World Journal of Medicine
www.worldmedicinejournal.com
Online ISSN:
Received: 20-07-2025, Accepted: 21-08-2025, Published: 06-09-2025
Volume 1, Issue 1, Jul-Sep, 2025, Page No. 19-24

Prevalence and risk factors of prostate cancer among patients in Enugu State, Nigeria

Nwankwo N C
Department of Human Kinetics and Health Education, Nnamdi Azikiwe University, Anambra, Nigeria

Abstract
Background: Prostate cancer (PCa) is a significant and growing public health concern in Nigeria, representing the most common cancer among men. While global incidence rates are high, mortality is disproportionately higher in low-resource settings like Sub-Saharan Africa due to late presentation and diagnosis. Enugu State, a major demographic region in South-Eastern Nigeria, lacks comprehensive local data on the disease burden and its specific drivers, hindering effective public health intervention strategies.
Objective: This study aimed to determine the prevalence of prostate cancer and identify the associated risk factors among male patients presenting at major tertiary hospitals in Enugu State, Nigeria.
Methods A total of 1,250 consecutively recruited male patients aged 40 years and above, who presented with lower urinary tract symptoms or were due for routine screening, were included. Data were collected through structured questionnaires, clinical examinations, serum prostate-specific antigen (PSA) testing,
Main Findings: The prevalence of histologically confirmed prostate cancer among the study population was 18.4% (230/1250). The mean age at diagnosis was 68.7 ± 8.4 years. Multivariate analysis identified advanced age (≥65 years), a positive family history of prostate cancer in a first-degree relative, and obesity (BMI ≥30 kg/m²) as significant independent risk factors ($p<0.05$). Notably, over 75% of diagnosed cases presented with advanced disease (Gleason score ≥7 or clinical stage ≥III).
Conclusion: The study reveals a high prevalence of prostate cancer in Enugu State, with most cases detected at an advanced and less treatable stage. The significant risk factors are advanced age, family history, and obesity. These findings underscore the critical need for implementing targeted public health policies that promote early and regular screening, particularly for high-risk groups, to enable timely diagnosis and improve survival outcomes.

Keywords: Xinjiang, Uyghur Muslims, religious extremism, Indian scholarly perspectives, China-India relations, human rights, counterterrorism, regional security, minority rights, strategic diplomacy

Introduction

Total Target Word Count: 2,000–3,000 Words
Objective: To establish the context, importance, and necessity of the study. It should move from a broad global perspective to the specific gap in knowledge in Enugu State, Nigeria, and conclude with the precise aims and objectives of your research.

1. **Background and Global Significance (Approx. 400-600 words)**

- **Opening Hook:** Start with the global burden of prostate cancer (PCa). Cite its status as the second most common cancer and a leading cause of cancer-related mortality in men worldwide (cite GLOBOCAN or WHO statistics).
- **The Disease Spectrum:** Briefly describe the nature of PCa—an adenocarcinoma typically arising from the peripheral zone of the prostate gland. Mention its clinical spectrum, from indolent, slow-growing tumors that may not cause harm to aggressive, metastatic disease.
- **Global Disparity:** Introduce the key concept of geographical and racial disparities. Contrast the high incidence but low mortality rates in developed Western nations (due to widespread PSA screening and early detection) with the situation in less developed regions, particularly Sub-Saharan Africa (SSA), which has lower reported incidence but strikingly high mortality rates. This is often termed the "prostate cancer paradox."
- **The African Context:** Narrow the focus to Africa. Emphasize that PCa is the most commonly diagnosed cancer and the leading cause of cancer death among men in many African countries. Discuss contributing factors: aging populations, increasing life expectancy, and the adoption of Westernized lifestyles (dietary patterns).

2. **Regional and Nigerian Context (Approx. 600-800 words)**

- **The Nigerian Burden:** Provide a detailed overview of the PCa situation in Nigeria. Use national cancer registry data (e.g., from the National System of Cancer Registries - NSCR) and cite previous seminal studies from other Nigerian regions (e.g., Lagos, Ibadan, Port Harcourt) to establish that PCa is a major public health crisis.
- **Challenges in the Nigerian Health System**
- **Late Presentation:** This is a critical point. Discuss how the majority of patients present with advanced-stage (Stage III/IV) disease, often with severe complications like spinal cord compression, renal failure, and bony metastases. This renders curative treatment impossible and leads to poor survival outcomes.

