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Prevalence and Pathological Features of Prostate Cancer in the Sunyani Teaching Hospital in Ghana in Sub-Saharan Africa. A 16-Year Retrospective Study.

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Abstract
Introduction: A retrospective review was conducted of all prostate cancers diagnosed at the Urology Unit of the Sunyani Teaching Hospital between 2009 and 2024. Subjects 40 years of age and older were eligible for screening.
Objective: To find the Prevalence and Pathological Features of Prostate Cancer in the Sunyani Teaching Hospital
Method: Urological ultrasound scanning, digital rectal examination, serum prostate-specific antigen (PSA) testing, family history, and histopathology (ultrasound-guided biopsy) with 12 to 16 cores as diagnostic and screening methods for prostate cancer were used. From patient folders and archives, information such as age, PSA results, and the year of screening or diagnosis were obtained. The diagnosis, carcinoma grade, perineural invasion, and percentage of tissues involved were among the histological results taken into consideration. According to the new scoring/grading method in use at the time of the study, the carcinomas were categorised into grade groups 1, 2, 3, 4, and 5. Men under 40years were not allowed to participate in this study.
Result: The annual prevalence fluctuated over the years, with the highest cases recorded in 2010 (139 cases, 9.9%) and 2018 (134 cases, 9.6%), The mean age of patients was 70.49±9.97 years, PSA levels varied widely, with a median of 13.40 ng/mL (IQR: 7.30–27.30). The largest proportion of cases had PSA values between 4-13.9 ng/mL (602 cases, 42.9%), Overall, the data highlights a higher prevalence of prostate cancer among older individuals, with considerable variation in PSA.
Conclusion: The findings underscore the high incidence of prostate cancer among older individuals, the significant variation in PSA levels, and the associations between Gleason grades and key pathological features such as perineural invasion and tissue involvement. The fluctuating trends in incidence from 2009 to 2024 reflect the dynamic nature of cancer epidemiology, influenced by various diagnostic and clinical factors

Keywords: Prevalence, Serum Prostate Specific Antigen, Advanced Prostate Carcinoma, Benign Prostate Hyperplasia, Prostatitis.

1.0 Introduction

Globally, cancer already poses a significant public health burden [1] Due to different lifestyle and behavioural patterns, as well as geographic and environmental factors, there has been a global increase in the number of new cases and deaths from various cancers over the past 20 years, particularly in low- and middle-income countries (LMICs) [2, 3]. Globally, there were 8.2 million cancer-related deaths and 14.1 million new cases in 2012 alone [4]. Over 75 million prevalent cases, 27 million incident cases, and 17 million cancer-related deaths are anticipated worldwide by 2030, adding to this burden [5, 6, 7]. Since 1970, many new cancer cases have been identified in Africa and LMICs, rising from 15% to 56% in 2008 and expected to reach roughly 70% by 2030, according to evidence [1, 8, 9]. They are largely associated with the region's high HIV/AIDS prevalence, rapid population increase, rising life expectancy, and urbanisation with increasingly westernised lifestyles [10].

Ghana's high incidence rate has been attributed to a range of lifestyle choices and a lack of appropriate understanding about prostate cancer [11,12]. According to numerous published researches, South Africa and Nigeria are two of the few nations having accurate and trustworthy statistics on the prevalence of prostate cancer. This isn't the situation in Ghana, though, where there is a lack of knowledge regarding the prevalence and trend. Because of this, it is challenging to obtain reliable information on the prevalence and death rate of prostate illnesses among Ghanaian men [11, 13]. However, only a small number of studies have reported the prevalence of prostate cancer in some regions of the nation [12, 14, 15]. The findings of these studies show that cancer cases are on the rise, with prostate cancer among them growing at an exponential rate. One source of trustworthy information that aids in organising a specific public health requirement is region-specific data. We want to provide enough information to assist regional health decisions regarding prostate cancer by looking at and assessing data from our area.

