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Update on prostate cancer epidemiology in Morocco

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Abstract

Background Prostate cancer stands as the most frequently diagnosed cancer among men globally, with over 600,000 new cases annually. In-depth epidemiological studies play a pivotal role in delineating the unique characteristics of specific populations. This study endeavors to comprehensively document the histopathological pattern of Moroccan prostate cancer patients while assessing the extent of underdiagnosis risk within the Moroccan population.

Methods A retrospective cross-sectional study, encompassing 141 cases of prostate cancer, was conducted. Prostate cancer-confirming biopsies were executed at both the University Hospital Hassan II in Fez and the University Hospital Mohammed VI in Oujda between 2015 and 2021. Statistical analysis employed SPSS version 21 software.

Results The mean age at presentation was 72 years. Prostatic adenocarcinoma emerged as the only histopathological type observed in our patients. Clinically staged diseases (T2, T3, and T4) were manifested in 71.1% of patients. Poorly differentiated tumors (Gleason grades 8, 9, and 10) were identified in 29.2% of cases. The majority of enrolled patients exhibited an intermediate to high-risk disease state.

Conclusions Our findings underscore the significance of prostate cancer as a substantial public health burden, given the severity of this pathology and the limited accessibility to diagnosis within the population. These results substantiate the necessity for further research into the epidemiology of prostate cancer in Morocco.

Keywords Prostate cancer, Epidemiology, Registry, Screening program, Morocco

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1 Background

The 2020 GLOBOCAN data [1] underscore a notable divergence in prostate cancer (PCa) incidence rates (IR) across Africa. In Northern Africa, the IR stood at 16.6 per 100,000 in 2020, reflecting a substantial increase of 6 per 100,000 compared to GLOBOCAN 2012. Conversely, Southern Africa recorded a significantly higher rate of 65.9 per 100,000.

In Morocco, PCa ranks as the most frequently diagnosed cancer and the second leading cause of cancer-related deaths in men, second only to lung cancer [2, 3]. Over the last decade, there has been a discernible rise in PCa cases [3], with an IR surpassing 350 per 100,000 annually among individuals aged over 65 years [3].

According to the cancer registry of Casablanca, PCa constitutes 12.4% of all cancer cases [3], with adenocarcinomas representing more than 99%, as reported by the Cancer Registry of Rabat [2].

Despite the escalating incidence of PCa, there exists a scarcity of information regarding the factors influencing its development in the Moroccan population. Recognized risk factors encompass age, family history, and obesity [4]. Moreover, numerous studies highlight the pivotal role of genetic alterations as significant risk factors across all PCa types [5].

Comprehensive and precise data on PCa patients, coupled with robust genetic investigations, are imperative for gaining profound insights into the etiology of the disease. Such data play a pivotal role in enhancing diagnostics and facilitating decision making in the management and treatment of PCa. This study's primary objective is to delineate the histopathological pattern of PCa precisely at the moment of diagnosis, with a specific focus on two central cities in Northeast Morocco, Fez, and Oujda.

2 Methods

The study focused on patients hailing from two major regions in Morocco, namely the Fez-Meknes and Oujda-Angad regions, who were under the care of the Hassan II University Hospital in Fez (CHU Fez) and the Mohammed VI University Hospital in Oujda (CHU Oujda). These hospitals stand as two of the country's five university hospitals.

A total of 141 prostate cancer (PCa) biopsies, supported by histopathology results confirming the PCa diagnosis, were meticulously gathered—90 from CHU Fez and 51 from CHU Oujda—during the period spanning 2015 to 2021. Cases of benign prostate hyperplasia (BPH) were excluded from the study. Thorough scrutiny of the medical records of each patient was conducted to compile clinical characteristics, laboratory findings, and pathological reports. Several key aspects were investigated, including age, symptoms, histologic type, treatment modality, and tumor stage. Tumor staging was categorized according to the American Joint Committee on Staging (AJCC) system, encompassing T1 (non-palpable tumor), T2 (tumor confined within the prostate), T3 (tumor extension through the prostatic capsule), and T4 (tumor invading peri-prostatic tissue other than the seminal vesicles) [6]. Additionally, the Gleason score was recorded, classified as Gleason 6 (3+3), Gleason 7 (4+3 and 3+4), Gleason 8 (4+4), Gleason 9 (4+5 and 5+4), or Gleason 10 (5+5). Patients were further categorized into three clinical groups: metastatic disease, locally advanced disease, and organ-confined disease.

