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Original Article

The Effect of Age, Geographical Location and Lifestyle on the Prevalence of Prostate Cancer in Nigerian Men Aged 40 to 65 years: A Case Study of Abia, Anambra, and Imo States

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Abstract

Introduction: This paper presents a study conducted to determine the effects of age, geographical location and lifestyle on the prevalence of prostate cancer in Nigerian men aged 40 to 65years, using Abia, Anambra and Imo states as case study. **Methodology:** Various hospitals in Abia, Anambra and Imo States were visited from September 2022 to June, 2023 for collection of data on prostate cancer. Patients' folders of the hospitals were used as source of data, from which records of prostate cancer from 2021 to 2017 were obtained. Patients folders provided ages, geographical locations, number of positive (+) and number of negative (-) cases of prostate cancer, etc. but did not provide information on the lifestyle of the patients. Therefore, while collecting data of 2021 to 2017 cases, a descriptive survey was also conducted, using structured questionnaire administered by purposive sampling to 315 male patients going for prostate cancer screening in the various hospitals. The questionnaire was structured to provide the lifestyle of screened patients in addition to ages and geographical locations of the patients. A total of 304 copies of questionnaire were retrieved after the prostate cancer screening and data collected for the old (2021 – 2017) and new (Sept. 2022 to June, 2023) cases were sorted and analyzed. Prevalence of prostate cancer was calculated for the old and new cases. SPSS Version 29.0 was used to run Chi-square test for associations between the suspected risk factors (age, geographical location and lifestyle)and prostate cancer. **Results:** The results show that age ($P<0.001$) and lifestyle ($P = 0.042$) have significant relationship with prostate cancer. Furthermore, smoking rate ($P = 0.024$); rate of alcohol consumption ($P = 0.031$) and rate of body exercise ($P = 0.033$) have all shown significant association with prostate cancer. However, the relationship between prostate cancer and study location is not statistically significant ($P = 0.191$, for 2021 – 2017; $P = 0.651$, for Sept. 2022 – June, 2023). **Conclusion:** Prostate cancer starts in Nigerian men at the age of 55year with highest occurrence at the age of 62years. Geographical location has no significant effect on the prevalence of prostate cancer in Nigerian men aged 40 to 65years. Lifestyle is a risk factor of prostate cancer in Nigerian men. Prevalence of prostate cancer is most in Abia state, followed by Anambra and Imo States.

Keywords: Age, Geographical location, Lifestyle, Prostate Cancer.

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Introduction

1.1.1 Background of the Study

Prostate cancer has become a common disease to male of all ages[1].It is usually detected in African men at the age of 40years, against the age 50years for Europeans. However, its highest incidence and mortality rates occur above the age of 65years[1]. The rising trend of prostate cancer morbidity and mortality is now a global challenge. Globocan[2]estimated a total of 1276,106 new cases of prostate cancer in 2018, to cause death of 358,989men worldwide. The International Agency for Research on Cancer (IARC) estimates that prostate cancer is the leading cancer in terms of incidence and mortality in men from Africa and the Caribbean[3]. IARC also estimated that cancer of the prostate is a growing problem in Africa with approximately 28,006 deaths in 2010, and 57,048 deaths in 2030[4]. Globocan also estimated a total of 2,293,818 new cases of prostate cancer until 2040 with 1.05% increase in mortality rate[5].

According to Globocan also, the highest incidence and mortality rates of prostate cancer are found in African-American men[1, 2]compared to the European men who record a few cases. The racial difference in prostate cancer status has been associated with the differences in social, environmental and genetic factors[1, 2].Ironically, the highest incidence rates of prostate cancer are recorded in High-Income countries while the Low-and-Middle-Income countries record the highest mortalities, especially the sub-Saharan Africa[2]. According to Okobia*et al*.[6], African-American men have the more common chromosome 8q24 variants, which is associated with increased prostate cancer risk.

1.1 Common Symptoms

Common symptoms found in men with the prostate cancer have been presented in various articles[7, 8] as follows:

1. Frequent urination
2. Weak or interrupted urine flow or the need to strain to empty the bladder.
3. The urge to urinate frequently at night.
4. Onset of erectile dysfunction (difficulty getting an erection).
5. Pain or burning sensation while passing urine.
6. Discomfort or pain when sitting caused by an enlarged prostate.
7. Blood in the seminal vesicle.
8. Blood in urine (Haematuria)
9. Feeling of incomplete emptiness of the bladder and leakage of urine.

