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Health locus of control and prostate cancer screening uptake following prostate cancer education among male college students in Nigeria. A quasi-experimental pretest–post-test control group study.

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Abstract

Background

Prostate cancer is the most frequently diagnosed malignancy among Nigerian men and a leading cause of cancer-related mortality in sub-Saharan Africa. Health locus of control (HLoC) is a well-established psychosocial construct with demonstrated influence on preventive health behaviour. This study investigated the effect of a structured disease education programme on knowledge, attitude, and uptake of prostate cancer screening among male college students in Oyo State, Nigeria, and examined the moderating roles of health locus of control and religion.

Methods

A quasi-experimental pretest-post-test control group design with a 2x2x2 factorial matrix was adopted. Two hundred (200) male students were recruited from government-owned Colleges of Education in Oyo State using a multi-stage sampling technique. Participants in the experimental group received an eight-week structured prostate cancer disease education programme; the control group received personal hygiene education. Data were collected using validated instruments: the Knowledge of Prostate Cancer Screening Scale (KPCSS, α=0.78), Attitude Towards Prostate Cancer Screening Scale (ATPCSS, α=0.81), and Uptake of Prostate Cancer Screening Scale (UPCSS, α=0.77). Multivariate Analysis of Covariance (MANCOVA) was used to test hypotheses at $p<0.05$.

Results

Disease education significantly improved knowledge ($F(1,192) = 139.204$, $p<0.001$, $\eta^2=0.420$), attitude ($F(1,192) = 184.553$, $p<0.001$, $\eta^2=0.490$), and uptake ($F(1,192) = 143.890$, $p<0.001$, $\eta^2=0.428$) of prostate cancer screening. Locus of control had a significant main effect on uptake ($F(1,192) = 3.624$, $p=0.048$, $\eta^2=0.019$), with participants of external locus of control recording higher post-intervention uptake scores. Religion had no significant main effect on any outcome.

Conclusions

Disease education is an effective intervention for improving prostate cancer screening behaviour among male college students in Nigeria. Health locus of control differentially predicts screening uptake, with externally oriented individuals responding more strongly post-intervention.

Recommendation

Targeted health education programmes in tertiary institutions should incorporate psychosocial constructs such as locus of control to optimise uptake of cancer screening.

Keywords: Prostate cancer; Health locus of control; Disease education; Screening uptake; Knowledge; Attitude; Nigeria; Cancer prevention; Sub-Saharan Africa.
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Background

Prostate cancer continues to represent a major public health challenge globally, with a disproportionate burden affecting men of African descent. Globally, it is the second most common cancer in men, with 1.47 million new cases estimated by GLOBOCAN 2022 [1]. Sub-Saharan Africa bears an especially severe burden: in 2022, the region recorded an estimated 86,364 new prostate cancer cases and 48,786 deaths, making it the third most incident cancer overall and one with the highest mortality rates in the world [2, 3]. Recent trend analyses using the African Cancer Registry Network data have demonstrated that prostate cancer incidence rates are rising rapidly across the continent in many countries by 2–10% annually a pattern attributed primarily to improving health care capacity and broader, if still limited, use of PSA testing [4]. Nigeria occupies a particularly acute position within this epidemiological landscape. Prostate cancer is the leading male malignancy in the country, with the Global Cancer Observatory estimating approximately 18,000 new cases annually as of 2022 [5]. Incidence rates have been documented at 114 to 127 per 100,000 men, among the highest reported anywhere in sub-Saharan Africa [6, 7]. Critically, a national cancer registry analysis confirmed that prostate cancer is also the second most common cancer among young Nigerian men below 55 years, representing 8.86% of all prostate cancer cases, which directly underscores the relevance of early health education in younger cohorts [8].