In our review of medical records, we explored the correlation between age and healthcare insurance and its potential impact on diagnostic delays. Two subgroup analyses were conducted: one comparing PCa patients under 70 years old to those over 70 years old and the other analyzing patients with two distinct types of healthcare insurance—RAMED type-insurance (Ramedists) and conventional Mutual Insurance (Mutualists).

Data analysis was executed using the Statistical Package for the Social Sciences (SPSS) software, version 21. Descriptive analyses of patients' clinical characteristics were performed, and inferential statistics were generated. Two subgroup analyses were conducted. The first subgroup compared patients under and over 70 years old to ascertain whether delayed presentation was associated with advanced disease at the time of diagnosis. The second subgroup comprised patients with Mutual healthcare Insurance and those with RAMED healthcare Insurance. The Wilcoxon rank-sum test was employed to assess differences for continuous variables based on dichotomous age classification for the first subgroup, and the Pearson Chi-square ($\chi 2$) test and Fisher's exact test were utilized to evaluate associations between categorized variables in the second subgroup.

3 Results

In the current study, a total of 141 Moroccan PCa patients participated. The mean age at presentation was 72 (standard deviation [SD] = 8, range: 52–91) (Table 1). The median PSA level at presentation was 34 ng/ml (interquartile range [IQR] = 12-160). Clinically staged (T2, T3, and T4) disease was present in 71.1% of patients, with 54.4% of patients at the T2c stage (tumor involves both sides). The detailed distribution of PCa patients across clinical stages is presented in Table 1. Gleason grades were available for 106 PCa patients, revealing that 29.2% had poorly differentiated tumors (Gleason grades 8, 9, and 10) (Table 1). Additionally, a high proportion (98.3%, $n = 56$) of patients were active smokers. Healthcare insurance analysis indicated that 87.5% of patients had RAMED coverage, while only 12.5% were covered by Mutual insurance. The prevalence of PCa in the two university hospitals from 2015 to 2021 is depicted in Fig. 1.

Descriptive analysis highlighted that all PCa cases were adenocarcinomas. Common symptoms included dysuria (58.5%), pollakiuria (37.5%), and hematuria (4%) (Fig. 2A). Treatment primarily involved hormonal therapy (47.7%), followed by radical prostatectomy (41.1%), with radiotherapy and chemotherapy applied in 10.6% and 8.2% of cases, respectively. Transurethral resection of the prostate was less frequent (Fig. 2B).

Table 1 Clinical and pathological characteristics of Moroccan PCa patients' study

	Non-missing observations	Mean (SD)	Median (IQR)	Range	Frequency
Age	141	72(8)	72(67–78)	52–91	–
Age group		–	–	–	
< 70 years	141	–	–	–	52(36.9)
> 70 years		–	–	–	89(63.1)
PSA (ng/ml)	113	414 (1432)	34(12–160)		–
T stage (detailed)					
cT1a		–	–	–	–
cT1c		–	–	–	30(29.1)
cT2a		–	–	–	3(2.9)
cT2b	103	–	–	–	8(7.8)
cT2c		–	–	–	56(54.4)
cT3a		–	–	–	3(2.9)
cT3b		–	–	–	1(1.0)
cT4b		–	–	–	2(1.9)
T stage (broad)					
T1		–	–	–	30(28.8)
T2	104	–	–	–	68(65.4)
T3		–	–	–	4(3.8)
T4		–	–	–	2(1.9)
Gleason score					
5		–	–	–	4(3.8)
6		–	–	–	27(25.5)
7	106	–	–	–	44(41.5)
8		–	–	–	21(19.8)
9		–	–	–	8(7.5)
10		–	–	–	2(1.9)
Smoking					
Yes	57	–	–	–	56(98.2)
No					1(1.8)
Type of Healthcare Insurance					
Ramedist	72	–	–	–	63(87.5)
Mutualist					9(12.5)