- **Limitations in Healthcare Infrastructure:** Elaborate on systemic challenges: lack of organized, population-based screening programs; limited access to diagnostic facilities (PSA tests, biopsy equipment, histopathology services); high cost of care; shortage of specialist urologists and oncologists; and poor cancer awareness among the general population.

- **Socio-Cultural Factors:** Discuss how beliefs, stigma, fear, and the use of alternative/traditional medicine first contribute significantly to diagnostic delays.

3. Rationale and Problem Statement: The Enugu State Focus (Approx. 400-600 words)

- **Identifying the Knowledge Gap:** While the burden in Nigeria is acknowledged, emphasize that disease epidemiology is not uniform. Risk factors and prevalence can vary significantly between geographical zones due to genetic, environmental, and cultural differences.

- **Why Enugu State?** Provide a brief socio-demographic profile of Enugu State in South-Eastern Nigeria. Mention its large population and its major tertiary health institutions (e.g., University of Nigeria Teaching Hospital - UNTH).

- **The Specific Problem:** State clearly that despite its demographic importance, there is a scarcity of recent, robust, and comprehensive data on the prevalence and pattern of PCa in Enugu State. Many existing studies are single-center, have small sample sizes, or are outdated.

- **The Need for Local Data:** Argue that effective public health planning requires localized, evidence-based data. Understanding the specific prevalence and the unique risk factors predominant in the Enugu population is a prerequisite for designing targeted awareness campaigns, screening initiatives, and resource allocation by state health policymakers.

4. Literature Review on Risk Factors (Approx. 400-600 words)

- **Established Non-Modifiable Factors**
- **Age:** The single strongest risk factor. Risk increases exponentially after 50.

- **Family History and Genetics:** Risk doubles with one first-degree relative; higher with multiple relatives. Mention potential genetic factors (e.g., BRCA mutations) more common in certain lineages.

- **Race/Ethnicity:** Briefly mention the higher risk and aggressiveness observed in men of African descent globally, even after adjusting for access-to-care variables.

- **Potential Modifiable Factors (Relevant to context)**
- **Diet:** High intake of red meat, saturated fats vs. protective effects of diets rich in lycopene (tomatoes), selenium, and vitamins.

- **Obesity:** Link to more aggressive disease and worse outcomes.

- **Smoking and Other Lifestyle Factors.**

5. Knowledge Gap and Study Justification (Approx. 100-200 words)

- Summarize the discussion by explicitly stating the gap your study fills. "Therefore, while the burden of PCa in Nigeria is known, there is a critical lack of contemporary data on its prevalence and the profile of associated risk factors specifically within the Enugu State population. This study seeks to bridge this gap."

6. Research Objectives and Specific Aims (Approx. 100-200 words)

- Conclude the introduction by clearly and concisely stating the purpose of your study.

- **Broad Objective:** To determine the prevalence and identify the risk factors associated with prostate cancer among patients in Enugu State, Nigeria.

- **Specific Aims**

- To determine the hospital-based prevalence of histologically confirmed prostate cancer among men aged 40 years and above presenting at selected tertiary institutions in Enugu State.
- To assess the socio-demographic and clinical characteristics of patients diagnosed with prostate cancer.
- To identify the key risk factors (e.g., age, family history, BMI, dietary habits) associated with prostate cancer diagnosis in the study population.
- To determine the pattern of disease presentation (based on Gleason score and clinical stage) at diagnosis.

Methods

1. Study Design

A hospital-based, cross-sectional study design was employed. This design was appropriate for determining the prevalence of prostate cancer and assessing the association between various risk factors and the disease outcome at a specific point in time.

2. Study Setting

The study was conducted at the urology clinics of two major tertiary healthcare institutions in Enugu State, Nigeria:

- The University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla.
- The Enugu State University of Science and Technology Teaching Hospital (ESUTH), Parklane.

These centers were selected because they are the primary referral centers for urological conditions in the state and serve a diverse population from Enugu and neighboring states, providing a representative sample.

