REVIEW ARTICLE

High mortality risk of prostate cancer patients in Asia and West Africa: A systematic review

Jude O. Okoye

Department of Medical Laboratory Science, Faculty of Health Sciences and Technology, College of Medicine, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria

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ABSTRACT

Globally, prostate cancer (PCa) is the second most preponderant cancer in men. It contributes to the high mortality-to-incidence ratio reported in West Africa and Asia largely due to low screening. The mortality risk is determined or predicted based on the prevalence of high-risk or aggressive PCa using a scoring or grading system such as Gleason score (GS), Gleason grade (GG), and prostate-specific antigen (PSA) level. In this review, peer-reviewed articles found on databases such as Google Scholar, Scopus, Web of Science, PubMed Central and, EMBASE were selected based on adherence to clinical guidelines for the classification of PCa. In West Africa and Asia, the result revealed that the frequency of high-risk PCa was 42% and 51.2% based on GS, 48.8% and 25.3% based on GG pattern, and 87.5% and 44.3% based on PSA level >10 ng/mL, respectively. Data revealed a high prevalence of high-risk PCa both in West Africa and Asia when compared with developed countries. However, the prevalence of high-risk PCa is higher in West Africa than in Asia. Studies have shown that high-risk PCas are associated with germline mutations and such mutations are prevalent in blacks and Asians than in whites. Thus, testing for germline mutations in patients with GS of ≥ 7, GG ≥ 3, high prostate density, low prostate volume, and PSA levels of >4.0 ng/mL may identify those at risk of developing lethal PCa and could reduce the mortality rates in Asia and West Africa.

Key words: Gleason grade, Gleason system, mortality risk, prostate cancer, PSA level

INTRODUCTION

Benign prostate hyperplasia (BPH) accounts for 78.3% of all prostate-related diagnoses and increases from 20% to 90% in men who are 40–80 years of age, whereas prostatic adenocarcinoma accounts for 92.4%–96.7% of all malignant tumors in the prostate.[1-3] Globally, the odds of developing prostate cancer (PCa) are 1 in 18 and the odds range from 1 in 52 for low sociodemographic index (SDI) countries to 1 in 9 in high SDI countries.[4] However, the mortality rate per new cases appears to be higher in the former than the latter. The reason for this could be linked to poverty, family history, genetics, and race.[5] This review evaluated and compared the aggressiveness of PCa in West Africa and Asia against that of developed countries, using diagnostic tools such as Gleason score (GS), Gleason grade (GG), and prostate-specific antigen (PSA) level.

MATERIALS AND METHODS

Peer-reviewed articles published between the year 2000 and 2020 were selected and screened using the PRISMA standard [Figure 1]. Sources of articles include Google Scholar, Scopus, Web of Science, PubMed Central, and EMBASE. Full-texts on clinical risk stratification of PCa cases were selected based on authors' adherence to the recommendations and reports

Address for correspondence: Mr. Jude Ogechukwu Okoye, Ph.D inview, Department of Medical Laboratory Science, Faculty of Health Sciences and Technology, College of Medicine, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.
E-mail: jog.okoye@unizik.edu.ng

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of the National Comprehensive Cancer Network (NCCN), and International Society of Urological Pathology.[6,7] To determine mortality risk or prevalence of aggressive PCa among Asian and West African patients in literature, PCa was clinically classified into low-, intermediate-, and high-risk groups using grading or scoring systems such as Gleason score (GS: ≤6, 7, and ≥8), Gleason grade (GG: 1 through 5) and PSA level (< 4, 4–10, and > 10 ng/mL). All cases with unknown or unassigned GS, GG, or PSA level were excluded. Chi-square analysis (GraphPad Prism version 6) was used to compare the frequency of high-risk PCa between West Africa and Asia.