IQR: Interquartile range, PSA; prostate-specific antigen; T1a: tumor incidental histologic finding in 5% or less of tissue resected; T1b: tumor incidental histologic finding in more than 5% of tissue resected; T1c: tumor identified by needle biopsy found in one or both sides, but not palpable; T2a: tumor involving one-half of one side or less; T2b: tumor involving more than one-half of one side but not both sides; T2c: tumor involving both sides; T3a: Extraprostatic extension (unilateral or bilateral); T3b: tumor invading seminal vesicle(s)

The first subgroup analysis, comparing PCa patients under 70 years to those over 70 years, suggested that patients in both groups presented with an advanced disease state (Table 2). The median PSA was lower in the younger group [21.98 ng/ml; IQR = 11–186] compared to the older group [39.35 ng/ml; IQR = 15–152]. Although individuals above 70 years old had a higher frequency of "PSA ≥ 100 ng/ml" than those under 70 years (20.8% versus 10.8%), these differences were not statistically significant (p value > 0.05) (Table 2).

The second subgroup analysis, comparing Ramedists to Mutualists, suggested that patients in the RAMED group were likely to present with advanced disease (Table 2). The median PSA was lower in the Ramedist group [21 ng/ml (IQR = 13–155)] compared to the Mutualist group [39.40 ng/ml (IQR = 10–100)], but this difference was not significant (p value = 0.446). Ramedists had a higher frequency of PSA ≥ 100 ng/ml than Mutualists (26.6% versus 3.1%), but again, these differences were not statistically significant (p value = 0.756). The clinical stratification of Ramedists versus Mutualists showed no significant differences (p value > 0.05) (Table 2).

While these findings lacked statistical significance, they hold clinical relevance as patients presented with advanced disease regardless of age or healthcare insurance type. The percentage of diagnosed PCa patients significantly decreased in 2020 and 2021, with reductions of 4.5% and 2.7%, respectively, compared to previous years due to the COVID-19 pandemic (Fig. 3).

4 Discussion

Similar to trends observed globally, North African countries, including Morocco, have witnessed a consistent increase in PCa incidence over the past decade. In 2019, North Africa reported an average rate of 11,800 PCa cases per 100,000 population, resulting in 5,100 deaths. Specifically, Morocco recorded an incidence of 3990 cases with a mortality rate of 1861 [7, 8]. The country has actively pursued extensive epidemiological studies facilitated by cancer registries in Rabat and Casablanca. Recently, a regional cancer hospital registry covering the Fez-Meknes region has been established, adding valuable data to the understanding of PCa epidemiology [9].

This study aims to contribute to the national epidemiological data on PCa in Morocco, focusing on the histopathological pattern. The dataset, collected from the regions of Fez and Oujda, fills a gap in areas that lacked a dedicated cancer registry until recently. Risk factors for PCa, including diet, age, smoking, ethnicity, and genetics, have been extensively explored globally. In alignment with the Casablanca registry's findings, our study revealed that PCa predominantly affects individuals above 50 years old, with no cases detected in those under 40 years [3]. The mean age of PCa presentation in our study was higher than in other African populations [10]. Adenocarcinomas accounted for over 80% of PCa histologic types, consistent with the global prevalence [11, 12].

While prostatic adenocarcinoma was the predominant type in our study, the prevalence of advanced disease in our population was lower compared to South Africa and Nigeria [13, 14]. Factors contributing to the high-risk disease in Moroccan patients include delayed diagnosis, absence of a PCa screening program, and the impact