Early detection through screening remains the most effective strategy for reducing prostate cancer mortality. Modalities include the Prostate Specific Antigen (PSA) blood test and Digital Rectal Examination (DRE). The American Cancer Society recommends risk-stratified screening based on PSA values, with more frequent testing for higher-risk individuals [9]. Yet, across Nigeria and sub-Saharan Africa, awareness and uptake remain critically low. A cross-sectional study in Ido-Ekiti, Ekiti State found that over 74% of respondents had poor knowledge of prostate cancer and screening methods, with an uptake rate of only 18.2% [10]. Similarly, a 2022 study in urban Lagos documented consistently low screening practices despite moderate awareness [11]. A scoping review and meta-analysis of Nigerian evidence from 2020 to 2024 found that observational studies dominated the literature, with few intervention-based designs and almost no reporting of implementation outcomes, confirming a persistent gap in experimental evidence [12].

Barriers to screening documented in recent Nigerian research extend beyond cognitive awareness to encompass structural, cultural, and psychosocial dimensions. Qualitative evidence from a 2024 study using focus group discussions with patients, caregivers, and healthcare providers at two Nigerian tertiary hospitals identified fear of diagnosis, stigma, financial costs, healthcare provider trust, and limited access to screening facilities as key inhibitors [13]. Cultural and masculinity-related norms, including the perception of screening as a sign of vulnerability, have also been implicated as contextually significant barriers in urban communities [14]. Notwithstanding, healthcare professionals' recommendations remain one of the most powerful facilitators of screening uptake, bridging the gap between awareness and behaviour [11].

Health Locus of Control (HLoC), first conceptualised by Wallston and Wallston, is a widely employed psychosocial framework for understanding health behaviour. It distinguishes between individuals who attribute health outcomes to their own actions (internal locus of control) versus those who attribute outcomes to external forces, including powerful others such as health educators and physicians, or chance [15]. HLoC has been identified as a determinant of health-seeking behaviour, with potential implications for cancer screening. While some earlier literature linked internal locus of control to greater engagement in health behaviour modification, more recent evidence suggests that the relationship is context-dependent, particularly where intervention delivery relies on the authority of health educators [16]. Religion is another important psychosocial moderator in Nigerian health contexts, with both Christian and Islamic perspectives influencing perceptions of disease causation and prevention-seeking [17].

Despite growing observational evidence, experimental studies examining the effectiveness of structured educational interventions targeting prostate cancer screening in Nigerian tertiary institutions remain scarce. College students, while younger than the typical high-risk demographic, constitute a strategic population: as future community health educators and family decision-makers, early investment in their cancer literacy can generate downstream preventive behaviour change across communities. The present study therefore investigated the effect of a structured disease education programme on knowledge, attitude, and uptake of prostate cancer screening among male College of Education students in Oyo State, Nigeria, with particular focus on the moderating roles of health locus of control and religion.

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Methods

Study Design

A quasi-experimental pretest-posttest control group design with a 2×2×2 factorial matrix was adopted. The design facilitated systematic examination of the main and interaction effects of treatment (prostate cancer education vs. personal hygiene education), religion (Christianity vs. Islam), and health locus of control (internal vs. external) on three dependent variables: knowledge, attitude, and uptake of prostate cancer screening. Pretested data served as covariates in all analyses. The study was registered prospectively prior to recruitment.

Study Timeline

The study was conducted across three discrete phases. **Phase 1 (Preparatory): 1 June – 31 August 2021.** This phase encompassed institutional ethical approval, development and pilot-testing of instruments, recruitment and training of research assistants, and initial college authority liaison. **Phase 2 (Intervention): 6 September 2021 – 20 January 2022.** Pretest data collection was completed between 6–10 September 2021. The eight-week structured prostate cancer education programme (12 sessions of two hours each) was delivered from 13 September to 3 December 2021, followed by a one-week washout period. Posttest assessment was administered on 10–14 January 2022. **Phase 3 (Analysis and Reporting): February – May 2022.** Data cleaning, statistical analysis, manuscript drafting, and peer review submission were completed during this phase

Study Setting and Population

The study was conducted in government-owned Colleges of Education in Oyo State, southwest Nigeria. The population comprised all full-time male students enrolled during the 2021/2022 academic session. Colleges of Education were selected because they constitute an accessible yet understudied setting for health education interventions and their students represent future educators with potential for community health behaviour diffusion.