According toAmerican Cancer Society (ACS) [8], if the cancer has spread outside the prostate gland, these symptoms may be experienced:

1. Pain in the back, hip, thighs, shoulders, or other bones.
2. Swelling or fluid accumulating in the legs or feet (Oedema).
3. Unexplained weight loss.
4. Fatigue due to low levels of red blood cells.
5. Changes in bowel habits.
6. Renal failure.

1.2 Causes/Prevention

The specific causes of prostate cancer have not been found but some of the risk factors of the disease have been identified, which include age, occupation, marital status, diet, lifestyle, race/ethnicity, smoking, family income, and body exercise[9, 10].

Total prevention or eradication of prostate cancer may not be achieved as the specific causes of the disease are not yet known. However, any means of reducing the risk factors, supposedly will reduce the prevalence of the disease. Previous studies[11, 12] have shown that early detection, followed by early treatment of prostate cancer helps in preventing the disease from reaching severe stages or higher risk groups. Also, improved nutritional habits, regular body exercise and healthy lifestyle have shown positive impacts in reducing the chances of prostate cancer occurrence[13].

1.3 Detection

Prostate Specific Antigen (PSA) is a protein produced by both normal and cancer cells in the prostate gland. It is measured in nanogram per milliliter (ng/ml). Men with high prostate specific antigen (PSA > 4ng/ml) are most often diagnosed with prostate cancer[1]. Related, studies have shown that PSA level can be deceptive in detecting prostate cancer, since men with high PSA level have been screen negative of prostate cancer and those with low PSA level have been diagnosed with prostate cancer[14, 15].

Because of the diagnostic inaccuracy of PSA level in prostate cancer detection, PSA surrogates have been recommended in addition to PSA level. The PSA surrogates include total PSA (tPSA), percent free PSA (%fPSA), PSA density, PSA velocity, and PSA slope[16]. However, the diagnostic accuracy of PSA surrogates is not yet established. Due to the inconsistencies associated with PSA methods of prostate cancer detection, different medical societies adopt different guidelines for detecting prostate cancer using PSA[12, 17].Other methods used for detection of prostate cancer include Biopsy, Digital Rectal Examination (DRE), Magnetic resonance Imaging (MRI),Positron Emission Tomography (PET) scan, Ultrasound, and Computed Tomography (CT) scan[18, 19].

1.4 Treatment

The method for treatment of prostate cancer is recommended by the healthcare provider depending on the risk group the patient belongs. Prostate Cancer Foundation[20] has presented three risk groups of prostate cancer based on PSA, DRE and biopsy as follows:

1. **Low risk:** Tumor is confined to the prostate, and the PSA is <10 and grade group 1 (Gleason 6). There is also a subset of extremely "slow-growing" tumors called "very low risk" in which fewer than 3 biopsy tissue samples contain cancer cells and the cancer is not detectable by DRE.
2. **Intermediate risk:** Tumor is confined to the prostate, the PSA is between 10 and 20, or grade group 2 or 3 (Gleason 7). This category is often divided into a "favorable" and "unfavorable" intermediate risk.
3. **High risk:** Tumor extends outside the prostate, the PSA >20 or grade group 4 or 5 (Gleason 8 to 10). There is also a subset of very aggressive tumors called "very high risk" in which the tumor has extended into the seminal vesicles (T3b) or the rectum or bladder (T4), or there are multiple biopsy samples with high grade cancer.

Based on the recommendation of the doctor, prostate cancer can be treated by the following methods:

1. **Surgery[21]:**This may involve removal of the prostate gland and the seminal vesicles. Prostate gland and the seminal vesicles all work together to transport the semen out of the penis. The sperm cannot go out of the body of the man to fertilize an egg without the secretion from these glands.
2. **Radiation Therapy[22]:**A high energy beam like X-ray is used in this case to kill the cancer cells. The radiation is focused on the area of the prostate where there is cancer. However, radiation therapy anywhere around the sex organ or belly can reduce the sperm count and testosterone level.

3. **Chemotherapy[23]:**In this case, drugs typically given through a needle in the vein are used to kill cells that undergo rapid division. Because sperm usually undergoes rapid division, it is also affected by chemotherapy. This could lead to infertility. The man's age and dosage of the chemotherapy both affect the risk of fertility.
4. **Hormone Therapy[24]:** This is also known as androgen deprivation therapy (ADT). In this case, a hormone is used to prevent the body from producing male sex hormone like testosterone. Hormone therapy suppresses the activities of the hormones that feed the prostate cancer cells. This is achieved by either preventing androgen biosynthesis (e.g. abiraterone) or by antagonizing androgen receptor (AR) function (e.g. bicalutamide, enzalutamide, darolutamide) [24].