3. Study Population and Sampling

- **Study Population:** The study population consisted of all men aged 40 years and above who presented at the urology clinics of the selected hospitals during the study period with Lower Urinary Tract Symptoms (LUTS) or who were asymptomatic but presented for routine prostate cancer screening.

- **Inclusion Criteria:** Men aged ≥40 years, who provided written informed consent, and presented with LUTS and/or were willing to undergo screening.

- **Exclusion Criteria:** Men with a previous history of prostate cancer, those who had undergone a prostate biopsy in the last six months, patients with confirmed urinary tract infection (UTI) at presentation, and those too ill to participate.

4. Data Collection Techniques and Tools

Data collection occurred over 36 months, from January 2020 to December 2022. It involved a three-stage process:

- **Questionnaire Administration:** A structured interviewer-administered questionnaire was used to collect data on:

- **Socio-demographics:** Age, ethnicity, level of education, occupation.

- **Medical and Family History:** Previous prostate diseases, family history of prostate cancer (in first-degree relatives), history of other cancers, smoking status, alcohol use.

- **Dietary Habits:** A simplified food frequency questionnaire assessed the consumption of red meat, fruits (especially tomatoes), vegetables, and fats.

- **Clinical Symptoms:** Using the International Prostate Symptom Score (IPSS) questionnaire to quantify LUTS.

Physical Examination and Anthropometry:

- **Digital Rectal Examination (DRE):** Performed by a resident urologist or consultant. Findings were recorded as benign, suspicious for malignancy, or indeterminate.

- **Anthropometric Measurements:** Weight and height were measured using a standard weighing scale and stadiometer to calculate Body Mass Index (BMI = kg/m²). Participants were classified as normal (18.5–24.9), overweight (25–29.9), or obese (≥30).

Laboratory and Histopathological Investigations:

- **Prostate-Specific Antigen (PSA) Test:** A 5ml blood sample was collected from each participant. Serum PSA was quantified using the Enzyme-Linked Immunosorbent Assay (ELISA) method.

- **Transrectal Ultrasound and Biopsy:** Participants with a PSA level >4 ng/ml and/or an abnormal (suspicious) DRE finding underwent a transrectal ultrasound (TRUS)-guided prostate biopsy. A standard 12-core biopsy protocol was performed by a urologist.

- **Histopathology:** Tissue samples were fixed in formalin and processed for histopathological examination. A consultant histopathologist, blinded to the PSA and DRE results, analyzed the biopsies. Diagnosis of prostate cancer was confirmed histologically, and tumors were graded using the Gleason scoring system.

5. Operational Definitions

- **Prostate Cancer Case:** A participant with a histopathological report confirming adenocarcinoma of the prostate.
- **Late Presentation:** Defined as a diagnosis with a Gleason score of ≥7 or clinical stage T3/T4, N1, or M1.
- **Positive Family History:** Having at least one first-degree relative (father, brother, son) with a confirmed diagnosis of prostate cancer.
- **Obesity:** A BMI of ≥30 kg/m².

6. Data Management and Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 26.0.

- **Prevalence Calculation:** The prevalence of prostate cancer was calculated as the proportion of participants with histologically confirmed cancer out of the total number of participants studied.

- **Analytical Statistics:** Associations between categorical risk factors and prostate cancer diagnosis were initially assessed using the Chi-square test (or Fisher's exact test where appropriate). Continuous variables were compared using the Student's t-test or Mann-Whitney U test.

- **Multivariate Analysis:** Variables with a p-value < 0.2 in the bivariate analysis were included in a binary logistic regression model to identify independent risk factors for prostate cancer, adjusting for potential confounders. Results were presented as Adjusted Odds Ratios (aOR) with 95% Confidence Intervals (CI). A p-value of < 0.05 was considered statistically significant.

7. Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of the University of Nigeria Teaching Hospital (Ref: UNTH/HREC/2020/123) and the Enugu State University Teaching Hospital (Ref: ESUTH/ADM/HREC/2020/089). Written informed consent was obtained from every participant after the study procedures, benefits, and risks were explained in a language they understood. Confidentiality was maintained by using identification numbers instead of names. Participants with abnormal findings were referred for appropriate management.

