

Original Research Article

Prostate cancer in Saudi Arabia: trends in incidence, morphological and epidemiological characteristics

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ABSTRACT

Background: Prostate cancer (PCa) is the second most common cause of cancer and the second leading cause of cancer death among men worldwide. This paper aims to determine the incidence of the prostate cancer cases in Saudi Arabia between 1994 and 2016.

Methods: In this study, the statistics of prostate cancer cases recorded in reports of the Saudi cancer registry for the period from 1994 to 2016 are used. The data and numbers of these reports were assessed to review the full picture during the study period. Age-standardized and age-specific incidence rates were calculated for these purposes.

Results: In total, 89,880 cancer cases were recorded for the period between 1994 and 2016. The number of prostate cancer cases out of this total is 5,332. The age-adjusted prostate cancer incidence increased from 4.1 in 1994 to 6.3 in 2016. A variation in the incidence of prostate cancer by region was noticed, and a direct relationship was identified between prostate cancer rates and the ages of those with prostate cancer, with the majority of people with prostate cancer being over 50 years.

Conclusions: The overall appearance of prostate cancer is moving upwards. Differences in the incidence rates between men who live in different Saudi regions suggest that environment, behaviour and genetic factors may be a cause. Exploring these factors is necessary to take advantage of them while drawing up the prevention plans.

Keywords: Cancer epidemiology, Cancer prevention, Cancer control, Prostate tumour, Renal tumour

INTRODUCTION

PCa is ranked first among the most frequently diagnosed cancers in men in 12 regions of the world.¹ It is the second most common cause of cancer and the second leading cause of cancer death among men worldwide, with an estimated 1,276,000 new cases and 359,000 new deaths in 2018.¹ In 2018, PCa was the most common type of cancer in terms of new cases and deaths in 12 regions of the world, most of which were within the developed world.¹ Thus, the incidence of PCa varies by geographic region, reaching up to a 24-fold difference between countries.²

Until 2030, a significant annual growth of 3% in the incidence rate of PCa is expected across the world.³ In Saudi Arabia, PCa represented 5% of all newly diagnosed cancers among Saudi males in 2018.⁴ There is a limitation in the number of research studies that have examined the pattern and trend of PCa cases at the national level in Saudi Arabia. While only one paper utilised data available publicly on the Saudi cancer registry (SCR), it is limited by its focus on only the data of eight years from 2001 to 2008.⁵

Therefore, in this study, the aim was to determine the overall incidence trends by including all PCa cases reported in Saudi Arabia for a period of 23 years between

1994 and 2016. To date, no national-level study has been conducted to investigate PCa rates across males, age and regions of Saudi Arabia over 23 years in the Saudi population using recently available updated data. Performing this kind of study will have an impact on PCa preventive plans by initiating additional screening programmes for high-risk age groups or the regions with the highest incidence rates. The aim of this surveillance data analysis was to assess the trends in PCa cancer incidence in Saudi Arabia and to determine correlation between the incidence and age, region and time.

METHODS

Data

The SCR is the main reference for monitoring and documenting all cancer cases in the kingdom. That record was created in 1994 and is affiliated with the ministry of health. The registry record contains a log of all cancer cases registered in the hospitals of Saudi’s thirteen regions. For the purpose of this study, all 5,332 of the Saudi confirmed PCa cases reported during the 23-year period from January 1994 to December 2016 were included in study. A number of variables and numbers related to PCa (ICD-10:C61) were taken from SCR reports, including data about demographics (sex, age and nationality), regional differences and tumour details, such as primary site and histology of the malignancy.

Study design

A retrospective descriptive epidemiological study was conducted of PCa cases in Saudi population diagnosed between January 1994 and December 2016. The analysis included all recorded cases without any exclusions.

Sample size

An entire population sampling method was performed in this study by involving all cancer cases within the Saudi population from 1994 to 2016.

Data analysis

The GraphPad prism6 software was the tool used for data analysis. The data were analyzed in the same way that was previously used by Alshehri et al.⁶ Data such as the percentages of PCa, the age-standardized (ASR) and age-specific (AIR) incidence rates of PCa per 100,000 stratified by age, sex, region and year of diagnosis were obtained from the SCR reports.

RESULTS

Steady increase in the number and percentage of cumulative PCa cases over 23 years

The total number of male cancer cases identified by the SCR from 1994 to 2016 was 89,880 cases. Of this, 5,332

cases (6%) were PCa. The number of registered PCa cases increased steadily from 154 in 1994 to a peak of 405 in 2016. The lowest number of PCa cases (131 cases) was reported in 1997 (Table 1). Menially, the percentage of PCa relative to other cancer types increased from 4.9% in 1994 to 7.2% in 2016 (Figure 1). This percentage reached its lowest value of 4.7% in 1997 (Figure 1).

