The estimated cancer incidence rates in this study showed that major cancers at BFC urban area were lung and prostate cancers in males, cervix and breast in females. These incidence rates were in agreement with the rates reported by the rural population-based EC Province Cancer Registry with the exception of oesophagus cancer incidence rates which were low. Oesophagus cancer was reported in 1957 as the leading cancer in both males and females in this urban hospital and is still reported as the leading cancer by the EC Province Cancer Registry. Therefore, oesophagus cancer cases that might not have been referred for radiotherapy at Frere Hospital should be investigated in order to produce undoubted incidence rate estimates of this cancer in this urban area.

Differences in trends of the leading cancers at BFC urban area existed over the 19 year period. Prostate cancer incidence rates decreased considerably from year 1999 whereas lung cancer incidence rates decreased between 2000 and 2003. Cervix and breast cancer‘s incidence rates remained stable over the period. It is therefore recommended that cancer incidence rates for leading cancers in this urban area must be monitored in order to detect changes in the existing trends. This can be done by establishing a population-based cancer register in BFC to monitor cancer incidence in this urban area. Information generated by such a cancer register will inform future research making it possible to examine urban-rural variations in cancer profiles thus giving a more comprehensive picture of the cancer burden in the Eastern Cape Province.

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APPENDIX A

EASTEN CAPE PROVINCE CANCER REGISTRY CONFIDENTIAL CANCER NOTIFICATION FORM

Registry No.

Today's Date

Day **Month** **Year**

Please complete and return to;
Medical Research Council
Burden of Disease Research Unit
PO Box 19070
Tygerberg
7505

PATIENT INFORMATION

Surname…… … …….. First Name……..

Other Name……. Maiden Name (Married female)……..

Day **Month** **Year**

Sex ☐ **M** ☐ **F** **Estimated Age** ☐☐ **Date of Birth** ☐☐ ☐☐ ☐☐☐☐

Identity Number ☐☐☐☐☐☐☐☐☐☐☐☐☐

PATIENT ADDRESS/ RESIDENCE/CONTACT

Magisterial
Area/Town……

Address Details
……

……

Phone (Work)….....Code No..... Cell….....

Chief /Headman/ Mayor/ Councillor……..

Ethnic Group ☐ **Black** ☐ **White** ☐ **Asian** ☐ **Coloured** ☐ **Unknown**

Marital Status ☐ **Single (Never married)** ☐ **Married** ☐ **Widowed** ☐ **Divorced** ☐ **Separated** ☐ **Minor** ☐ **Unknown**

Smoker ☐ **Stopped** ☐☐ **Years** ☐ **Non-smoker**

SOURCE OF INFORMATION

Hospital/ Private Practi tioner/ Clinic/ Laboratory/Other…….....

Ward…….....

Folder /In-Patient/Out-Patient Number ☐☐☐☐☐☐☐☐☐

TUMOUR INFORMATION

Full Diagnosis…….....

Site of Tumour……..

Pathology Report/ Radiology/Scope/.Disease History/Notes

……

……

Ever had Pap-smear? ☐ **Yes** ☐ **No** **Ever had PSA testing?** ☐ **Yes** ☐ **No**

Year? ……Parity…….. **Year……**

Pathology Number ☐☐☐☐☐☐☐☐☐☐

Topography **C** ☐☐/☐

Morphology **M** ☐☐☐☐/☐

Behaviour ☐

Extent of Disease ☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **Unknown**

Stage of Disease ☐ **I** ☐ **II** ☐ **III** ☐/ ☐ **Unknown**

HIV Status: ☐ **egative** **Pos** ☐ **Unknow** ☐

Incidence Date ☐☐ ☐☐ ☐☐☐☐

Basis of Diagnosis: **Clinical only** ☐ **Radiography** ☐ **Pathology** ☐ **Death Certificate Only** ☐

☐ **Scan** ☐ **Unknown** ☐ **Other Specify**

……

TREATMENT

Surgery ☐ **Radiotherapy** ☐ **Chemotherapy** ☐ **Hormone Therapy** ☐ **Immunotherapy** ☐
Palliative

☐ **Unknown** ☐ **Other (Specify)**

……
……..