MORTALITY-TO-INCIDENCE RATIOS AND SCREENING FOR PROSTATE CANCER

Over 1 million men are diagnosed with PCa every year with approximately 28% mortality.[8] Data from the GLOBOCAN 2012 report, as reviewed by Chen *et al.*,[9] show a significant inverse relationship between mortality-to-incidence ratios (MIRs) and life expectancy ($P = 0.0002$), with Nigeria having the second-lowest life expectancy (55 years) and the highest MIR (80.6) in the world. According to the report, the MIR (pooled) is also higher in Asian countries (51.6) than in the USA (13.0), Germany (18.4), and UK (23.3). The lower pooled MIR (18.2) and high life expectancy (80.3 years) in developed countries (the USA, Germany, and UK) when compared with that of Africa and Asia may be linked to low poverty status, high health budget, awareness and high screening services in developed countries. This is further underscored by the fact that a higher incidence rate of PCa is seen in the UK's affluent regions, whereas a higher mortality rate is observed in the UK's deprived regions.[10] Lower incidence of PCa is reported in China (9.1) than in the USA (75.7); however, higher mortality rate per new cases is reported in China than in the USA.[11-15] The latter could be ascribed to higher prevalence aggressive PCa in China (30%) than in the USA (0.5%).[13-15] Despite China's advanced economy, it accounts for 34% of the total PCa-related mortality in Asia.[16] This suggests that there are other co-founding factors to high mortality rate in Asia apart from poverty. To detect PCa early, some biomarkers have being proposed. One such biomarker is the PSA.

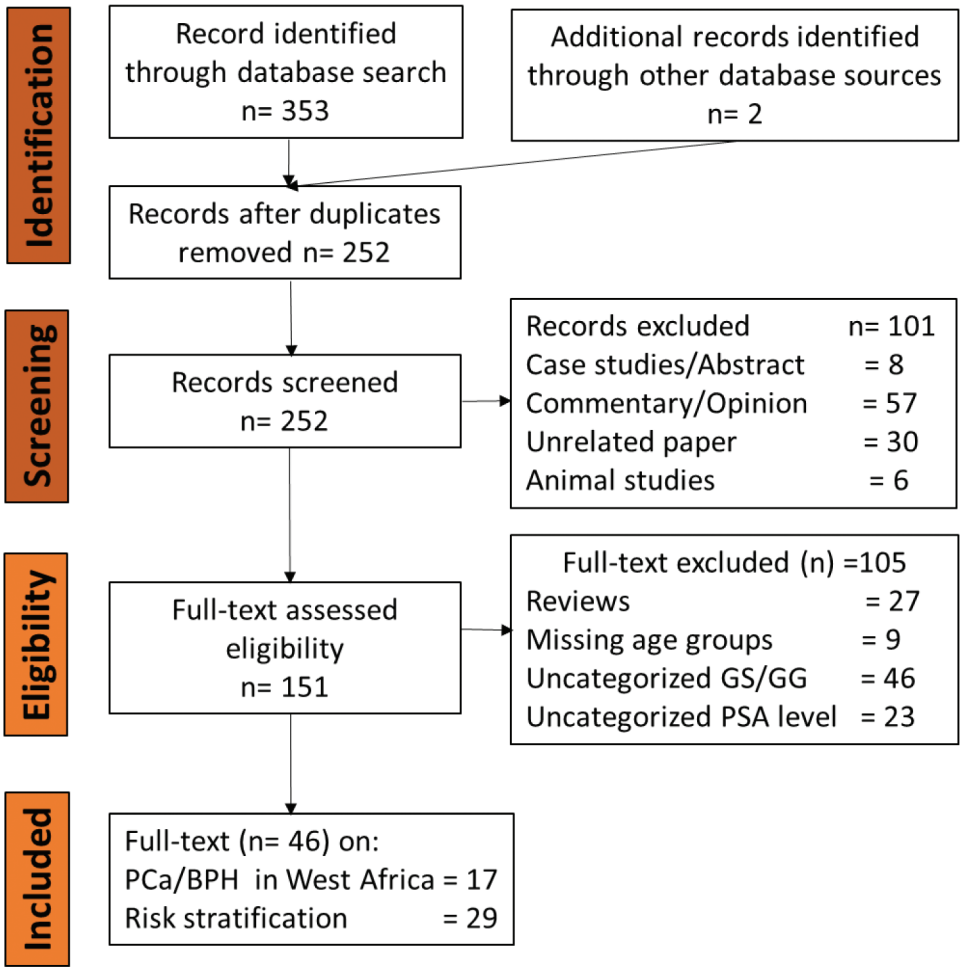

Figure 1: PRISMA flow diagram on prevalence of PCa/BPH and its risk stratification