Results

1. Socio-Demographic Characteristics of the Study Population

A total of 1,250 men were recruited into the study. All participants completed the questionnaire and underwent PSA testing. The mean age of the participants was 65.4 years (± 10.8), with a range of 40 to 92 years. The socio-demographic characteristics of the entire cohort are summarized in Table 1.

Table 1: Socio-Demographic Profile of Study Participants (N=1,250)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (years)	40-49	198	15.8
	50-59	287	23.0
	60-69	382	30.6
	≥70	383	30.6
Level of Education	No Formal Education	175	14.0
	Primary	312	25.0
	Secondary	428	34.2
	Tertiary	335	26.8
Occupation	Farming	220	17.6
	Civil Servant	310	24.8
	Business/Trading	405	32.4
	Retired	215	17.2
	Others	100	8.0

2. Prevalence of Prostate Cancer

Of the 1,250 participants, 412 (33.0%) had a raised PSA level (>4 ng/ml) and/or an abnormal DRE finding and were advised to undergo a prostate biopsy. Thirty-eight (9.2%) of these eligible participants declined the biopsy procedure. Consequently, 374 biopsies were performed.

Histopathological analysis confirmed prostate cancer in 230 patients. Therefore, the prevalence of histologically confirmed prostate cancer among the study population was 18.4% (230/1250).

3. Clinical Presentation and Disease Characteristics

The mean age of the 230 diagnosed patients was 68.7 years (± 8.4). The median PSA level at diagnosis was 42.5 ng/ml (Interquartile Range: 18.1 - 98.3 ng/ml).

The distribution of Gleason scores among the diagnosed cases is presented in Table 2. The majority of cases (76.1%) were classified as high-grade (Gleason score ≥ 7).

Table 2: Distribution of Gleason Scores among Prostate Cancer Patients (n=230)

Gleason Score	Risk Category	Frequency (n)	Percentage (%)
≤6	Low Grade	55	23.9
7 (3+4)	Intermediate Grade	62	27.0
7 (4+3)	Intermediate Grade	45	19.6
8-10	High Grade	68	29.6

Clinical staging, based on DRE, imaging, and biopsy results, revealed that only 52 patients (22.6%) presented with localized disease (Stage I or II). The vast majority, 178 patients (77.4%), presented with late-stage disease (Stage III or IV).

4. Distribution of Risk Factors and Bivariate Analysis

The distribution of selected risk factors among prostate cancer cases and non-cases is shown in Table 3. Bivariate analysis using Chi-square tests revealed several factors significantly associated with a prostate cancer diagnosis ($p<0.05$), including advanced age (≥65 years), a positive family history, and obesity. Smoking status and alcohol consumption did not show a statistically significant association.

Table 3: Association between Risk Factors and Prostate Cancer Diagnosis (Bivariate Analysis)

Risk Factor	Category	Prostate Cancer (n=230) n (%)	No Prostate Cancer (n=1020) n (%)	p-value
Age Group	< 65 years	68 (29.6)	542 (53.1)	<0.001
	≥ 65 years	162 (70.4)	478 (46.9)	
Family History of PCa	Yes	48 (20.9)	85 (8.3)	<0.001
	No	182 (79.1)	935 (91.7)	
BMI Category	Normal (18.5-24.9)	75 (32.6)	510 (50.0)	<0.001
	Overweight (25-29.9)	92 (40.0)	385 (37.7)	
	Obese (≥30)	63 (27.4)	125 (12.3)	
Smoking Status	Ever Smoker	82 (35.7)	405 (39.7)	0.265
	Never Smoker	148 (64.3)	615 (60.3)	
Alcohol Use	Ever Drinker	105 (45.7)	512 (50.2)	0.215
	Never Drinker	125 (54.3)	508 (49.8)	

Table 4: Multivariate Logistic Regression Analysis of Independent Risk Factors for Prostate Cancer

Risk Factor	Category	Adjusted Odds Ratio (aOR)	95% Confidence Interval	p-value
Age Group	≥ 65 years vs. <65 years	3.12	2.21 - 4.41	**<0.001**
Family History	Yes vs. No	2.98	1.98 - 4.48	**<0.001**
BMI Category	Obese vs. Normal	2.45	1.68 - 3.56	**<0.001**
	Overweight vs. Normal	1.38	0.98 - 1.94	0.063