2. 0 Methods and Materials

A retrospective review was conducted of all prostate cancers diagnosed at the Urology Unit of the Surgical Department of Sunyani Teaching Hospital in Sunyani, Ghana, between 2009 and 2024. Being the primary referral centre in the area, the Sunyani Teaching Hospital is one of the largest hospitals in Ghana, servicing both the local community and beyond. Through infrastructure, the hospital has standard facilities. The hospital is accessible to all locations that share borders with the region as well as those that are farther away due to its geographic location, the country's transportation system, and the region's commercial and cosmopolitan character. According to earlier research, subjects 40 years of age and older were eligible for screening. At the time of the study, our facility used urological ultrasound scanning, digital rectal examination, serum prostate specific antigen (PSA) testing, family history, and histopathology (ultrasound guided biopsy) with 12 to 16 cores as diagnostic and screening methods for prostate cancer. From patient folders and archives, information such as age, PSA results, and the year of screening or diagnosis were obtained. The diagnosis, carcinoma grade, perineural invasion, and percentage of damaged tissues were among the histological results taken into consideration. According to the new scoring/grading method in use at the time of the study, the carcinomas were categorised into grade groups 1, 2, 3, 4, and 5. Men under 40years were not allowed to participate in this study except upon special request or family history of cancer of the prostate.

Data Analysis

Descriptive statistics and correlation tests were performed using SPSS (Version 20.0; SPSS Inc., Chicago, IL) and GraphPad Prism 8.0. The sample population was stratified by age, year, PSA, diagnosis, grade, and frequency of distribution among the various strata to account for the underlying sampling frame and produce representative population prevalence estimates. Additionally, the prevalence of the different histological appearances was investigated. P-value was set at 0.05.

3.0 Results

1. Data on Year of Diagnosis, Age, and PSA of Prostate Cancer Cases.

The data presents the yearly incidence, age distribution, and PSA levels of prostate cancer cases at Sunyani Teaching Hospital. The annual prevalence fluctuated over the years, with the highest cases recorded in 2010 (139 cases, 9.9%) and 2018 (134 cases, 9.6%), while the lowest occurred in 2022 (35 cases, 2.5%). The mean age of patients was 70.49±9.97 years, with most cases occurring in the 70-79 age group (525 cases, 37.4%), followed by the 60-69 group (432 cases, 30.8%). Younger individuals below 50 years accounted for a small proportion (1.6%). PSA levels varied widely, with a median of 13.40 ng/mL (IQR: 7.30–27.30). The largest proportion of cases had PSA values between 4-13.9 ng/mL (602 cases, 42.9%), while 7.6% had PSA levels below 4 ng/mL, and 5.9% had values of 94 ng/mL or higher. A small fraction (1.7%) had no PSA test done. Overall, the data highlights a higher prevalence of prostate cancer among older individuals, with considerable variation in PSA levels (Table 3.1).

Table 3.1. Data on Year of Diagnosis, Age and PSA of Prostate Cancer Cases.

Variable	Frequency (n= 1403)	Percentage (%)
Year		
2009	84	6
2010	139	9.9
2011	97	6.9
2012	110	7.8
2013	113	8.1
2014	96	6.8
2015	69	4.9
2016	103	7.3
2017	118	8.4
2018	134	9.6
2019	66	4.7
2020	75	5.3
2021	61	4.3
2022	35	2.5
2023	36	2.6
2024	67	4.8
Age (n=1401)	**Mean± S. D**	
	70.49± 9.97	

Age Group		
< 40	3	0.2
40-49	20	1.4
50-59	163	11.6
60-69	432	30.8
70-79	525	37.4
80-89	221	15.8
90-99	35	2.5
>100	2	0.1
Not Stated	2	0.1
PSA (1379)	**Median (IQR)**	
	13.40(7.30-27.30)	
PSA Group		
< 4	106	7.6
4-13.9	602	42.9
14-23.9	261	18.6
24-33.9	129	9.2
34-43.9	85	6.1
44-53.9	57	4.1
54-63.9	20	1.4
64-73.9	10	0.7
74-83.9	9	0.6
84-93.9	17	1.2
≥ 94	83	5.9
Not Done	24	1.7

2. Data on the Diagnosis and other Features of Prostate Cancer Cases.

Most prostate cancer cases were benign prostate hyperplasia (BPH), accounting for 919 cases (65.50%), followed by carcinoma of the prostate (CAP) with 492 cases (35.07%). Prostatitis was observed in 232 cases (16.54%), while high-grade PIN was found in 20 cases (1.43%). Additionally, 228 cases (16.25%) had both BPH and prostatitis, 14 cases (1.00%) had both BPH and CAP, and 2 cases (0.14%) had both CAP and prostatitis. Among the CAP cases, the most common grade was grade 2 (165 cases, 33.54%), followed by grade 4 (152 cases, 30.89%), while grade 3 was the least frequent (17 cases, 3.46%). Most affected tissue percentages ranged between 40 and 69% (39.84%), whereas only 17 cases (3.46%) had a tissue affection (TA) percentage below 10%. Furthermore, 310 CAP cases (63.01%) showed no perineural invasion, whereas 182 cases (36.99%) exhibited invasion into the perineural region (figure 3.1).