Considering the sensitivity (81.9%–89.5%) and specificity (38.2%–52.3%) of PSA (at >4 ng/mL), many countries including Asian countries have been scaling up PCa screening.[17] However, the starting age for the screening remains controversial considering the high cost of a nationwide screening. It is hypothesized that the high mortality rate associated with PCa is linked to the age group commonly selected for screening (>70 years). As a good number of affected individuals stand the chance of being missed due to exclusion, the age group of 50–59 years is currently being advocated for screening.[18,19] Although the PSA level of > 4 ng/mL is considered appropriate for PCa screening, a PSA level of ≥3 ng/mL has also been recommended for screening among men ≤60 years.[20,21] It is believed that this will reduce the number of participants that are missed due to age-related low levels of PSA. Despite the fact that PCa is the leading cause of mortality in African men,[22] there is little or no concerted effort for a nationwide screening for PCa in West Africa. Most of the screening exercises are academic-related. This has minimal impact on MIR because there is hardly any follow-up on individuals with abnormal PSA, hence the high prevalence of occult PCa in Nigeria (8%).[23] Due to the free travel agreement between the Nigeria government and the governments of other West African countries, Nigeria is also inhabited by men from other west African countries. Thus Nigeria, the most populous country in Africa, is largely a microcosm of the West African subregion. The prevalence of abnormal PSA among apparently healthy men in West Africa ranges from 6.6% to 11.2%,[24-27] whereas the combined prevalence of abnormal digital rectal examination (DRE) and PSA >4 ng/mL ranges from 5.8% to 7.1%,[25,26]

In West Africa, the frequency distribution of BPH and PCa across all age groups appears to be similar due to the fact that the peak incidence of both diseases occurs in the age group of 60–69 years [Figure 2 and Table 1].[23,28-43] Although the symptoms of PCa and BPH are also similar, the latter is yet to be established as a direct precursor for the former. However, according to a prospective study carried out by Aghaji and Odoemene,[44] 92% of patients (age range = 64–89 years) who were diagnosed with BPH developed PCa one to 10 years postprostatectomy (mean time interval = 6.6 years). According to their follow-up report, approximately 21% of the patients under surveillance died after a period of 1 year. Based on these reports, it is recommended that patients diagnosed of BPH who have had prostatectomy should be actively monitored and tested for germline mutations associated with aggressive PCa, especially those who are >54 years.

GLEASON SCORE OF PROSTATE CANCER IN WEST AFRICA AND ASIA

GS is a prognostic tool that informs the course of treatment for patients diagnosed with PCa. It identifies cases that are likely to be metastatic.[7] Using GS to stratify the death risk among men with PCa, the frequency of low-risk (GS ≤ 6), intermediate-risk (GS7), and high-risk (GS ≥ 8) PCa ranges from 42% to 53%, 36% to 41%, and 6% to 15%, respectively, in the USA.[45-47] In the UK, the frequency of GS ≤ 6, GS 7, and GS ≥ 8 ranges from 38% to 56%, 34% to 38%, and 10% to 21%, respectively,[48-50] whereas in Germany the frequency is 11%, 48%, and 36%, respectively.[51] These figures suggest that the prevalence of high-risk PCa is lower in the USA, the UK, and Germany than in West Africa and