VITAL STATUS

Date of last follow-up ☐☐ ☐☐ ☐☐☐☐ ☐ **Alive** ☐ **Dead**

Abstraction done by:……
Please print name

APPENDIX B

UNIVERSITY of the
WESTERN CAPE

OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH DEVELOPMENT

12 April 2013

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape has approved the methodology and ethics of the following research project by: Ms N Sithole (School of Public Health)

Research Project: Cancer profile in an urban hospital of the Eastern Cape

Registration no: 13/2/26

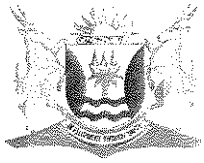
Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Private Bag X17, Bellville 7535, South Africa
T: +27 21 959 2988/2948 . F: +27 21 959 317
E: pjosias@uwc.ac.za
www.uwc.ac.za

APPENDIX C



Eastern Cape Department of Health

Enquiries:	**Zonwabele Me**rile	Tel No:	040 608 0830
Date:	06th May 2013	Fax No:	043 6421409
e-mail address:	**zonwabele.merile@impilo.ecprov.gov.za**		

Dear Ms Nomfuneko Sithole

Re: Cancer profile in an urban hospital of the Eastern Cape Province: a 19 year case series study

The Department of Health would like to inform you that your application for conducting a research on the abovementioned topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.
2. You are advised to ensure, observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants.
3. The Department of Health expects you to provide a progress on your study every 3 months (from date you received this letter) in writ'lng.
4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Epidemiological Research & Surveillance Management. You may be invited to the department to come and present your research findings with your implementable recommendations.
5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

D CTOR: EPIDEMIOLOGICAL RESEARCH & SURVEILLANCE MANAGEMENT

PGDP EASTERN CAPE

!kmnvo ciu;umnnl!iie>'

APPENDIX D

Overall malignant cases by site, age group and sex, 1991-2009

Cancer Site	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total	%	ICD 10
a.Males												
Lip	0	0	1	2	7	10	7	8	5	40	0.5	C00
Tongue	0	0	1	12	47	125	120	69	21	395	5.2	C01-C02
Mouth	0	2	4	13	90	157	175	120	37	598	7.8	C03-C06
Salivary glands	0	0	0	3	8	7	9	9	3	39	0.5	C07-C08
Tonsil	0	0	0	5	45	64	58	30	9	211	2.8	C09
Pharynx	0	4	3	15	25	69	73	25	9	223	2.9	C10-C14
Oesophagus	0	1	2	7	58	77	58	39	9	251	3.3	C15
Stomach	0	0	0	3	11	14	17	4	0	49	0.6	C16
Small intestine	0	0	1	1	3	0	1	0	1	7	0.1	C17
Colon	0	4	9	32	44	49	50	45	3	236	3.1	C18
Rectum	0	1	7	14	24	36	49	31	9	171	2.2	C19-C20
Anus	0	0	3	10	13	14	11	5	6	62	0.8	C21
Liver	0	1	5	5	2	3	2	4	0	22	0.3	C22
Gallbladder	0	0	0	1	0	2	1	0	0	4	0.1	C23
Pancreas	0	0	1	0	3	7	9	2	0	22	0.3	C25
Nasal cavity & Middle	0	0	0	1	1	1	1	2	1	7	0.1	C30
Accessory sinus	0	2	6	9	24	32	34	19	7	133	1.7	C31
Larynx	0	0	4	3	70	200	212	116	29	634	8.3	C32
Trachea, Bronchus, Lung	0	2	4	65	210	456	428	222	34	1,421	18.6	C33-C34
Bone	7	44	24	9	4	4	2	3	2	99	1.3	C40-C41
Melanoma skin	0	0	5	7	16	25	27	14	5	99	1.3	C43
Other skin	0	1	4	13	29	43	52	47	25	214	2.8	C44
Mesothelioma	0	0	0	0	5	5	9	7	1	27	0.4	C45
Kaposi sarcoma	0	4	31	61	40	10	9	4	3	162	2.1	C46
Connective & Soft tissue	3	24	23	10	17	22	26	13	5	143	1.9	C47-C49
Breast	0	0	0	3	9	21	27	23	9	92	1.2	C50
Penis	0	0	1	5	5	11	5	2	3	32	0.4	C60
Prostate	0	0	0	1	9	65	245	171	55	546	7.1	C61
Testis	12	2	14	22	19	13	8	3	2	95	1.2	C62
Kidney	36	4	0	0	13	9	16	6	0	84	1.1	C64
Bladder	0	2	2	2	8	19	31	39	14	117	1.5	C67
Eye	30	1	2	10	10	7	9	6	4	79	1.0	C69
Brain	31	18	8	20	15	29	17	5	0	143	1.9	C70-C72
Thyroid	0	0	0	1	2	13	7	4	1	28	0.4	C73
Other endocrine gland	0	1	3	3	6	4	3	2	0	22	0.3	C75
ILL-Defined	1	2	6	11	31	40	33	22	6	152	2.0	C76
Lymph nodes	1	1	1	7	24	52	64	33	11	194	2.5	C77
Unknown primary	1	2	8	12	43	54	62	35	7	224	2.9	C80
Hodgkin's disease	11	21	32	23	13	16	10	14	1	141	1.8	C81
Non-Hodgkin's Lymphoma	10	12	10	40	29	38	33	21	7	200	2.6	C82-C85;C96
Multiple myeloma	0	0	0	4	27	53	54	35	9	182	2.4	C90
Lymphoid leukemia	11	8	1	1	0	4	8	5	0	38	0.5	C91
Myeloid leukemia	1	3	2	1	1	6	3	1	0	18	0.2	C92-C94
Total	**155**	**167**	**228**	**467**	**1,060**	**1,886**	**2,075**	**1,265**	**353**	**7,656**	**100.0**	