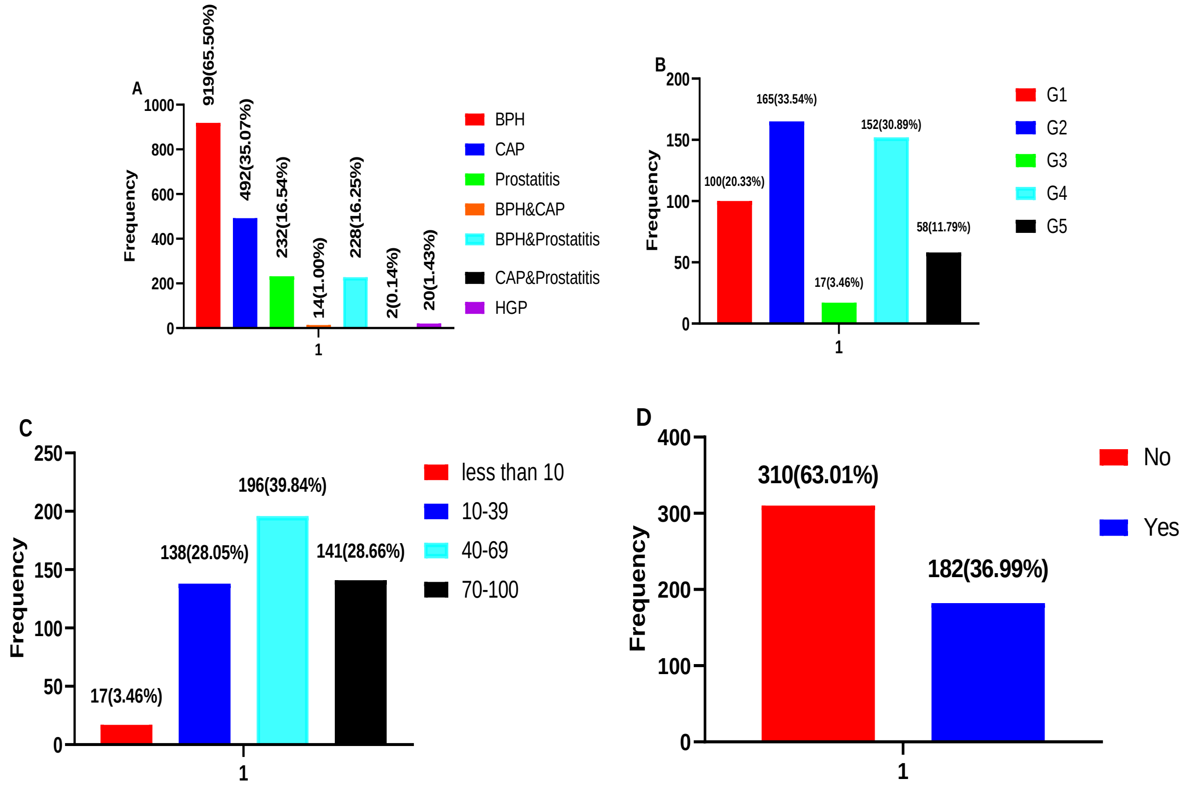

Figure 3.1 presents the frequencies of different diagnoses and key features of prostate cancer. **Figure A** illustrates the distribution of various diagnoses. **Figure B** depicts the Gleason Grade Groups for carcinoma of the prostate cases. **Figure C** highlights the percentage of tissue affected in carcinoma of the prostate cases, while **Figure D** represents the extent of perineural involvement in these cases.

3.3 Difference in the Distribution of Age among Benign Prostatic Hyperplasia and Prostate Carcinoma Cases.

A significant difference was observed in both the mean age and median PSA levels between BPH and carcinoma of the prostate (CA) cases. The mean age was 69.55±10.06 years for BPH and 72.02±9.59 years for CA ($p<0.0001$). Similarly, the median PSA levels were 10.50 (5.90–19.60) for BPH and 22.80 (12.43–49.96) for CA ($p<0.0001$), respectively (figure 3.2).