Although it has been noted that Africa will suffer high prevalence of prostate cancer in near future, adequate measures have not been put in place to avert the impending threat of the disease. A study[25] has reported prevalence of (1046 per 100,000) for Nigerian men in Lagos State. In order to have an overview of the case of Nigeria and proffer sustainable solution, there is need to investigate the prevalence of prostate cancer in other states of Nigeria.

As a way forward, this study is aimed to determine the effects of age, geographical location, and lifestyle on the prevalence of prostate cancer in Nigerian men aged 40 to 65years using Abia, Anambra and Imo States as case study

1.5 Research Null Hypotheses

1. Age is not a risk factor of prostate cancer in Nigerian men.
2. Geographical location is not a risk factor of prostate cancer in Nigeria men.
3. Lifestyle is not a risk factor of prostate cancer in Nigerian men.

1.6 Objectives of the study

The main objective of this study is to determine the effects of age, geographical location and lifestyle on the prevalence of prostate cancer in Nigeria men aged 40 to 65years.
The specific objectives are:

1. To determine the incidence and prevalence of prostate cancer in Nigeria from Abia, Anambra and Imo States.
2. To determine statistically whether age, geographical location and lifestyle are risk factors of prostate cancer in Nigerian men.
3. To propose possible ways of reducing the prevalence of prostate cancer in Nigeria based on the research findings.

1. Literature Review

1.1 Theoretical Framework

Health Belief Model (HBM) was developed in the 1950s by American public health researchers. It applies to a range of health behaviours providing a framework for shaping behaviour patterns relevant to public health as well as training health care professionals to work from their patients' subjective perceptions of illness and treatment[26]. According to Health Believe Model, the willingness of a person to change health behaviour or accept an intervention is determined by *Perceived susceptibility*, *Perceived severity*, *Health motivation, Perceived benefits and Perceived barriers* on the implementation of the intervention[26].

The age, geographical location and lifestyle influence the thought and behavious of a person. Many Nigerian men exhibit poor attitudes to healthcare practices such as prostate cancer screening/treatment. This unhealthy attitude is suspected to be due to the poor socio-economic condition of the country. This also suggests that the spread of prostate cancer in Nigeria is traceable to poor socio-economic factors as stated in previous works[1, 2].

Age and geographical location influence socio-economic conditions of a person, such as income, whereas socio-economic conditions influence the lifestyle of the individual such as smoking, drinking, and body exercise. Therefore; age, geographical location and lifestyle of individuals in a society are considered as socio-economic variables and risk factors of prostate cancer as mentioned in related studies[1, 2]. However, several studies have been conducted on the epidemiology of prostate cancer.

1.2 Review of Empirical studies

Okwor*et al.*[16] evaluated the pooled sensitivity and specificity of PSA and its surrogates, and to systematically synthesize the optimum thresholds for the detection of prostate cancer in sub-Saharan Africa.The results obtained shows that thirteen (13) studies of males diagnosed with prostate cancer were included, where 10 studies reported PSA sensitivity/specificity/both and 4 reported on PSA surrogates (3 reported %free PSA, and 1 reported PSA density). Two meta-analyses were conducted to pool the diagnostic accuracy of PSA and %free PSA. The sensitivity of PSA (n =10) at the cut-off values of 10ng/ml were 86.8%, 93.1%, and 76.0% respectively; while specificity (n = 8) were 42.3%, 29.3%, and 28.8% respectively. The PSA cut-off of 4 – 10 ng/ml possessed the highest diagnostic accuracy (55.7%). The specificity (91.5%) and diagnostic accuracy (84%) of %free PSA (n = 3) was best at cut-off value ≤ 10%. Based on the research findings, it was concluded that having highest diagnostic accuracy individually and a combination of PSA 4 –10 ng/ml and %free PSA ≤ 10% may be a more appropriate criterium for deciding eligibility for prostate biopsy among males in sub-Saharan Africa[16].

A study[9] conducted in Canada to determine the effects of occupation on the outcome of prostate cancer screening shows that age, occupation, educational status, marital status, level of body exercise, and lifestyle are all risk factors of prostate cancer. Another study[27] shows significant association between alcohol consumption and prostate cancer ($p < 0.001$).

In a systematic review and meta-analysis of the diagnostic accuracy of prostate-specific antigen (PSA) for the detection of prostate cancer in symptomatic patients[28], Merriel *et al*. showed that PSA is highly sensitive but poorly specific for prostate cancer detection in symptomatic patients.