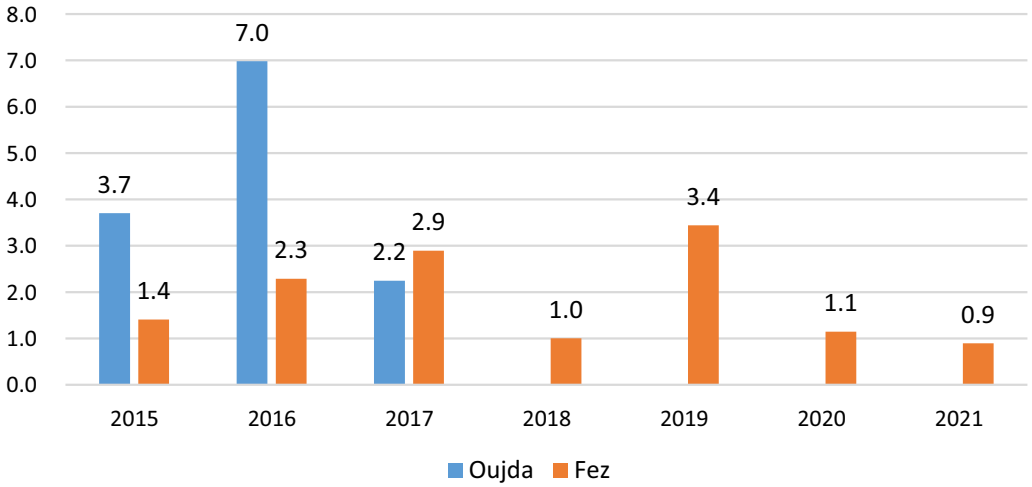

Fig. 1 Prevalence of PCa in Oujda and Fez

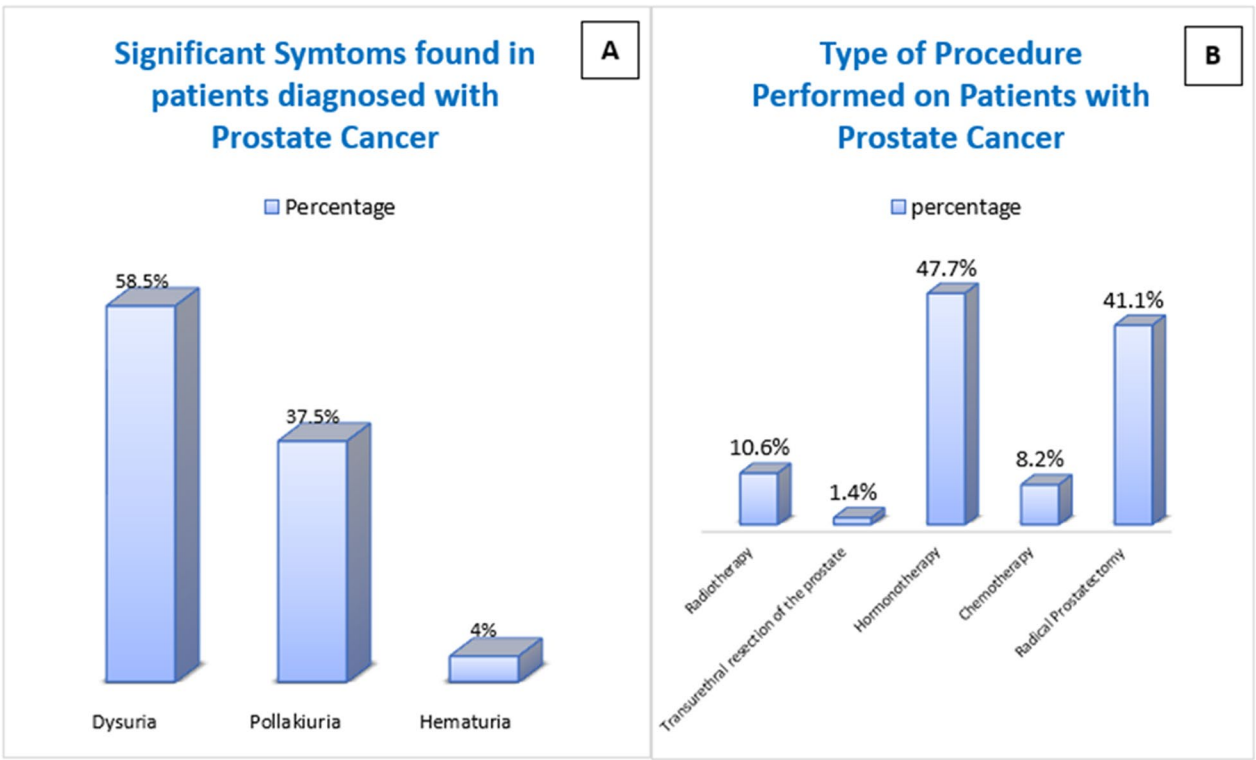

Fig. 2 Clinical characteristics of PCa patients

of low socioeconomic status. Studies have shown that health insurance coverage can significantly influence cancer stage at diagnosis and post-treatment quality of life [15]. This is particularly relevant in regions with limited access to health care, as observed in many African populations, especially in poor rural communities [14].