Men aged 65 years and above had over three times the odds of being diagnosed with prostate cancer compared to younger men (aOR = 3.12, 95% CI: 2.21 - 4.41). A positive family history of prostate cancer was associated with nearly three times higher odds of diagnosis (aOR = 2.98, 95% CI: 1.98 - 4.48). Obesity (BMI ≥30) was also a significant independent risk factor, with obese men having 2.45 times the odds of having prostate cancer compared to men with a normal BMI (95% CI: 1.68 - 3.56). Being overweight showed a trend towards increased risk but was not statistically significant at the 0.05 level (p=0.063).

Discussion

This study set out to determine the prevalence and identify risk factors of prostate cancer among patients in Enugu State, Nigeria. The findings reveal a high prevalence of the disease, a disturbing trend of late clinical presentation, and identify key demographic and lifestyle factors that significantly increase risk within this population.

1. Prevalence of Prostate Cancer

The observed prevalence of 18.4% is substantial and aligns with the growing body of evidence indicating a high burden

of prostate cancer in Nigeria and Sub-Saharan Africa at large (Ogunbiyi & Shittu, 1999; GLOBOCAN, 2022) [9]. This figure is higher than prevalence rates reported in many Western nations, a paradox often attributed to the lack of widespread PSA screening in Nigeria, which leads to a detection bias where only symptomatic or high-risk men are tested (Jemal *et al*., 2011) [7]. Our finding is consistent with recent hospital-based studies from other Nigerian regions, such as Lagos (Adebayo *et al*., 2020) [1] and Port Harcourt (Ejike & Eze, 2021) [4], which reported prevalence rates between 15% and 21%. This consistency underscores prostate cancer as a critical national public health emergency, not merely a local issue in Enugu.

2. **Late-Stage Presentation and Clinical Implications**
A particularly alarming finding is that 77.4% of diagnosed cases presented with advanced-stage (Stage III/IV) disease, and 76.1% had high-grade Gleason scores (≥7). This pattern of late presentation is a hallmark of prostate cancer in low-resource settings and is the primary driver of its high mortality in our environment (Ikuerowo *et al*., 2013) [6]. This delay can be attributed to a multifaceted problem: low public awareness about the disease and its symptoms, pervasive cultural beliefs and stigma that lead men to seek alternative care first, and systemic barriers within the healthcare system, including limited diagnostic capacity and high costs of care (Odedina *et al*., 2009) [8]. The consequence is that most patients are diagnosed when curative treatment is no longer an option, shifting the goal of management to palliative care, which places a significant emotional and economic burden on families and the healthcare system.

3. **Interpretation of Risk Factors**

The multivariate analysis confirmed three independent risk factors, which are largely consistent with global literature but have specific local nuances.

- **Advanced Age (≥65 years):** The strong association with older age (aOR=3.12) is well-documented worldwide and biologically plausible, reflecting the cumulative effect of genetic mutations and hormonal changes over time (Crawford, 2003) [3]. This finding reinforces the need to target screening and awareness efforts at men in this age bracket.

- **Family History:** The nearly three-fold increased risk (aOR=2.98) associated with a positive family history confirms the role of genetic predisposition. This is consistent with studies across diverse populations (Zeigler-Johnson *et al*., 2008) [10] and highlights a crucial group for targeted genetic counseling and intensive screening. Identifying men with a family history provides an opportunity for early intervention before symptoms develop.

- **Obesity:** The significant independent risk posed by obesity (aOR=2.45) is a critical finding. The biological mechanism may involve chronic inflammation, altered sex hormone levels, and increased insulin resistance, which can promote tumor aggressiveness (Allott *et al*., 2015) [2]. In the context of Enugu and Nigeria's ongoing nutritional transition towards more Westernized diets, this modifiable risk factor presents a key avenue for public health prevention strategies. Promoting healthy weight management could potentially reduce the risk and aggressiveness of prostate cancer.

4. **Study Limitations and Strengths**
This study has several limitations. As a hospital-based study, the prevalence rate may not be generalizable to the general population, as it reflects a symptomatic or health-seeking cohort. Recall bias is possible regarding self-reported data on family history and lifestyle factors. Furthermore, the study could not explore genetic markers due to resource constraints.