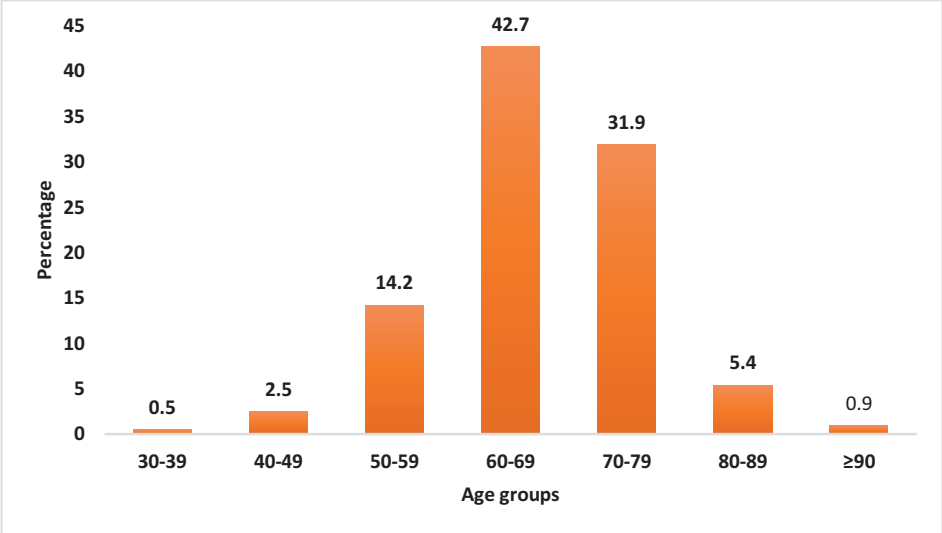

Figure 2: Frequency distribution of benign prostate hyperplasia across age groups,[28-33] showing higher and lower frequency of BPH in the age groups of 60–69 and 30–39 years, respectively, when compared with other groups. It also shows that BPH can be found in individuals younger <40 years of age

Asia [Table 2].[3,28,29,31,36,37,40,41,52-61] An earlier study shows that the death risk of patients with a GS of 7 to 10 range from 29% to 43%, irrespective of age.[62] This might be due to a lower prevalence of pathogenic mutation (BRCA1/2) in GS ≤ 6 (0.6%) than in GS ≥ 7 (1.2%–3.4%).[63] Another study shows that the metastasis hazard ratio of GS8 and GS9 is 3.5 and 9.3, respectively, when compared with GS7.[64]

Currently, the Gleason grading pattern (GG) is being proposed by John Hopkins Hospital as a more reliable tool than the Gleason scoring pattern.[65] Of note, the GG pattern

Table 1: Frequency of prostate cancer across age groups in West Africa

Year	City	No. of cases	Age range (%)						
			30–39	40–49	50–59	60–69	70–79	80–89	≥ 90
[34]2019	Port H.	676	4 (0.6)	21 (3.1)	122 (18.1)	224 (33.1)	223 (33.0)	73 (10.8)	9 (1.3)
[35]2018	Calabar	563	1 (0.2)	11 (2.0)	104 (18.5)	213 (37.8)	153 (27.2)	59 (10.5)	22 (3.9)
[36]2018	Calabar	111	0 (0.0)	4 (3.6)	20 (18.0)	39 (35.1)	39 (35.1)	6 (5.4)	3 (2.7)
[37]2018	Zaria	211	2 (0.8)	7 (3.3)	38 (18.3)	77 (36.5)	61 (29.0)	23 (10.5)	3 (1.5)
[23]2017*	Lagos	7	0 (0.0)	0 (0.0)	3 (42.9)	1 (14.3)	2 (28.6)	1 (14.3)	0 (0.0)
[30]2017	Enugu	160	7 (4.4)	35 (21.9)	70 (43.8)	34 (21.3)	13 (8.1)	1 (0.6)	0 (0.0)
[38]2015	Ibadan	50	0 (0.0)	1 (2.0)	4 (8.0)	20 (40.0)	25 (50.0)	0 (0.0)	0 (0.0)
[39]2015	Zaria	145	2 (1.3)	7 (4.6)	28 (18.5)	59 (39.0)	49 (32.2)	0 (0.0)	0 (0.0)
[29]2015	Lagos	89	0 (0.0)	2 (2.2)	8 (9.0)	35 (39.3)	35 (39.3)	9 (10.1)	0 (0.0)
[40]2013	Lagos	35	0 (0.0)	1 (2.9)	10 (28.6)	24 (68.6)	0 (0.0)	0 (0.0)	0 (0.0)
[41]2012	Port H.	383	0 (0.0)	4 (1.0)	56 (14.6)	110 (28.7)	154 (40.2)	55 (14.4)	4 (1.0)
[31]2011	Benin	252	0 (0.0)	1 (4.0)	36 (14.3)	88 (34.9)	95 (37.7)	28 (11.1)	4 (1.6)
[28]2011	Lagos	222	0 (0.0)	9 (4.1)	32 (14.4)	95 (42.8)	74 (33.3)	9 (4.1)	3 (1.4)
[42]2010	Ilorin	90	0 (0.0)	4 (4.4)	22 (24.4)	31 (34.4)	24 (26.7)	8 (8.9)	1 (1.1)
[43]2005	Ilorin	114	1 (0.9)	4 (3.5)	16 (14.0)	43 (37.7)	30 (26.3)	7 (6.1)	4 (3.5)
[33]2004	Kano	37	0 (0.0)	2 (5.4)	8 (21.6)	18 (48.6)	6 (16.2)	2 (5.4)	1 (2.7)
[32]2000	Zaria	95	0 (0.0)	4 (4.2)	19 (20.0)	41 (43.2)	29 (30.5)	2 (2.1)	0 (0.0)
Total		**3240**	**17 (0.5)**	**117 (3.6)**	**596 (18.4)**	**1152(35.6)**	**1012 (31.2)**	**283 (8.7)**	**54 (1.7)**