Subgroup analyses were conducted to explore potential contributors to advanced disease. Patients older than 70 years presented with higher PSA levels and clinically advanced disease, mirroring the findings in the overall cohort. A subgroup analysis based on healthcare insurance type revealed no significant differences in clinical

Table 2 Comparison of clinical and pathological characteristics by age group and by healthcare insurance type

Variable	Age group		*p* value	Type of healthcare Insurance		*p* value
	< 70	**> 70**		**RAMED**	**Mutual**	
PSA (ng/ml):						
Non-missing observations	41	72	0.393 ‡	55	7	0.446 ‡
Median (IQR)	21.98 (11–186)	39.35 (15–152)		21 (13–155)	39.40 (10–100)	
PSA category: n (%)						
< 100	33(27.5%)	49(40.8%)	0.335*	39(60.9%)	6(9.4%)	0.756†
> 100	13(10.8%)	25(20.8%)		17(26.6%)	2(3.1%)	
T stage (broad): n (%)						
T1	11(10.6%)	19(18.3%)	0.945†	16(27.6%)	1(1.7%)	0.793†
T2	27(26%)	41(39.4%)		33(56.9%)	5(8.6%)	
T3	2(1.9%)	2(1.9%)		2(3.4%)	0(0.0%)	
T4	1(1%)	1(1%)		1(1.7%)	0(0.0%)	
Metastatic: n (%)						
Yes	13(9.8%)	26(19.7%)	0.558*	17(24.6%)	2(2.9%)	0.864†
No	37(28%)	56(42.4%)		44(63.8%)	6(8.7%)	
High risk n (%)						
Yes	11(8.3%)	24(18.2%)	0.286*	14(20.3%)	3(4.3%)	0.397*
No	39(29.5%)	58(43.9%)		47(68.1%)	5(7.2%)	
Metastatic /	13(9.9%)	26(19.8%)	0.370†	17(24.6%)	2(2.9%)	0.896†
PSA > 100 ng/ml						
Locally	1(0.8%)	2(1.5%)		2(2.9%)	0(0.0%)	
Advanced						
Organ confined, high risk	11(8.4%)	24(18.3%)		14(20.3%)	3(4.3%)	
Organ confined, intermediate risk	14(10.7%)	21(16%)		21(30.4%)	2(2.9%)	
Organ confined,	11(8.4%)	8(6.1%)		7(10.1%)	1(1.4%)	

* Fishers exact test

† Pearson chi-square ($\chi 2$) test

‡ Wilcoxon rank-sum test

characteristics. Younger patients and those with RAMED insurance still presented with intermediate and high-risk disease, emphasizing the influence of socioeconomic factors on disease progression.

Despite these clinically relevant findings, the study has limitations, including missing health information and a relatively small sample size. Further comprehensive data collection is warranted to offer a complete overview of Moroccan PCa epidemiology. Data from two institutions may not fully represent the entire country, but it sheds light on the low incidence and late presentation of PCa in Morocco.

In summary, this study provides insights into the histopathological pattern of PCa in Morocco. The COVID-19 pandemic has further impacted PCa diagnosis, with a significant decrease in cases in 2020 and 2021. These findings underscore the need for an extensive epidemiological study to comprehensively understand PCa presentation in the Moroccan population and the challenges posed by external factors such as the ongoing pandemic.

5 Conclusions

This study illuminates a concerning trend among Moroccan men diagnosed with PCa, wherein delayed diagnosis and the prevalence of intermediate to high-grade disease are prevalent despite early age of diagnosis or specific health insurance coverage. These findings underscore the critical need for additional research and the implementation of routine screening protocols to detect PCa at an earlier, more manageable stage. Early detection through screening is pivotal for improving PCa outcomes and survival rates, making it an essential strategy for PCa control in the population.