Table 1: Number and percent of prostate cancer cases compared to all cancer types from 1994 to 2016.

Year	Number of PCa* cases	Percent of PCa* cases out of all cancer types (%)
1994	154	4.90
1995	154	5.30
1996	156	5.7
1997	131	4.70
1998	151	5.00
1999	138	4.80
2000	166	5.9
2001	156	5.40
2002	176	5.90
2003	172	5.30
2004	214	6.2
2005	261	7.00
2006	228	5.80
2007	259	6.00
2008	267	6.3
2009	295	6.40
2010	280	6.10
2011	311	6.30
2012	288	5.7
2013	306	5.80
2014	324	6.10
2015	340	6.20
2016	405	7.20
Mean	231	5.83

* PCa: Prostate Cancer

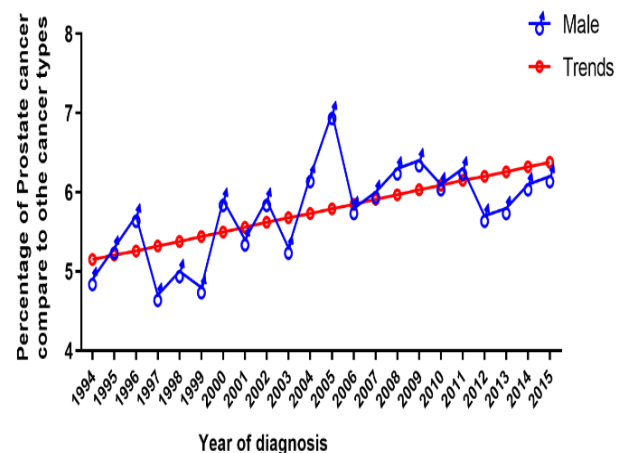


Figure 1: Steady increase in percentage curves for PCa out of all cancer types from 1994 to 2016.

ASR of PCa cases increased over the study period

The ASR increased from 4.1 per 100,000 in 1994 to 6.3 per 100,000 in 2016 (Figure 2). Despite this increase, the linear regression data demonstrates the correlation between the ASR of PCa and the year of diagnosis, with an R2 of 0.5 considered a moderate positive increase trend. The lowest ASR value recorded in 1997 was 3.1 per 100,000, with the average ASR over the study period being 4.8 per 100,000 (Figure 2).

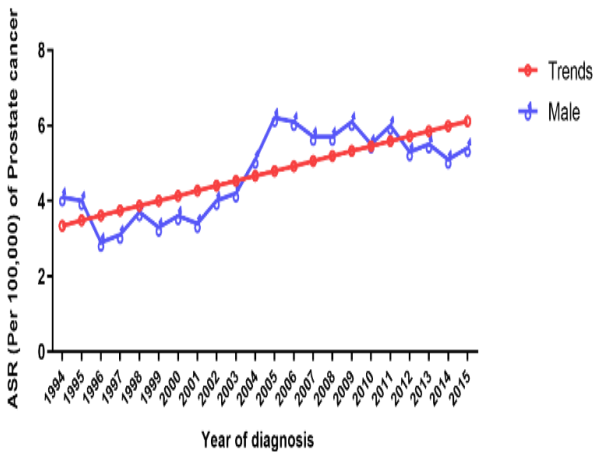


Figure 2: ASR of PCa increased over the study period. The ASR was 4.1 per 100,000 in 1994 and dropped to 0.6 per 100,000 in 2001, followed by a continued increase up to 6.3 per 100,000 in 2016.

AIR of PCa cases increased with age

Over the 23 years from 1994 to 2016, the AIR data showed a positive correlation between PCa incidence and age (Figure 3). The majority of cancer cases occurred in the older age groups, with more than 98% of PCa cases being diagnosed after the age of 50 years (Figure 3) and with a mean age at PCa diagnosis of 68 years.

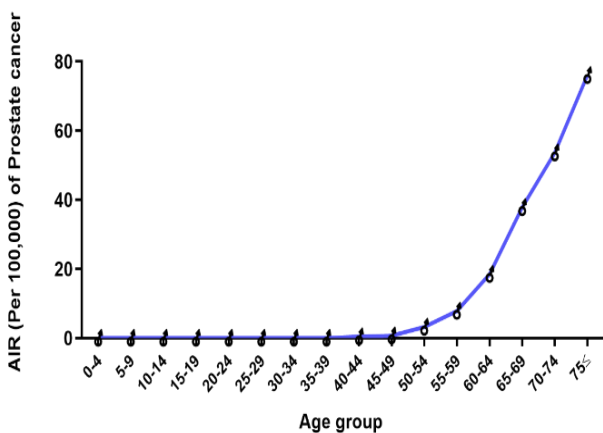


Figure 3: AIR of PCa increased with age. The total AIR of PCa increased noticeably, where more than 98% of the cases were diagnosed after the age of 50.