Cancer Site	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total	%	ICD 10
b. Females												
Lip	0	0	3	0	4	9	10	8	3	37	0.3	C00
Tongue	0	0	2	2	3	16	35	24	9	91	0.8	C01-C02
Mouth	0	3	5	8	17	46	86	57	34	256	2.1	C03-C06
Salivary glands	0	5	7	8	8	10	16	8	5	67	0.6	C07-C08
Tonsil	0	0	1	1	3	10	8	9	5	37	0.3	C09
Pharynx	0	1	3	6	12	14	19	9	8	72	0.6	C10-C14
Oesophagus	0	0	0	13	32	53	55	25	9	187	1.5	C15
Stomach	0	1	2	2	5	5	14	9	3	41	0.3	C16
Small intestine	0	0	1	1	2	1	2	1	0	8	0.1	C17
Colon	0	3	13	25	44	38	60	26	9	218	1.8	C18
Rectum	0	0	8	14	25	30	32	24	13	146	1.2	C19-C20
Anus	0	0	2	7	4	9	11	4	6	43	0.4	C21
Liver	0	0	1	1	0	1	3	2	0	8	0.1	C22
Gallbladder	0	0	0	0	1	7	4	2	0	14	0.1	C23
Pancreas	0	1	0	2	4	5	5	1	0	18	0.1	C25
Nasal cavity & Middle	0	0	1	0	3	4	3	2	1	14	0.1	C30
Accessory sinus	0	0	5	8	11	15	21	16	3	79	0.7	C31
Larynx	0	0	0	5	13	29	32	12	2	93	0.8	C32
Trachea, Bronchus, Lung	0	0	3	8	71	114	141	73	15	425	3.5	C33-C34
Bone	2	45	18	4	9	6	3	1	1	89	0.7	C40-C41
Melanoma skin	0	0	7	8	16	17	36	34	21	139	1.2	C43
Other skin	0	0	2	16	14	32	31	35	30	160	1.3	C44
Mesothelioma	0	0	0	0	1	0	2	1	1	5	0.0	C45
Kaposi sarcoma	0	3	56	69	28	15	4	1	2	178	1.5	C46
Connective & Soft tissue	5	21	22	21	25	13	23	12	4	146	1.2	C47-C49
Breast	0	4	65	346	648	605	509	346	139	2,662	22.0	C50
Vulva Vagina	0	3	8	10	29	28	46	25	9	158	1.3	C51-C52
Cervix	0	1	64	465	940	1,064	1,156	569	168	4,427	36.6	C53
Corpus uteri	0	0	1	4	15	49	150	92	15	326	2.7	C54
Ovary	1	16	26	42	58	63	73	45	11	335	2.8	C56
Placenta	0	6	35	33	19	9	7	2	1	112	0.9	C58
Kidney	30	2	3	6	5	7	6	4	1	64	0.5	C64
Bladder	0	0	0	3	0	11	13	18	11	56	0.5	C67
Eye	24	1	20	26	19	11	7	10	5	123	1.0	C69
Brain	25	25	7	18	19	18	14	6	0	132	1.1	C70-C72
Thyroid	0	2	12	27	28	20	26	12	6	133	1.1	C73
Other endocrine gland	0	1	4	5	7	8	4	2	0	31	0.3	C75
ILL-Defined	2	1	4	9	28	31	37	20	11	143	1.2	C76