So far, the studies cited in this paper have not shown substantial efforts to determine the cause(s) of the increasing prevalence of prostate cancer in Nigeria which this study aims to achieve.

2. Materials and Methods

2.1 Research Design

Descriptive design (cross-sectional survey)was adopted by Marianna *et al*.[29] in the study of knowledge, attitudes and practices of prostate cancer screening in a sample of men in Italy. Descriptive cross-sectional survey has also been adopted in this study. The research methods are illustrated in a flow chart given as **Figure 1**.

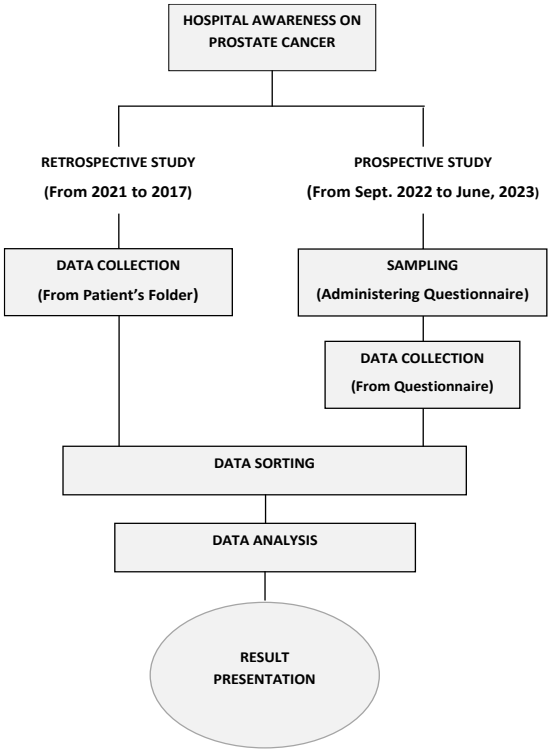

Figure 1: Research Methods Illustrated in a Flow Chart

Retrospective Study: This involved collection of 2021 to 2017 data on prostate cancer from patients' folders.

Prospective Study: This is the Field Work (FW) conducted to obtain September, 2022 to June, 2023 data on prostate cancer using structured questionnaire.

Population of Study: For the retrospective study which was focused 2021 to 2017 cases and the prospective Field Work (FW) which was focused on cases from September, 2022 to June, 2023, the population of study include Abia, Anambra and Imo States men aged 40 to 65years.

Sample size: From 2021 to 2017**,** the total number of screened patients (i.e. sample for the retrospective) is5077.

Kish formula, given by Equation (1) was used to estimate the sample size for the prospective study.

$$n = \frac{Z_\alpha{}^2 pq}{d^2} \qquad (1)$$

Where n is sample size, Z_α is the standard normal variate (taken at 5% error margin), P is the expected proportion in the entire population based on previous studies, d is the absolute error or precision and q = (1 – P).

Based on a previous study[25], 28.8% proportion (i.e. P = 0.288) was deemed sufficient for this study. Also, Z_α = 1.96, and d = 0.05 were used to obtain 315 as the sample size.

Sampling: Purposive (or selective) sampling technique was adopted in this study.

2.2 Data Collection

Various hospitals in Abia, Anambra and Imo States in Nigeria were visited from September 1, 2022 to June 30, 2023 for collection of primary and secondary data on prostate cancer. A brief awareness on prostate cancer was conducted at each hospital on daily basis although the period of hospital visitation. The purpose of the awareness was to motivate male patients in different ward to go for prostate cancer screening. After the awareness 2021 to 2017 data on prostate cancer were collected from patients' folders. While collecting the data, structured questionnaire were administered to patients going for prostate cancer screening.

The first test conducted was PSA screening while the doctors used the results of other tests to confirm whether the screened patient is prostate cancer positive (+) or negative (-). The confirmatory tests include Digital Rectal Examination (DRE), Magnetic Resonance Imaging (MRI) and Biopsy. This exercise was done on daily basis for duration of ten months. Questionnaire was administered to a total of three hundred and fifteen (315) patients going for prostate cancer screening while (304) completed copies were retrieved after the screening.

2.3 Data Analysis

The qualitative data collected from the questionnaire include age, geographical location and lifestyle of the sample population while the quantitative data include the total number of screened patients, number of patients that tested positive (+) and number of patients that testes negative (-) of prostate cancer, number of patients smoking at different rates, number of patients drinking at different rates, and number of patients at different rates of body exercise.