Eastern province and Riyadh regions recorded the highest ASRs of PCa cases

The ASR data for PCa cases demonstrated a wide variation across Saudi regions (Figure 4). The Eastern province region had the highest male ASR mean at 9.6 per 100,000, followed by Riyadh at 7.2 per 100,000. Conversely, the Jazan and Hail regions reported the lowest ASR averages of 1.8 per 100,000. Finally, the average ASR of PCa was 3.4 per 100,000 among the total Saudi population during the study period.

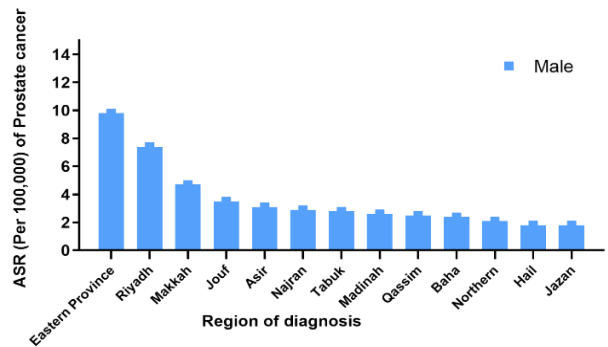
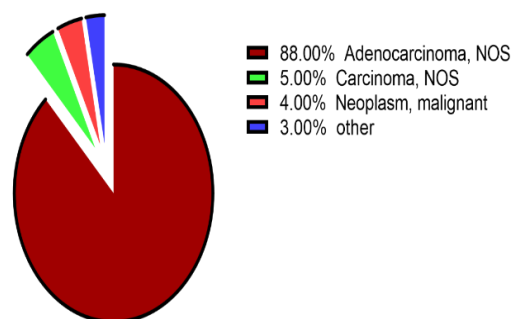


Figure 4: The ASR of PCa varies by region in Saudi Arabia. The Eastern province and Riyadh regions had the highest ASR rates, while such regions as the Jazan and Hail had the lowest.

Adenocarcinoma-NOS is the most common PCa subtype among Saudis

The proportion of histologic subtypes of PCa was calculated from the total number of cases in the 1994-2016 period (Figure 5). The most common PCa subtype was the adenocarcinoma-not otherwise specified (NOS) subtype, with the morphology code ICD-O-3-code 8140, constituting 88% of the total cases. The carcinoma-NOS subtype with morphology code ICD-O-3-code 8010 came second at 5%, while around 4% of PCa cases were of the malignant neoplasm subtype, with morphology code ICD-O-3-code 8000.



Mean Morphological Distribution of Prostate Cancer

Figure 5: Prostatic adenocarcinoma-NOS is the most common histopathology subtype among Saudis, constituting 88% of all cases.

Most diagnosed PCa cases were at the localised stage

There are many cancer staging systems, such as the tumour, node and metastasis (TNM) system and the stage grouping system. Another staging system, which called summary staging system, is used to cluster cancer cases into one of five main categories (*in situ*, localised, regional, distant, unknown). This staging system is more often used by cancer registries. Thus, SCR reports describe the PCa case distribution via the stage at diagnosis by the calendar period of diagnosis. From 1994 to 2016, the data concerning stage showed that the majority of PCa cases were diagnosed in the localised stage (36%), which was followed by the distant stage (29%). The rarest stage was the regional stage, which was diagnosed in 9% of patients. Finally, 26% of cases were diagnosed in the unknown stage (Figure 6).

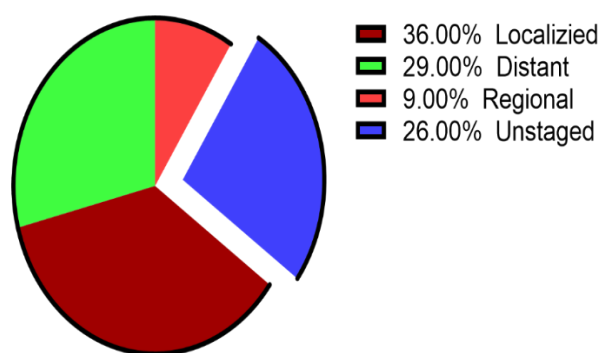


Figure 6: Stage distribution of PCa in Saudi Arabia. The majority of PCa cases are diagnosed at the localised stage.