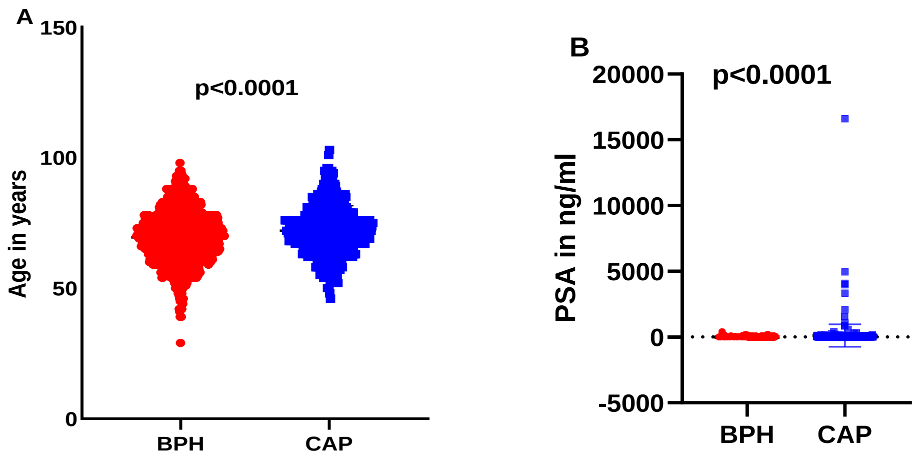

Figure 3.2 illustrates the variation in age and PSA distribution between Benign Prostatic Hyperplasia (BPH) and Prostate Carcinoma (CA) cases. **Figure A** represents the age distribution differences between BPH and CA, while **Figure B** depicts the variation in PSA levels between these two conditions.

3.4 Association of PNI, %TA and PSA with Gleason Grade Group of Prostate Cancer

The chi-square test results indicate significant associations between Gleason Grade Groups (G1–G5) and perineural invasion (PNI), percentage of tissue affected (% TA), and PSA levels ($p < 0.0001$ for all variables). Higher-grade tumours (G3–G5) were more likely to show perineural invasion, with G3 (58.8%), G5 (59.6%), and G4 (39.5%) having the highest proportions of PNI-positive cases. The percentage of tissue affected also varied significantly, with lower-grade tumours (G1 and G2) having more cases with less than 40% tissue involvement, while higher-grade tumours (G3–G5) were more frequently associated with greater tissue involvement (40–100%). PSA levels also showed a strong association with Gleason grades, where lower PSA levels (<4 ng/mL) were rare across all groups, and PSA levels ≥94 ng/mL were most prevalent in G3 (41.2%), G4 (15.4%), and G5 (22.0%), suggesting that higher-grade tumours tend to have higher PSA levels. These findings highlight that more aggressive prostate cancer cases (G3–G5) are associated with increased perineural invasion, greater tissue involvement, and elevated PSA levels (Table 3.2).

Table 3.2 Association of PNI, %TA and PSA with Gleason Grade Group of Prostate Cancer

Variable	G1	G2	G3	G4	G5	Total	P-Value
PNI							**<0.0001**
No	69(69.0%)	117(70.9%)	7(41.2%)	92(60.5%)	25(43.1%)	310(63.0%)	
Yes	31(31.0%)	48(29.1%)	10(58.8%)	60(39.5%)	33(59.6%)	182(37.0%)	
% TA							**<0.0001**
< 10	16(16.0%)	1(0.6%)	0(0.0%)	0(0.0%)	0(0.0%)	17(3.5%)	
10—39	42(42.0%)	52(31.5%)	4(23.5%)	35(23.0%)	5(8.6%)	138(28.0%)	
40-69	34(34.0%)	63(38.2%)	9(52.9%)	55(36.2%)	35(60.3%)	196(39.8%)	
70-100	8(8.0%)	49(29.7%)	4(23.5%)	62(40.8%)	18(31.0%)	141(28.7%)	
PSA Group							**<0.0001**
< 4	2(2.0%)	3(1.8%)	0(0.0%)	1(0.7%)	0(0.0%)	6(1.3%)	
4-13.9	36(36.4%)	51(30.9%)	2(11.8%)	34(22.8%)	7(14.0%)	130(27.1%)	
14-23.9	25(25.3%)	43(26.1%)	6(35.3%)	26(17.4%)	10(20.0%)	110(22.9%)	
24-33.9	10(10.1%)	11(6.7%)	0(0.0%)	19(12.8%)	14(28.0%)	54(11.3%)	