The data collected was sorted and analyzed using statistical tools. SPSS version 29.0 was used to conduct Chi-square test for the association between Age, geographical locations and lifestyle (including smoking, drinking and body exercise)on prevalence of prostate cancer at significant level of $p < 0.05$. Microsoft Office Excel 2010 was used to calculate the mean, standard deviation and modal age of screened patients. Prevalence of prostate cancer was calculated using Equation (2). The results obtained are presented in this paper in two-way tables and bar charts

$$\text{Prev.(ASR per}100000) = \frac{\text{No. of Cases}}{\text{Population}} \times 100000 \quad (2)$$

Where Prev. (ASR per 100000) = Prevalence of prostate cancer measured in Age Standardized Rate (ASR).

2.4 Study settings

Abia, Anambra and Imo states are all located in the south-east geopolitical zone of Nigeria. The occupants of the states are predominantly Igbo speaking. These states are well populated and known for agriculture and commercial activities. Cancer treatment hospitals in the states include Federal Medical Centre Umuahia, Abia State; Federal Teaching Hospital Owerri, Imo State; Nnamdi Azikiwe University Teaching Hospital Nnewi, Anambra State; Federal Teaching Hospital Owerri, Imo State; Okigwe General Hospital Okigwe, Imo State; Imo State University Teaching Hospital (IMSUTH) Orlu, Imo State and American Cancer Hospital Ikeduru, Imo State.

3. Results and Conclusions

Table 1: Age of Prostate Cancer Occurrence for Nigerian men in Abia, Anambra and Imo States

Period	**Age (Years)**		
	Mean	**SD**	**Mode**
2021 – 2017	53.9	7.4	61.8
Field Work	55.8	7.6	62.5
AVG	**54.85**	**7.5**	**62.15**

SD = Standard deviation

Table 2: Number of cases and Prevalence of prostate cancer in a population of Nigerian men in Abia, Anambra and Imo States Based on age

	Period	**Age (yrs)**					**Total**
		40 - 45	**46 - 50**	**51 - 55**	**56 - 60**	**61 - 65**	
Population	**2017**	362	246	113	100	25	**846**
	2018	453	293	111	110	26	**993**
	2019	360	291	250	259	16	**1176**
	2020	356	235	219	213	23	**1046**
	2021	323	230	212	210	41	**1016**
	Total	**1854**	**1295**	**905**	**892**	**131**	**5077**
	FW	**108**	**67**	**58**	**55**	**16**	**304**
Number of cases	**2017**	3	3	2	2	5	**15**
	2018	4	4	2	2	5	**17**
	2019	3	4	4	5	3	**19**
	2020	3	4	4	4	5	**20**
	2021	3	3	4	4	8	**22**
	Total	**16**	**18**	**16**	**17**	**26**	**93**
	FW	**1**	**1**	**1**	**1**	**3**	**7**
Prev. (ASR) per 100000	**2017**	829	1220	1770	2000	20000	**-**
	2018	883	1365	1802	1818	19231	**-**
	2019	833	1375	1600	1931	18750	**-**
	2020	843	1702	1826	1878	21739	**-**
	2021	843	1702	1826	1878	21739	**-**
	AVG	**846**	**1473**	**1765**	**1901**	**20292**	**-**
	FW	**926**	**1492**	**1724**	**1818**	**18750**	**-**

Field Work (FW) = Prospective Study from September, 2022 to June, 2023, AVG = Average value.

Table 3: Number of cases and Prevalence of prostate cancer in a population of Nigerian men in Abia, Anambra and Imo States Based on geographical location

	Period	**Location**			**Total**
		Abia	**Anambra**	**Imo**	
Screened Population	**2017**	300	230	316	**846**
	2018	342	376	275	**993**
	2019	406	467	303	**1176**
	2020	300	349	397	**1046**
	2021	327	300	389	**1016**
	Total	**1675**	**1722**	**1680**	**5077**
	FW	**84**	**100**	**120**	**304**
Number of cases	**2017**	5	4	6	**15**
	2018	6	7	4	**17**
	2019	7	8	4	**19**
	2020	9	6	5	**20**
	2021	11	6	5	**22**
	Total	**38**	**31**	**24**	**93**
	FW	**3**	**2**	**2**	**7**
Prev. (ASR) per 100000	**2017**	1667	1739	1899	-
	2018	1754	1862	1455	-
	2019	1724	1713	1320	-
	2020	3000	1719	1259	-
	2021	3364	2000	1285	-
	AVG	**2302**	**1807**	**1444**	-
	FW	**3571**	**2000**	**1667**	-

Table 4: Number of cases and Prevalence of prostate cancer in a population of Nigerian men in Abia, Anambra and Imo States Based on Lifestyle (Field Work)