H = harcourt

*Autopsy based (occult PCa)

The table shows higher and lower frequency of PCa in the age groups of 60–69 and 30–39 years, respectively, when compared with other groups. It also shows that PCa can found in individuals younger <40 years of age

Table 2: Risk stratification of prostate cancer patients by Gleason score

Authors/reference	City/country/region	Classification of risk		
		Low	Inter-mediate	High
		GS ≤ 6	GS 7	GS ≥ 8
Obiorah and Ofuru[34]	Port H.	282 (41.7)	97 (14.7)	297 (43.9)
Abubakar *et al.*[37]	Zaria	68 (32.2)	43 (20.4)	100 (47.4)
Isiwele *et al.*[35]	Calabar	5 (0.9)	297 (52.8)	261 (46.4)
Bassey *et al.*[36]	Calabar	42 (44.2)	20 (21.1)	33 (33.4)
Nwafor *et al.*[29]	Lagos	21 (33.9)	20 (32.3)	21 (33.9)
Ikuerowo *et al.*[40]	Lagos	11 (25.6)	20 (46.5)	12 (27.9)
Sapira *et al.*[41]	Port H.	58 (30.9)	53 (28.2)	77 (41.0)
Ugare *et al.*[52]	Calabar	33 (37.1)	22 (24.7)	34 (38.2)
Anunobi *et al.*[28]	Lagos	112 (50.9)	20 (9.1)	88 (40.0)
Forae *et al.*[31]	Benin	122 (58.1)	20 (16.4)	68 (32.4)
Total (*N* = 2357)	**West Africa**	**754 (32.0)**	**612 (26.0)**	**991 (42.0)**
Uemura *et al.*[53]	UFO	176 (9.1)	465 (24.1)	1288 (66.8)
Faroog *et al.*[3]	India	11 (19.3)	21 (36.8)	25 (43.9)
Awang *et al.*[54]	Malaysia	10 (12.8)	57 (73.1)	11 (14.1)
Heo *et al.*[55]	Korea	218 (32.3)	180 (26.7)	277 (41.0)
Xu *et al.*[56]	China	10 (9.4)	22 (20.8)	69 (65.1)
Zhu *et al.*[57]	China	47 (26.7)	74 (42.0)	55 (31.3)
Sarikaya *et al.*[58]	Turkey	66 (44.6)	35 (23.6)	47 (31.8)
Osman *et al.*[59]	Saudi Arabia	19 (25.0)	24 (31.6)	33 (43.4)
Shahab *et al.*[60]	Indonesia	21 (47.7)	16 (36.4)	7 (15.9)
Tsang *et al.*[61]	Hong Kong	229 (79.8)	42 (14.6)	16 (5.6)
Total (*N* = 3571)	**Asia**	**807 (22.6)**	**936 (26.2)**	**1828 (51.2)**

H = harcourt, WA = West Africa, fight against prostate cancer = UFO (countries: *n* = 8; Japan, China, South Korea, Singapore, Malaysia, Thailand, Taiwan, India)