Lymph nodes	0	0	4	7	11	19	29	13	9	92	0.8	C77
Unknown primary	0	2	3	16	21	31	40	31	6	150	1.2	C80
Hodgkin's disease	6	13	18	21	15	9	12	9	2	105	0.9	C81
Non-Hodgkin's Lymphoma	6	11	22	45	31	30	50	32	7	234	1.9	C82-C85;C96
Multiple myeloma	0	0	0	10	18	45	60	30	14	177	1.5	C90
Lymphoid leukemia	8	14	1	2	1	1	7	2	4	40	0.3	C91
Myeloid leukemia	0	1	2	2	1	1	2	0	1	10	0.1	C92-C94
Total	**109**	**186**	**461**	**1,326**	**2,268**	**2,559**	**2,904**	**1,664**	**604**	**12,081**	**100.0**	

APPENDIX E

Estimated BFC minimal cancer incidence rates by cancer site, age group and sex, 1991-2009

Cancer site	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total	%	CR	ASR	ICD 10
a. Males														
Lip	0.0	0.0	0.0	0.1	0.7	0.7	0.8	4.9	2.6	9.9	0.6	0.3	0.4	C00
Tongue	0.0	0.0	0.0	1.0	1.9	7.4	16.7	18.7	18.5	64.2	3.8	2.0	2.9	C01-C02
Mouth	0.0	0.0	0.0	0.6	3.7	11.3	20.5	19.5	18.5	74.2	4.4	2.6	3.7	C03-C06
Salivary glands	0.0	0.0	0.0	0.0	0.6	0.7	2.1	5.7	0.0	9.1	0.5	0.3	0.5	C07-C08
Tonsil	0.0	0.0	0.0	0.3	1.6	3.9	5.9	7.3	10.6	29.6	1.8	0.9	1.3	C09
Pharynx	0.0	0.2	0.0	0.9	1.3	4.9	10.9	5.7	5.3	29.1	1.7	1.2	1.7	C10-C14
Oesophagus	0.0	0.0	0.2	0.4	4.9	7.4	11.7	15.5	2.6	42.7	2.5	1.9	2.6	C15
Stomach	0.0	0.0	0.0	0.2	1.0	2.1	3.8	0.8	0.0	7.9	0.5	0.4	0.6	C16
Small intestine	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	2.6	3.1	0.2	0.0	0.1	C17
Colon	0.0	0.1	0.4	1.7	3.0	6.0	14.2	21.2	5.3	51.9	3.1	2.1	2.9	C18
Rectum	0.0	0.1	0.1	0.6	1.6	4.6	12.1	19.5	10.6	49.3	2.9	1.5	2.3	C19-C20
Anus	0.0	0.0	0.1	0.4	0.4	0.9	1.7	0.8	5.3	9.6	0.6	0.3	0.4	C21
Liver	0.0	0.1	0.3	0.2	0.1	0.5	0.0	0.0	0.0	1.2	0.1	0.1	0.1	C22
Pancreas	0.0	0.0	0.0	0.0	0.0	1.2	1.7	0.8	0.0	3.6	0.2	0.2	0.2	C25
Nasal cavity & Middle	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8	0.0	1.0	0.1	0.0	0.0	C30
Accessory sinus	0.0	0.1	0.2	0.2	1.2	1.4	2.5	4.1	5.3	14.9	0.9	0.5	0.7	C31
Larynx	0.0	0.0	0.2	0.1	3.7	16.9	26.4	32.6	18.5	98.3	5.8	3.4	5.0	C32