To address this challenge effectively, there is a compelling call for increased public awareness about PCa.

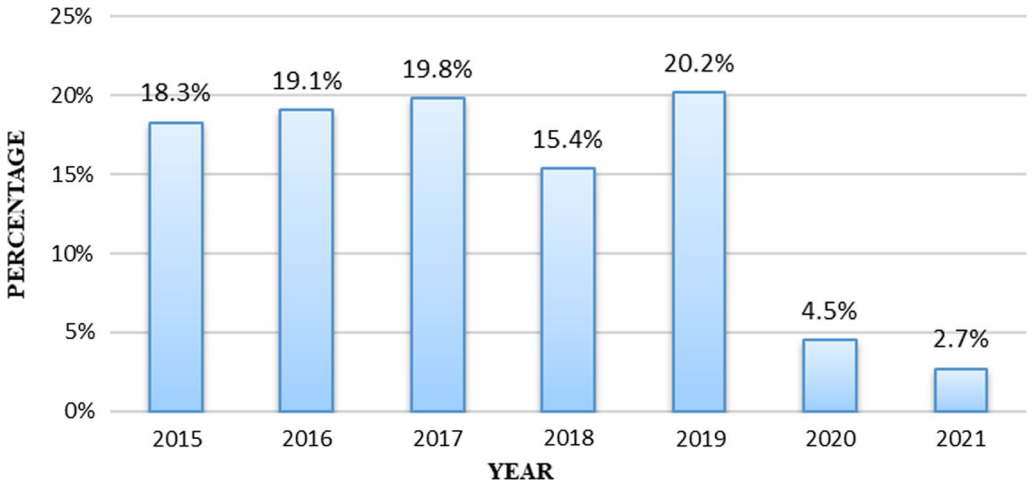

Fig. 3 Percentage of diagnosed PCa patients in Fez area from 2015 to 2021

Empowering men to recognize early symptoms and seek medical assistance before the disease advances is crucial. Presently, only two population-based cancer registries operate in Morocco, providing limited coverage. Urgently needed, akin to many African countries, is the establishment of a comprehensive national registry that spans the entire Moroccan population. Such an initiative would significantly improve data quality, allowing for a more nuanced understanding of PCa characteristics among Moroccan men. Moreover, it would serve as a valuable tool to enhance healthcare outcomes for PCa patients in the country.

In conclusion, the findings from this study emphasize the imperative of proactive measures, such as routine screening and a national cancer registry, to address the challenges posed by delayed diagnosis and the prevalence of advanced-stage disease. By bolstering public awareness and improving the infrastructure for cancer data collection, Morocco can take decisive steps toward better managing and ultimately reducing the impact of prostate cancer on its male population.

Abbreviations

PCa	Prostate cancer
IQR	Interquartile range
PSA	Prostate-specific antigen
BPH	Benign prostatic hyperplasia
IR	Incidence Rates

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Author contributions
CS wrote, conceived, analyzed, and reviewed the writing of the manuscript. HB; HG; and KO conceived, supervised, and reviewed the writing of the manuscript. NI and LB revised it critically for important intellectual content. MB and KR performed the analysis and interpretation of data. MM; HF; and BM collected the data. All authors read and approved the final manuscript.

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Availability of data and materials
The raw dataset generated during the current study is not publicly available due to identifiable patient information but are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This is a retrospective study of patients' files and did not involve patients. This study was approved by the "Ethics Committee University-Hospital Fez" and the methods were carried out in accordance with the approved guidelines and the Declaration of Helsinki version 2008, concerning good practices, the European directive (ref: 2001/20/CE) and the decision of the Minister of Health N 02/DRC/00 of 03/12/2012, relating to biomedical research. The ID of the study is N 25/16. The Ethics Committee Hospital-University Fez approved the use of the clinical information of previously registered patients in the registries. The retrospective study was approved by the Ethics Committee University-Hospital Fez and does not require informed consent as patients received normal standard of care treatment.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no conflict of interest.

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