Variable	Category	Population	No. of cases	Prev. (ASR) per 100000
Lifestyle	**Smoking**	65	4	6154
	Alcoholism	84	2	2381
	Regular exercise	155	1	465
Smoking	**1 – 2 sticks per day**	21	1	4762
	3 – 4 sticks per day	18	1	5556
	5 – 6 sticks per day	16	1	6250
	7 – 8 sticks per day	6	2	33333
	>8 sticks per day	4	2	50000
Alcohol	**1 – 3 litres per week**	31	1	3226
	4 – 6 litres per week	20	1	5000
	7 – 9 litres per week	20	2	10000
	10 – 12 litres per week	9	1	11111

	>12 litres per week	4	2	50000
Exercise	**1 – 2 times per month**	4	1	25000
	3 – 4 times per month	12	2	16667
	4 – 6 times per month	10	1	10000
	7 – 8 times per month	21	1	4762
	>8 times per month	108	2	1852

Table 5: Results of Chi-square test showing the Association between Age and Prostate Cancer Occurrence for Nigerian men in Abia, Anambra and Imo States

Period	**Age (years)**	**No. of cases**	**Screened (-)**	**P – value**
2021 - 2017	**40 – 45**	16	1838	
	46 – 50	18	1277	
	51 – 55	16	889	
	56 – 60	17	875	
	61 – 65	26	105	**< 0.001**
Field Work	**40 – 45**	1	107	
	46 – 50	1	66	
	51 – 55	1	57	
	56 – 60	1	54	
	61 – 65	3	13	**< 0.001**

Table 6: Results of Chi-square test showing the Association between Geographical location and Prostate Cancer Occurrence for Nigerian men in Abia, Anambra and Imo States

Period	**Location (State)**	**No. of cases**	**Screened (-)**	**P – value**

2017 - 2021	**Abia**	38	1637	
	Anambra	31	1691	
	Imo	24	1656	**0.191**
Field Work	**Abia**	3	81	
	Anambra	2	98	
	Imo	3	118	**0.651**

Table 7: Results of Chi-square test showing the Association between Lifestyle and Prostate Cancer Occurrence for Nigerian men in Abia, Anambra and Imo States (Field Work)

Variable	Category	No. of cases	Screened (-)	P – value
Lifestyle	**Smoking**	4	61	
	Drinking (alcohol)	2	82	
	Regular exercise	1	154	**0.042**
Smoking	**1 – 2 sticks per day**	1	20	
	3 – 4 sticks per day	1	17	
	5 – 6 sticks per day	1	15	
	7 – 8 sticks per day	2	4	
	>8 sticks per day	2	2	**0.024**
Alcohol	**1 – 3 litres per week**	1	30	
	4 – 6 litres per week	1	19	
	7 – 9 litres per week	2	18	
	10 – 12 litres per week	1	8	
	>12 litres per week	2	2	**0.031**
Exercise	**1 – 2 times per month**	1	3	
	3 – 4 times per month	2	10	
	4 – 6 times per month	1	9	
	7 – 8 times per month	1	20	
	>8 times per month	2	106	**0.033**

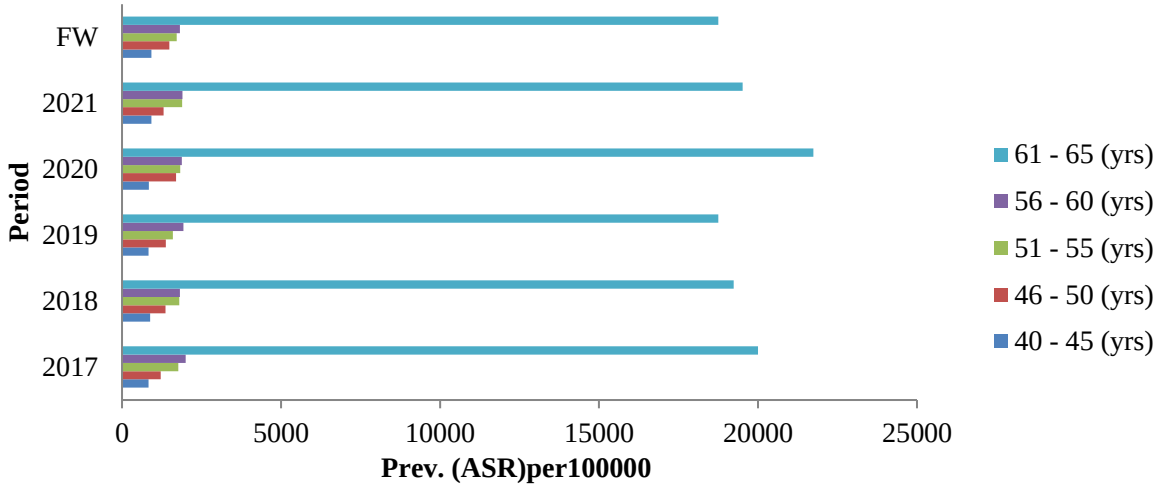

Figure 2: Prevalence of prostate cancer for Nigerian men in Abia, Anambra and Imo States based on age