34-43.9	9(9.1%)	15(9.1%)	2(11.8%)	19(12.8%)	4(8.0%)	49(10.2%)
44-53.9	4(4.0%)	11(6.7%)	0(0.0%)	17(11.4%)	3(6.0%)	35(7.3%)
54-63.9	1(1.0%)	5(3.0%)	0(0.0%)	4(2.7%)	1(2.0%)	11(2.3%)
64-73.9	1(1.0%)	1(0.6%)	0(0.0%)	3(2.0%)	0(0.0%)	5(1.0%)
74-83.9	2(2.0%)	4(2.4%)	0(0.0%)	2(0.0%)	0(0.0%)	8(1.7%)
84-93.9	4(4.0%)	1(0.6%)	0(0.0%)	1(0.7%)	0(0.0%)	6(1.3%)
≥ 94	5(5.1%)	20(12.1%)	7(41.2%)	23(15.4%)	11(22.0%)	66(13.8%)

PNI= Perineural Invasion; %TA= Percentage of Tissue Affected; PSA= Prostate Specific Antigen.

3.5 Annual Incidence of Prostate Cancer

The annual incidence rate of prostate cancer showed a fluctuating trend from 2009 to 2024. It steadily increased from 2009 to 2010 before declining in 2011 (rising from 84 to 139, then dropping to 97). From 2011, the incidence increased until 2013, followed by a decline until 2015 (97, 110, 113, 96, and 69). A steady rise occurred from 2015 to 2018, peaking before a sharp decline in 2019 (69, 103, 118, 134, and 66). The incidence slightly increased in 2020 (75) but declined again through 2022 (61 and 35). A minor increase was observed in 2023 (36), followed by a sharp rise in 2024 (67). Overall, the trend line indicates a gradual decline in prostate cancer incidence from 2009 to 2024. Additionally, the overall crude incidence of prostate cancer at Sunyani Teaching Hospital was 2.35 per 1,000 population (Figure 3.3)

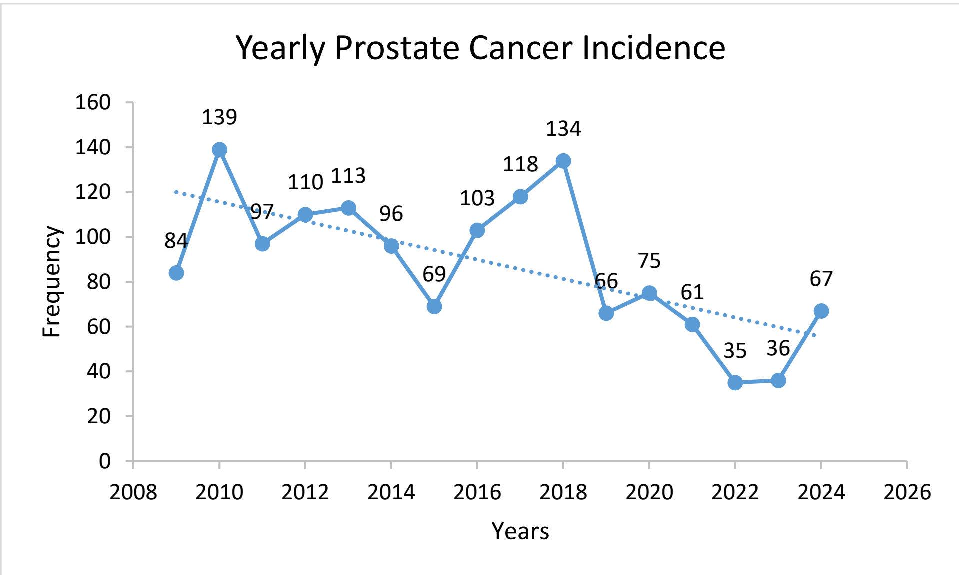

Figure 3.3 shows the annual incidence of prostate cancer at Sunyani Teaching Hospital.

4.0 Discussion

The findings from this study provide a detailed analysis of prostate cancer cases at Sunyani Teaching Hospital, focusing on the annual incidence, patient age distribution, PSA levels, pathological diagnoses, and associations with Gleason grades. The data reveals significant insights into the epidemiology and characteristics of prostate cancer cases in this institution.