The table shows higher prevalence of intermediate-risk and high-risk PCa in Asia than in West Africa ($P = 0.211$ and $P < 0.001$, respectively) and shows higher prevalence of low-risk PCa in West Africa than in Asia ($P < 0.001$)

is yet to be fully and globally used in clinical diagnosis, especially in Africa. In the USA, the prevalence of GG1, GG2, GG3, GG4, and GG5 is approximately 40%, 34%, 13%, 9%, and 4%, respectively.[46] Again, these figures show that the prevalence of high-risk PCa is higher in West Africa and Asia [Table 3] than in the USA.[35-37,39,52,54,58,66-71] Unlike the GS system which revealed significantly and significantly higher prevalence of intermediate-risk and high-risk PCa in Asia than in West Africa ($P = 0.211$ and $P < 0.001$, respectively), the more reliable GG system revealed significantly higher prevalence of both intermediate-risk (GG3) and high-risk (GG4/5) PCa in West Africa than in Asia ($P < 0.001$). The tool shows that patients with GG1, GG2, GG3, GG4, and GG5 have risk-free survival of 96%, 88%, 63%, 48%, and 26%, respectively.[72] The gradual decline in risk-free survival from GG1 to GG5 may be related to the increase in frequency of ataxiatelangiectasia mutated (ATM)/BRCA1/2 mutations from GG1 through GG5; 1.5%, 3.0%, 8.3%, 5.6%, and 6.5%, respectively.[73] Wei *et al.*[68] also observed a higher frequency of GG5 in carriers of germline mutations (BRCA1/2 and ATM) than in noncarriers (65% vs. 46%). They also observed high metastasis in carriers than in noncarriers (71% vs. 58%). As most of the PCa cases in West Africa and Asia are within GG3 to GG5 [Table 3], it is hypothesized that the risk-free survival of patients with PCa is low, especially in West Africa. This is supported by studies that show that 50%–75% of PCa observed in West Africa are either advanced, poorly differentiated or metastatic.[20-23]

Furthermore, based on the PSA level, the prevalence of low-, intermediate-, and high-risk PCa in the USA is 23%, 68%, and 10%, respectively.[74] This report also shows that the prevalence of high-risk PCa is higher in West Africa and Asia [Table 4] than in the USA.[33,35-37,58,60,74-76] In addition, the prevalence of high-risk PCa, based on PSA >10 ng/mL, is higher in West Africa than in Asia ($P < 0.001$). This latter could be considered a tiebreaker between GS and GG patterns of risk stratification and supports the fact that

Table 3: Risk stratification of prostate cancer patients by Gleason grade

Authors/reference	City/country/region	Risk stratification				
		Low		Inter-mediate	High	
		GG1	GG2	GG3	GG4	GG5
Emiogun *et al.*[66]	Lagos	37 (12.9)	36 (12.5)	33 (11.5)	58 (20.2)	123 (42.9)
Isiwele *et al.*[35]	Calabar	5 (0.9)	48 (8.5)	249 (44.2)	202 (35.9)	59 (10.5)
Bassey *et al.*[36]	Calabar	12 (11.2)	4 (3.7)	38 (35.5)	34 (31.8)	19 (17.8)
Abubakar *et al.*[37]	Zaria	68 (32.2)	13 (6.2)	29 (13.7)	63 (29.9)	38 (18.0)
Oluwole *et al.*[39]	Zaria	45 (31.0)	10 (6.9)	60 (41.4)	30 (20.7)	0 (0.0)
Ugare *et al.*[52]	Calabar	1 (1.1)	8 (9.0)	22 (24.7)	48 (53.9)	10 (11.2)
Total (*N* = 1403)	**West Africa**	**168 (12.0)**	**119 (8.5)**	**431 (30.7)**	**435 (31.0)**	**250 (17.8)**
Taguchi *et al.*[67]	Japan	119 (11.6)	395 (38.6)	148 (14.5)	225 (22.0)	135 (13.2)
Wei *et al.*[68]	China	13 (4.2)	25 (8.0)	38 (12.2)	86 (27.5)	150 (48.1)
Awang *et al.*[54]	Malaysia	10 (12.8)	36 (46.2)	21 (26.9)	1 (1.3)	10 (12.8)
Cho *et al.*[69]	South Korea	1349 (46.8)	571 (19.8)	410 (14.2)	406 (14.1)	147 (5.1)
Yeong *et al.*[70]	Singapore	249 (39.0)	258 (40.4)	79 (12.4)	31 (4.9)	21 (3.3)
Khan *et al.*[71]	Pakistan	0 (0.0)	7 (12.3)	8 (14.0)	18 (31.6)	24 (42.1)
Sarikaya *et al.*[58]	Turkey	66 (44.6)	21 (14.2)	14 (9.5)	17 (11.5)	30 (20.3)
Total (*N* = 5141)	**Asia**	**1809 (35.2)**	**1313 (25.5)**	**718 (14.0)**	**784 (15.2)**	**517 (10.1)**