Trachea, Bronchus, Lung	0.0	0.2	0.3	4.3	20.0	68.4	111.4	116.4	58.1	378.9	22.5	14.5	21.0	C33-C34
Bone	0.2	1.1	0.4	0.5	0.0	0.7	0.8	0.0	5.3	9.1	0.5	0.5	0.5	C40-C41
Melanoma skin	0.0	0.0	0.3	0.2	1.6	3.5	5.4	6.5	5.3	22.9	1.4	0.9	1.2	C43
Other skin	0.0	0.1	0.2	0.6	1.9	4.4	12.6	26.9	47.5	94.1	5.6	2.0	2.9	C44
Mesothelioma	0.0	0.0	0.0	0.0	0.3	0.7	2.9	4.9	2.6	11.4	0.7	0.3	0.5	C45
Kaposi sarcoma	0.0	0.1	1.3	3.7	2.5	0.9	0.8	1.6	2.6	13.6	0.8	1.2	1.2	C46
Connective & Soft tissue	0.2	0.3	0.7	0.3	1.8	1.2	4.6	4.1	2.6	15.7	0.9	0.8	1.0	C47-C49
Breast	0.0	0.0	0.0	0.1	0.6	1.4	4.6	4.1	10.6	21.3	1.3	0.5	0.8	C50
Penis	0.0	0.0	0.0	0.3	0.1	1.8	0.4	0.8	2.6	6.2	0.4	0.2	0.3	C60
Prostate	0.0	0.0	0.0	0.1	1.2	9.2	67.4	88.7	81.8	248.5	14.7	5.6	9.2	C61
Testis	0.1	0.1	0.8	1.9	2.4	1.6	2.1	1.6	2.6	13.3	0.8	1.0	1.0	C62
Kidney	0.7	0.1	0.0	0.0	1.0	1.8	3.8	0.8	0.0	8.3	0.5	0.6	0.7	C64
Bladder	0.0	0.1	0.1	0.0	0.9	3.7	9.2	21.2	31.7	66.8	4.0	1.3	2.1	C67
Eye	0.6	0.1	0.1	0.2	0.6	0.2	1.3	0.8	5.3	9.2	0.5	0.4	0.4	C69
Brain	0.9	0.7	0.3	1.1	1.2	5.8	6.3	2.4	0.0	18.7	1.1	1.4	1.7	C70-C71
Thyroid	0.0	0.0	0.0	0.0	0.3	0.9	0.8	1.6	0.0	3.7	0.2	0.2	0.2	C73
Other endocrine gland	0.0	0.0	0.2	0.1	0.7	0.5	0.8	0.8	0.0	3.1	0.2	0.2	0.3	C75

Ill-Defined	0.0	0.1	0.2	0.7	2.7	4.6	8.0	11.4	2.6	30.3	1.8	1.3	1.8	C76
Lymph nodes	0.0	0.0	0.1	0.5	1.0	5.3	9.2	9.0	15.8	41.0	2.4	1.2	1.8	C77
Unknown primary	0.0	0.1	0.3	1.0	4.0	6.5	15.1	15.5	13.2	55.6	3.3	2.1	2.9	C80
Hodgkin's disease	0.2	0.9	1.4	1.2	0.7	1.4	2.1	6.5	2.6	17.1	1.0	1.1	1.2	C81
Non-Hodgkin's Lymphoma	0.5	0.3	0.6	2.8	1.5	4.9	7.5	12.2	10.6	40.9	2.4	1.8	2.2	C82-C85;C96
Multiple myeloma	0.0	0.0	0.0	0.2	1.9	6.0	10.5	17.9	13.2	49.7	2.9	1.5	2.2	C90
Lymphoid leukemia	0.2	0.3	0.1	0.1	0.0	0.5	1.7	3.3	0.0	6.0	0.4	0.3	0.4	C91
Myeloid leukemia	0.0	0.1	0.1	0.1	0.1	0.9	0.0	0.8	0.0	2.2	0.1	0.1	0.2	C92-C94
Total	**3.7**	**4.9**	**8.7**	**26.9**	**75.5**	**206.7**	**420.8**	**517.8**	**422.3**	**1687.2**	**100.0**	**58.9**	**83.2**	