Annual Incidence and Age Distribution

The annual incidence of prostate cancer at Sunyani Teaching Hospital exhibited considerable variation over the years. The highest recorded incidences occurred in 2010 (139 cases, 9.9%) and 2018 (134 cases, 9.6%), while the lowest incidence was noted in 2022 (35 cases, 2.5%) (Figure 3.1). The overall mean age of patients diagnosed with prostate cancer was 70.49 ± 9.97 years, indicating that prostate cancer predominantly affects older individuals. The largest proportion of cases were observed in the 70-79 age group (37.4%), followed by the 60-69 age group (30.8%). The frequency of cases among individuals under 50 years was notably low, accounting for only 1.6% of the total sample. These findings are consistent with existing literature, which reports that prostate cancer primarily affects older men, with the risk increasing with age [16, 17].

PSA Levels and Distribution

PSA levels also varied widely among the prostate cancer cases. The median PSA level was 13.40 ng/ml, with an interquartile range (IQR) of 7.30–27.30 ng/ml. The largest proportion of cases (42.9%) had PSA levels in the range of 4–13.9 ng/ml. A smaller proportion (7.6%) had PSA levels below 4 ng/ml, while 5.9% had levels ≥94 ng/ml. A small number of cases (1.7%) did not undergo PSA testing. Elevated PSA levels have long been associated with prostate cancer and are commonly used as a diagnostic tool, with higher levels typically correlating with more advanced stages of the disease [18]. The variation in PSA levels observed in this study further supports the notion that PSA can be a valuable, albeit imperfect, biomarker for prostate cancer [19].

Pathological Diagnoses and Gleason Grades

In terms of pathology, majority of prostate cancer cases were diagnosed as benign prostate hyperplasia (BPH), accounting for 65.5% of the cases, followed by carcinoma of the prostate (CAP) at 35.1%. Prostatitis was observed in 16.5% of cases, and high-grade prostatic intraepithelial neoplasia (PIN) was found in 1.4% of cases. Interestingly, 16.25% of cases had both BPH and prostatitis, while 1% had both BPH and CAP. Among the carcinoma cases, the most common Gleason grade was 2 (33.5%), followed by grade 4 (30.9%), while grade 3 was the least common (3.5%) (Figure 3.1). These results align with the established understanding that prostate cancer typically presents in older men and is frequently associated with benign prostatic conditions like BPH [20]. The Gleason scoring system remains a vital tool for grading prostate cancer and predicting prognosis [21].

Perineural Invasion, Tissue Affection, and PSA Levels in Gleason Grades

The chi-square test results indicated significant associations between Gleason grade and key pathological features such as perineural invasion (PNI), the percentage of tissue affected (TA), and PSA levels ($p < 0.0001$ for all variables). Higher-grade tumours (G3–G5) were more likely to exhibit perineural invasion, with the highest proportions of PNI observed in G3 (58.8%), G5 (59.6%), and G4 (39.5%) cases. Similarly, higher-grade tumours had a higher percentage of tissue affected, with G3–G5 tumours showing greater involvement (40–100%). PSA levels also correlated strongly with Gleason grades, with the highest levels of PSA (≥94 ng/mL) being most prevalent in G3 (41.2%), G4 (15.4%), and G5 (22.0%) tumours. These findings are consistent with previous studies that report a positive correlation between higher Gleason scores and more aggressive disease, including greater tissue involvement and elevated PSA levels [22, 23].

Trend in Incidence Over the Years

The annual incidence of prostate cancer at Sunyani Teaching Hospital exhibited fluctuating trends from 2009 to 2024. After a sharp increase in 2010, the incidence declined in 2011, followed by another increase until 2013. From 2015 to 2018, the incidence showed a steady rise before a sharp drop in 2019. The incidence slightly increased in 2020 but continued to decline through 2022, with a slight increase observed in 2023 and a sharp rise in 2024. The overall trend suggests a gradual decline in the incidence of prostate cancer over the 15-year period (Figure 3.3). This fluctuation could be influenced by factors such as changes in diagnostic practices, increased awareness, or demographic shifts, as observed in other regional and global studies [24]. Furthermore, the overall crude incidence of prostate cancer at the hospital was 2.35 per 1,000 population, providing a context for understanding cancer trends at the institution.

5.0 Conclusion

The data from Sunyani Teaching Hospital presents a comprehensive overview of the epidemiological and pathological characteristics of prostate cancer cases. The findings underscore the high incidence of prostate cancer among older individuals, the significant variation in PSA levels, and the associations between Gleason grades and key pathological features such as perineural invasion and tissue involvement. The fluctuating trends in prevalence from 2009 to 2024 reflect the dynamic nature of cancer epidemiology, influenced by various diagnostic and clinical factors. These results contribute to the growing body of literature on prostate cancer in West Africa and can inform future research and clinical management strategies.

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