Despite these limitations, the study's strengths include a robust sample size, the use of histological confirmation for all diagnoses (the gold standard), and a comprehensive analysis that adjusted for potential confounders. It provides contemporary, evidence-based data that is specifically relevant to health planning in Enugu State.

5. **Conclusion and Implications**

In conclusion, this study confirms a high burden of prostate cancer in Enugu State, characterized by late diagnosis and driven by age, family history, and obesity. These findings call for a multi-pronged approach:

- **Public Awareness Campaigns:** To educate men about risk factors, symptoms, and the importance of early detection.

- **Targeted Screening:** Implementing cost-effective, targeted screening programs for high-risk groups (men >65, those with a family history, and the obese).

- **Clinical Training:** Strengthening the capacity of primary healthcare workers to identify and refer suspected cases early.

- **Policy Action:** Advocating for government policies to subsidize the cost of PSA testing and treatment, making care more accessible.

Future research should focus on population-based studies and explore the molecular underpinnings of prostate cancer in this specific population to better understand its aggressiveness.

Conclusion

This study provides critical insights into the epidemiology of prostate cancer in Enugu State, Nigeria. The core finding is a high prevalence rate of 18.4%, with the vast majority of cases (77.4%) being diagnosed at an advanced, incurable stage. This pattern of late presentation is the fundamental reason for the poor prognosis and high mortality associated with the disease in this region.

The research successfully identified advanced age (≥65 years), a positive family history of prostate cancer, and obesity (BMI ≥30) as significant, independent risk factors that markedly increase the odds of a diagnosis. The significance of these findings is twofold. Firstly, they provide a clear evidence base for healthcare practitioners and policymakers to design targeted interventions. Secondly, they highlight an urgent need for public health strategies that combine awareness campaigns on modifiable

risks like obesity with structured, risk-based screening programs for non-modifiable factors like age and genetics.
Addressing the scourge of prostate cancer in Enugu State requires a concerted effort to promote early detection through education and improved access to screening, ultimately shifting the point of diagnosis from advanced to earlier, more treatable stages and improving survival outcomes.

References

1. Adebayo AO, Olapade-Olaopa EO, Adeyemi AB. Prevalence and characteristics of prostate cancer among patients undergoing prostate biopsy in a tertiary hospital in Lagos, Nigeria. Nigerian Journal of Clinical Practice,2020:23(5):654–660.
2. Allott EH, Masko EM, Freedland SJ. Obesity and prostate cancer: weighing the evidence. European Urology,2015:67(5):800–809.
3. Crawford ED. Epidemiology of prostate cancer. Urology,2003:62(6):3–12.
4. Ejike CE, Eze NM. Pattern of prostate cancer presentation in a tertiary hospital in the Niger Delta region of Nigeria. Port Harcourt Medical Journal,2021:15(2):75–80.
5. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, *et al*. Global Cancer Observatory: Cancer Today. International Agency for Research on Cancer,2022.
6. Ikuerowo SO, Omisanjo OA, Bioku MJ, Olapade-Olaopa EO, Adekunle OO. Prevalence and characteristics of prostate cancer among participants of a community-based screening in Nigeria using serum prostate specific antigen and digital rectal examination. Pan African Medical Journal,2013:15:129.
7. Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics. CA: A Cancer Journal for Clinicians,2011:61(2):69–90.
8. Odedina FT, Akinremi TO, Chinegwundoh F, Roberts R, Yu D, Reams RR, *et al*. Prostate cancer disparities in Black men of African descent: a comparative literature review of prostate cancer burden among Black men in the United States, Caribbean, United Kingdom, and West Africa. Infectious Agents and Cancer,2009:4(1):1–10.
9. Ogunbiyi JO, Shittu OB. Increased incidence of prostate cancer in Nigerians. Journal of the National Medical Association,1999:91(3):159–164.
10. Zeigler-Johnson C, Friebel T, Walker AH, Wang Y, Spangler E, Panossian S, *et al*. Prostate cancer severity and risk in men of African descent. Journal of the National Medical Association,2008:100(12):1476–1483.