DISCUSSION

This paper discussed the pattern of PCa over 23 years in Saudi Arabia. The strength of this study is its population-based cancer registry approach and that it covers a recent available updated data from 1994-2016. The average ASR over the study period is 4.8 per 100,000. Globally, the ASR of PCa varies across countries and populations. countries located in Oceania and North America recorded the highest ASR (79.1 and 73.7 respectively). Conversely, countries located in Africa and Asia have lowest ASR value (26.6 and 11.5 respectively) compare to developed countries. Although Saudi Arabia is one of the lowest countries with ASR value, the overall ASR trend of PCa increased from 4.1 per 100,000 in 1994 to 6.3 per 100,000 in 2016. A number of reasons can be suggested in this aspect. First, the lack of practice using the formal prostate-specific antigen (PSA) test as a screening or early detection tool in Saudi Arabia could contribute to this increase.⁷ Despite that fact that some studies have questioned the sensitivity of the PSA test in detecting PCa, many studies showed that introducing PSA screening into clinical practice contributed to reducing the incidence of PCa cases, especially those in the late and advanced stages.⁸⁻¹⁰ Moreover, the rapid growth in the socioeconomic status and macroeconomics

of Saudi Arabia could be another possible cause for the increase in the incidence of PCa over the study, as different studies have linked the incidence of PCa and economic status.^{11,12} They found that a higher socioeconomic status was associated with a higher risk of PCa. This view is supported by a clear increase in the incidence of PCa cases in the most urbanised regions in Saudia, such as the Eastern province and Riyadh regions, compared to other regions (Fig4). Life and dietary habits, easy access to medical services and increased life expectancy are the most important reasons for the high rate of diagnosed cases of PCa in these urban areas. Furthermore, the huge variances in incidence rates between men of different Saudi regions, who have overwhelmingly the same race and ethnicity, confirm the relationship between environmental factors and PCa. A study performed in the United States (US) noted an increase in the rate of PCa among immigrants from Japan and China.¹³ As with the majority of studies, these findings might have a light of a limitation. The SCR report did not contain the data of the original city in which the patient lived, as some patients from peripheral regions may have traveled to cities that contained central hospitals and then been diagnosed and calculated as residents of those central regions. This limitation may affect the accuracy of data related to the number of patients per region. Thus, it seems fair to conclude that further studies are required to draw any strong conclusions about the cause of the disparity in the incidence of PCa between Saudi regions.

Age is well thought an important prognostic factor in treatment protocol selection. This study noticed the majority of PCa patients (98%) in Saudi Arabia were diagnosed at an advanced age, above 50 years. Multiple previous studies have similarly reported a link between PCa and advanced patient age.¹⁴⁻¹⁷ In the US, 87% of new PCa cases were diagnosed in patients above the age of 65 years.¹⁸ Decreased the age of people diagnosed with PCa in the Saudi is fairly has a good induction. This is because only 9.5% of patients at age 50 are at risk of developing clinically significant cancer, with only 2.9% at risk of dying from PCa.¹⁴

Another finding of this study is that the majority of PCa cases in Saudi Arabia were diagnosed at the localised stage, which agrees with the global pattern of PCa. For instance, the majority of PCa cases in in the US and Europe were diagnosed at the localised stage.¹⁹ At this early stage, patients will realise greater benefits from the active surveillance treatment strategy, where the patient receives no treatment except close monitoring and continued follow up.²⁰⁻²¹ This is because localised PCa cells feature less proliferative activity and they do not usually metastasise.²²

The determination of the histological variants of PCa cells is important for the diagnostic recognition of cancer and therapeutic significance of the cancer treatment.²³ The findings reveal that adenocarcinoma is the major

histopathological type of PCa among Saudis (88%). This result is not surprising, because the structural cells of the prostate tissue are mostly formed by glandular cells (epithelial cells).²⁴ The prognosis of this cancer depends on the score given by the Gleason system. In this system, cancer cells will be given a score from 1 to 5 based on the level of resemblance to normal tissue.²⁵ A low score means a better prognosis rate; however, a higher score means a poor prognosis and is more likely that the cancer will grow fast and metastasis.²⁵ Including such information to the cancer registry records is necessary matter as these classification systems constitute a common language among researchers, clinicians and scientists.

CONCLUSION

In conclusion, there has been an overall increase in the incidence of PCa in Saudi Arabia. Therefore, early-detection screening programmes offered to Saudis seem a great tool to discover the disease at earlier and curable stages. It is worth noting here that these screening programmes and investigation studies should focus on men aged 50 years or older, and more in-depth studies must be conducted to explore the causes of the differences in the number of PCa cases between the populations of the various Saudi regions.

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