The table shows higher prevalence of GG4 in both in West Africa and Asia than other GGs. It also reveals higher prevalence of intermediate-risk (GG3) and high-risk (GG4/5) PCa in West Africa than in Asia ($P < 0.001$) but shows lower prevalence of low-risk (GG1/2) PCa in West Africa than in Asia ($P < 0.001$)

Table 4: Risk stratification of patients with prostate cancer by PSA level

Authors/reference	City/country/region	Classification of risk (PSA level)		
		Low	Inter-mediate	High
		<4 ng/mL	4–10 ng/mL	>10 ng/mL
Abubakar *et al.*[37]	Zaria	0 (0.0)	16 (7.6)	195 (92.4)
Bassey *et al.*[36]	Calabar	7 (6.9)	14 (13.9)	80 (79.2)
Ikuerowo *et al.*[35]	Lagos	0 (0.0)	2 (4.7)	41 (95.3)
Emokpae *et al.*[33]	Kano	3 (8.1)	7 (20.6)	27 (73.0)
Total (*N* = 392)	**West Africa**	**10 (2.5)**	**39 (11.9)**	**343 (87.5)**
Wang *et al.*[75]	China	7 (1.6)	173 (40.2)	250 (58.1)
Huang *et al.*[76]	China	9 (6.6)	37 (27.2)	90 (66.2)
Sarikaya *et al.*[58]	Turkey	57 (4.0)	429 (49.3)	24 (52.0)
Shahab *et al.*[60]	Indonesia	17 (4.2)	104 (26.2)	276 (69.6)
Kang *et al.*[74]	Korea	34 (6.8)	233 (46.4)	235 (46.8)
Total (*N* = 1975)	**Asia**	**124 (6.3)**	**976 (49.4)**	**875 (44.3)**

The table shows higher prevalence of high-risk PCa in West Africa than in Asia ($P < 0.001$) but lower prevalence of intermediate-risk and low-risk PCa in West Africa than in Asia ($P < 0.001$ and $P = 0.004$, respectively)

the prevalence of high-risk PCa is higher in West Africa than in Asia. The difference between the two regions could be accrued to large-scale PSA screening, early detection germline mutation in high-risk groups, and management of identified cases in Asia.[77,78] The high frequency of PCa in the age group of 50–59 years [Table 1] further compounds the issue of high MIR in West Africa.[79,80] This calls for a review of the starting age for PSA testing. Although Carlsson *et al.*[19] advocate that screening should start at ≥ 50 years, it will be more appropriate for screening to start at ≥40 years in West Africa, as earlier proposed by Vickers *et al.*,[81] considering that 18.9% of PCa in the region occurs in the age range of 50–59 years. Thus, starting the screening exercise at ≥40 years may forestall the progression of the disease and reduce the mortality rate of PCa in the age range of 50–69 years.

RACE AND ANCESTRAL MIGRATION INFLUENCES ON INCIDENCE AND MORTALITY

Ancestral migration has been shown to increase the incidence of PCa among Asians and Africans.[16] In England, the age-standardized incidence rate (ASR) of PCa per 100,000 for Black African and Black Caribbean is 99.2 and 110.1, respectively, whereas that of white and Asian is 44.9 and 21.3, respectively.[82] Interestingly, country-of-origin based GLOBACON estimate shows that ASR incidence of PCa for Black African and Black Caribbean is 21.1 and 71.1, respectively, whereas that of Asians ranges from 1.9 to 5.1.[82] Possibly, emigrational amplification of mutated genes may be occurring considering the fact that the incidence of PCa in men living in West Africa (61.3–127) is lower than the incidence in men with African ancestry who are living in the Caribbean (56.4–304), United State (258.3) and Europe (139.3–647.0).[83] As at 2004, the incidence–mortality ratio of PCa in Chinese men and Chinese-Americans is approximately 1:50 and 1:9, respectively.[84] This further supports the fact that race and ancestral migration favors higher incidence rates of PCa in offspring. According to literature review carried out by Chung *et al.*[11] in Asia countries, age, family history, consumption of fat, eggs, red meat, fat, and dairy are risk factors for PCa.