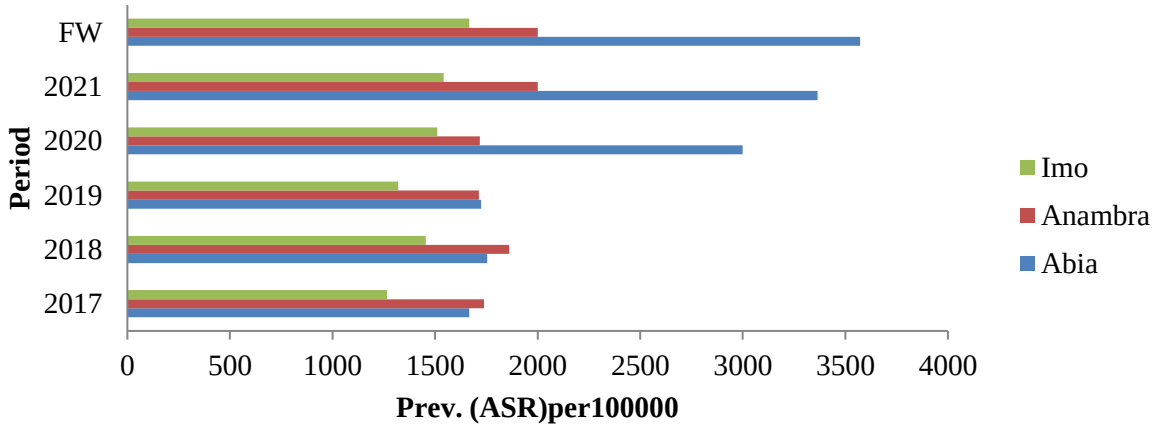

Figure 3: Prevalence of prostate cancer for Nigerian men in Abia, Anambra and Imo States based on geographical location

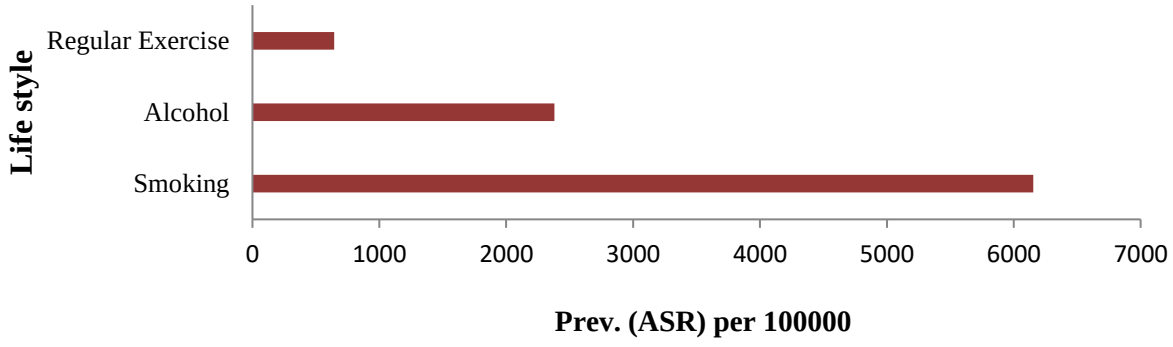

Figure 4: Prevalence of prostate cancer for Nigerian men in Abia, Anambra and Imo States based on lifestyle

Discussion

Although age has long been identified as risk factor of prostate cancer, more recent studies such as[1] have shown that prostate cancer can attack males of all ages. According to GLOBOCAN[2], Prostate cancer starts in Africa-American at age of 40 while for the Europeans it starts at the age of 50. This perception may be deceptive now that prostate cancer can attack younger people. According to Mayo Clinic[14], the highest incidence of prostate cancer occurs at the age of 65 but this study gives about 62years as age of peak incidence of prostate cancer (See Table 1). Interestingly, the result in Table 1 suggests that prostate cancer starts in Nigerian men at about 55years of age against 40years stated by GLOBOCAN for African men.