Cancer site	**0-9**	**10-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**70-79**	**80+**	**Total**	**%**	**CR**	**ASR**	**ICD 10**
b. Females														
Lip	0.0	0.0	0.1	0.0	0.0	0.6	0.6	2.0	2.5	5.7	0.7	0.2	0.2	C00
Tongue	0.0	0.0	0.0	0.2	0.1	1.3	2.5	6.6	6.2	17.0	1.7	0.5	0.6	C01-C02
Mouth	0.0	0.1	0.2	0.3	0.5	3.6	9.3	11.1	22.5	47.5	6.2	1.5	1.7	C03-C06
Salivary glands	0.0	0.0	0.3	0.3	0.4	0.4	2.3	0.5	2.5	6.6	0.7	0.3	0.4	C07-C08
Tonsil	0.0	0.0	0.0	0.0	0.4	1.3	1.4	1.5	2.5	7.1	0.7	0.3	0.3	C09
Pharynx	0.0	0.0	0.2	0.3	0.8	1.3	2.3	2.0	2.5	9.3	0.7	0.5	0.5	C10-C14
Oesophagus	0.0	0.0	0.0	1.0	2.2	5.1	7.9	6.1	5.0	27.3	1.4	1.4	1.6	C15
Stomach	0.0	0.1	0.1	0.1	0.5	0.4	3.1	1.5	3.7	9.5	1.0	0.4	0.4	C16
Small intestine	0.0	0.0	0.0	0.1	0.3	0.2	0.3	0.0	0.0	0.8	0.0	0.1	0.1	C17
Colon	0.0	0.1	0.3	1.3	3.2	5.1	11.9	12.1	8.7	42.7	2.4	2.1	2.3	C18
Rectum	0.0	0.0	0.2	0.7	1.7	4.0	4.5	8.1	10.0	29.2	2.7	1.2	1.3	C19-C20
Anus	0.0	0.0	0.2	0.3	0.3	0.6	2.0	1.0	2.5	6.7	0.7	0.3	0.3	C21
Liver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	C22
Gallbladder	0.0	0.0	0.0	0.0	0.0	0.9	0.3	0.5	0.0	1.7	0.0	0.1	0.1	C23
Pancreas	0.0	0.0	0.0	0.1	0.1	0.6	0.8	0.5	0.0	2.1	0.0	0.1	0.2	C25
Nasal cavity & Middle	0.0	0.0	0.1	0.0	0.3	0.4	0.0	0.5	0.0	1.2	0.0	0.1	0.1	C30
Accessory sinus	0.0	0.0	0.1	0.2	0.3	1.1	1.7	2.0	1.2	6.6	0.3	0.3	0.4	C31
Larynx	0.0	0.0	0.0	0.1	0.4	2.1	5.1	4.5	2.5	14.7	0.7	0.6	0.8	C32
Trachea, Bronchus, Lung	0.0	0.0	0.1	0.4	5.9	13.4	26.6	24.2	12.5	83.0	3.4	3.9	4.7	C33-C34
Bone	0.0	0.8	0.5	0.2	0.4	0.2	0.0	0.0	0.0	2.1	0.0	0.3	0.3	C40-C41
Melanoma skin	0.0	0.0	0.4	0.4	0.8	1.7	5.1	9.1	13.7	31.1	3.8	1.0	1.1	C43
Other skin	0.0	0.0	0.1	0.6	0.8	2.5	5.1	10.1	29.9	49.0	8.2	1.3	1.3	C44
Mesothelioma	0.0	0.0	0.0	0.0	0.1	0.0	0.6	0.5	1.2	2.4	0.3	0.1	0.1	C45
Kaposi sarcoma	0.0	0.1	2.0	3.0	1.4	0.9	0.8	0.5	0.0	8.8	0.0	1.2	1.0	C46
Connective & Soft tissue	0.2	0.4	0.4	0.8	1.7	1.1	1.7	2.5	1.2	10.2	0.3	0.8	0.8	C47-C49
Breast	0.0	0.0	2.3	15.6	39.7	54.4	69.5	84.7	86.1	352.4	23.6	18.4	20.2	C50