Higher mortality rate has also been reported in Black Non-Hispanics PCa patients (47.2%) than in white Hispanic PCa (19.9%).[14] According to Heyns's review, the mortality ratio between blacks and whites diagnosed of PCa is 2.4:1.[85] The race related differences in mortality of patients with PCa could be linked to variation of mutation frequency. This is buttressed by the fact that the prevalence of BRCA1 and BRCA2 are higher in blacks than in whites (14.3% vs. 5.0% and 3.6% vs. 3.5%, respectively), whereas the prevalence of ATM is higher in white than in blacks (0.7% vs. 0.0%).[86] A recently published study reveals that the standard mortality rate (SMR) of BRCA1 and BRCA2 were 1.8 and 3.9, respectively.[50] These reports suggest that ancestral or family history and environmental factors determine the degree to which an individual is affected by germline mutations.

RELATIONSHIP BETWEEN RACE, FAMILY HISTORY, AND AGGRESSIVE PROSTATE CANCER

PCa is the most inherited cancer.[27] According to Pritchard,[87] the prevalence of pathogenic germline mutation is higher in PCa patients who have a first degree relative with breast, ovarian or colorectal cancer (71%) than in those without an affected first degree relative (22%). The effect of family history is commonly seen in blacks than in Whites.[88] In the USA, the prevalence of pathogenic mutation in BRCA1/2 is higher in African American (1.4%) than in Caucasians (1.0%).[63] The reason for the difference could be due to some inherited genes or family history. This is underscored by the reports of Chandrasekar *et al.*[86] which shows that the prevalence of hereditary PCa (HPC) are higher in blacks than in white, with differences of 1.2%. According to Lindström *et al.*,[89] family history is strongly associated with lethal/aggressive PCa. Their study revealed that a poor father survival implies a poor son survival with hazard ratio of 2.07. Approximately 12% of DNA repair genes occur in men with metastatic PCa than in the general population.[88] Following genome-wide investigations, approximately 163 single-nucleotide polymorphisms (SNPs) have been linked to the development of PCa. These SNP accounts for 28% of the family history associated with PCa. Individually, these SNPs exact minor effects but collectively they prove debilitating. Individuals with the SNPs are considered to have low and high genetic risk score (GRS) than the general population when their risk odd ratios are less than 1 and greater than 1, respectively.[90] In other to identify men who should be actively monitored for PCa, GRS appears to be a broad and reliable risk index for PCa than DNA repair genes (BRCA2 and ATM) or family history.[90] However, BRCA1/2 mutations are early indicators of PCa, whereas ATM mutation identifies individuals at risk of developing aggressive or metastatic PCa.[50,88] Thus, testing for a combination of GRS, BRCA1/2 and ATM with active follow up of positive individuals may reduce PCa related mortality to a great extent.

CONCLUSION

The high prevalence of high-risk PCa in Asia and West Africa, when compared with the USA, the UK, and Germany,

could be a reflection of the level of screening and treatment of identified cases in both regions. The lower prevalence of high-risk PCa in Asia when compared with West Africa could be due to race, differences in family history and inherited germline mutations. However, it is unclear whether the low interest in identifying germline mutations in West African patients is due to low incidence of the disease in the subcontinent or lack of funds. Screening individuals who are aged >50 and ≤ 69 years and with a family history of prostate, breast, ovarian or pancreatic cancer, or Lynch syndrome may improve stratification and eliminate the need to test the entire patients, thereby lowering the cost of testing for germline mutations. Testing for BRCA2, BRCA1 and ATM in selected patients who have GS ≥ 7 or GG ≥ 3, high prostate density, low prostate volume and PSA levels of >4.0 ng/mL may aid early identification of men at risk of developing lethal or aggressive PCa.

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Conflicts of interest

There are no conflicts of interest.

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