For patients diagnosed at 40 – 45years; **Table 2** shows prevalence of (863 per 100000) and (926 per 100000) for (2021-2017) and (Field Work: September, 2022 – June, 2023) respectively. Those diagnosed at 46 – 50years had prevalence of (863 per 100000) and (926 per 100000) for 2021-2017 and Field Work respectively. Those diagnosed at 61 – 65years had prevalence of (19846 per 100000) and (18750 per 100000) for 2021-2017 and Field Work respectively. These results confirm that age is a risk factor of prostate cancer as stated in previous works[9, 10]. Furthermore, the result of Chi-square tests, given in **Table 5** shows significant association between age and prostate cancer occurrence ($P < 0.001$). Cheryl *et al.*[9] got a similar result ($P < 0.0001$).**Figure 2** also shows that for every year; prevalence of prostate cancer increases with age of diagnosed patients. Actually, this result contradicts the recent findings that men of all ages can be diagnosed with prostate cancer[1].

The 2018 World Health Organization (WHO) report[2] on prostate cancer suggests that the prevalence of prostate cancer varies with geographical location. The results of this study tend to confirm it. **Table 3**shows prevalence of (2302 per 100000), (1807 per 100000) and (1444 per 100000) respectively for Abia, Anambra and Imo States from 2021 to 2017 and (3571 per 100000), (2000 per 100000) and (1667 per 100000) respectively for Abia, Anambra and Imo States for the Field Work. This variation may be due to differences in socio-economic conditions of people in the various locations as noted in previous works[1, 2]. This result also suggest that within the period of this study, the socio-economic condition of people in Abia State is worst compared to Anambra and Imo States. **Figure 3** also shows that except 2017 and 2018, Abia State prevalence of prostate cancer is highest each year compared to Anambra and Imo States. However, the results in Table 6 show insignificant association between geographical location and prevalence of prostate cancer ($P = 0.191$ for 2021 to 2017; $P = 0.651$ for Field Work).

Lifestyle has been identified in previous studies[9, 10] as risk factor of prostate cancer. The results of this study confirm it. **Table 4** shows prevalence of (6154 per 100000), (2381 per 100000) and (465 per 100000) respectively for smoking, drinking (alcohol) and regular body exercise. This result suggests that smoking accelerates occurrence of prostate cancer most, followed by drinking while regular exercise reduces the risk of occurrence. A study[9] showed significant association between lifestyle and prevalence of prostate cancer; the results of this study in **Table 7** also show significant association between lifestyle and prostate cancer occurrence ($P = 0.042$).Figure 4 illustrates this trend.

For smokers, **Table 4** shows highest prevalence of (50000 per 100000 for > 8 sticks/day), and lowest (4762 per 100000 for 1 – 2 sticks/day), which depicts that those that smoke at higher rates are more susceptible to prostate cancer. For those that drink alcohol, Table 4 also shows highest prevalence of

(50000 per 100000 for >12litres/week), and lowest (3226 per 100000 for 1 – 3litres/week) which also connotes that increase in drinking rate accelerates the occurrence of prostate cancer. For body exercise, **Table 4** shows highest prevalence of (2500 per 100000 for 1 – 2 times/month), and lowest (1852 per 100000 for > times/month) which suggests regular exercise reduces the risk of prostate cancer. The results in Table 7 further revealed that smoking rate (P = 0.024); drinking rate (P = 0.031) and rate of body exercise (P = 0.033), all have significant relationship with prostate cancer occurrence.

Conclusion

Based on the findings from this study, it is concluded that prostate cancer starts in Nigerian men at the age of 55year with highest occurrence at the age of 62years. Geographical location has no significant effect on the prevalence of prostate cancer in Nigerian men aged 40 to 65years. Lifestyle is a risk factor of prostate cancer in Nigerian men. Smoking increases the risk of prostate cancer likewise drinking of alcohol but regular body exercise reduces the risk of prostate cancer. Prevalence of prostate cancer is most in Abia state, followed by Anambra state but lesser in Imo state. Nigeria is experiencing rise in prevalence of prostate cancer.

Contribution to Knowledge

This study has revealed that the age of prostate cancer occurrence in Nigerian men is 55±7.5years. It has also shown that geographical location has no significant effect prostate cancer occurrence. The effects of smoking rate, rate of alcohol consumption and rate of body exercise on the prevalence of prostate cancer have been determined statistically.

Further Research

Further studies are recommended in which other variables such as education, occupation, marital status, diet, etc. will be considered.

Conflict of Interest

The authors of this paper declare no conflict of interest on this paper.

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