Vulva Vagina	0.0	0.1	0.2	0.3	1.7	1.9	5.4	3.5	3.7	16.8	1.0	0.8	1.0	C51-C52
Cervix	0.0	0.0	2.2	16.2	42.1	64.8	90.1	91.8	76.1	383.4	20.9	20.7	23.0	C53
Corpus uteri	0.0	0.0	0.0	0.1	0.8	4.7	18.9	25.7	12.5	62.7	3.4	2.3	2.8	C54
Ovary	0.1	0.4	1.1	2.4	4.2	7.4	11.3	11.6	7.5	46.0	2.1	2.7	3.0	C56
Placenta	0.0	0.1	1.7	1.2	1.0	0.9	1.4	0.5	0.0	6.9	0.0	0.8	0.8	C58
Kidney	0.6	0.0	0.2	0.3	0.4	1.1	0.6	1.5	1.2	5.8	0.3	0.4	0.4	C64
Bladder	0.0	0.0	0.0	0.1	0.0	0.8	2.3	5.5	6.2	14.9	1.7	0.4	0.5	C67
Eye	0.4	0.0	0.2	0.5	0.6	0.6	0.6	1.5	0.0	4.4	0.0	0.4	0.4	C69
Brain	0.9	0.7	0.3	1.1	1.2	2.6	3.1	2.5	0.0	12.5	0.0	1.1	1.2	C70-C71
Thyroid	0.0	0.1	0.5	1.1	1.7	0.9	3.1	3.5	5.0	16.0	1.4	0.9	0.9	C73
Other endocrine gland	0.0	0.0	0.2	0.5	0.3	0.8	0.8	1.0	0.0	3.6	0.0	0.3	0.3	C75
Ill-Defined	0.1	0.0	0.0	0.5	2.6	3.0	6.2	5.5	7.5	25.4	2.1	1.2	1.3	C76
Lymph nodes	0.0	0.0	0.2	0.3	0.9	2.5	3.7	3.0	5.0	15.5	1.4	0.7	0.8	C77
Unknown primary	0.0	0.1	0.1	0.6	1.8	4.0	7.6	11.1	5.0	30.2	1.4	1.4	1.6	C80
Hodgkin's disease	0.2	0.4	0.7	1.1	0.8	0.6	1.7	3.5	1.2	10.1	0.3	0.7	0.7	C81
Non-Hodgkin's Lymphoma	0.2	0.2	0.9	2.2	1.8	3.2	9.6	9.6	6.2	33.9	1.7	1.9	2.0	C82-C85;C96
Multiple myeloma	0.0	0.0	0.0	0.6	1.3	5.7	9.3	6.1	7.5	30.4	2.1	1.4	1.6	C90
Lymphoid leukemia	0.1	0.2	0.1	0.1	0.1	0.0	1.1	0.5	2.5	4.7	0.7	0.2	0.2	C91
Myeloid leukemia	0.0	0.1	0.1	0.0	0.1	0.2	0.6	0.0	0.0	1.0	0.0	0.1	0.1	C92-C94
Total	**2.6**	**3.9**	**16.1**	**54.7**	**125.4**	**208.9**	**342.6**	**381.4**	**364.3**	**1499.9**	**100.0**	**75.3**	**83.3**	