Sample Size Determination

The required sample size was determined through an a priori power analysis conducted using G*Power 3.1 (Faul et al., 2009) for a MANCOVA with three dependent variables. Based on a medium effect size (Cohen's $f = 0.25$, corresponding to $\eta^2 \approx 0.06$), a two-tailed significance level of $\alpha = 0.05$, a desired statistical power ($1-\beta$) of 0.80, and one primary between-subjects factor (treatment group), the minimum required total sample was estimated at 176 participants. To account for anticipated attrition of approximately 10–15% based on rates reported in comparable quasi-experimental studies in Nigerian tertiary settings the target sample was inflated to 200 participants (100 per group). This sample also satisfied the practical requirement of having 25 participants per cell in the 2×2×2 factorial design (8 cells × 25 = 200), ensuring adequate cell frequencies for MANCOVA.

Sampling Technique and Random Allocation

A total of 200 male participants were recruited using a five-stage multi-stage sampling procedure. In Stage 1, purposive sampling was used to identify three government-owned Colleges of Education: Federal College of Education (SP), Oyo; Oyo State College of Education, Lanlate; and Emmanuel Alayande College of Education, Oyo Town.

Unit of Assignment: The college, not the individual student, constituted the primary unit of random allocation. This decision was made to prevent contamination that would arise if students from experimental and control conditions interacted within the same institutional environment. In Stage 2, simple random sampling (fishbowl draw without replacement) was applied to the two government-owned colleges to select one for inclusion, yielding Emmanuel Alayande College of Education, Oyo Town. In Stage 3, the two remaining eligible colleges (Federal College of Education, Akinmorin and Emmanuel Alayande College of Education, Oyo Town) were randomly assigned to experimental or control conditions using a coin toss conducted in the presence of two independent witnesses: Federal College of Education, Oyo was allocated to the experimental group; Emmanuel Alayande College of Education, Oyo Town was allocated to the control condition. The allocation sequence was generated independently by a research colleague not involved in recruitment or data collection.

Minimising Bias from Non-Individual Randomisation:

Given that individual-level randomisation was not feasible as students within a single institution share social networks and academic environments several procedures were employed to minimise selection bias. First, baseline

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equivalence of the two groups was systematically assessed across key demographic variables (age, religion, locus of control classification, and year of study) and across all three primary outcome measures at pretest. Second, pretest scores were entered as covariates in all MANCOVA models to statistically control for any residual pre-existing differences between groups. Third, both groups received an active educational intervention (prostate cancer education vs. personal hygiene education) of equivalent duration and format, thereby controlling for attention and contact effects.

In Stage 4, four schools spanning disciplines (Science, Education, Arts and Social Sciences, and Languages) were purposively selected from each college. In Stage 5, 25 volunteer students per school were recruited. Only full-time students who provided written informed consent were included; external and part-time students were excluded.

Intervention

The experimental group received a structured Prostate Cancer Disease Education programme delivered over eight weeks (12 sessions of two hours each) between **13 September and 3 December 2021**. The curriculum covered: an overview of cancer; epidemiology and risk factors of prostate cancer; aetiology; signs and symptoms; screening methods (PSA and DRE); barriers to screening; and the importance of early detection. Pedagogical approaches included conventional didactic instruction, group discussion, chart and poster displays, and printed lecture notes. The control group received a comparable Personal Hygiene Education programme addressing personal hygiene practices, pathogen contact and disease prevention, and disease transmission. Both programmes were delivered in residential camp settings to ensure logistical control over content fidelity and participant attendance. Posttest assessment was conducted on **10–14 January 2022**, one week following the washout period. Five trained research assistants supported data collection.

Blinding

Participant blinding: Complete blinding of participants was not feasible, as participants were necessarily aware of which educational programme they were receiving. However, participants in neither group were informed of the specific outcome measures or hypotheses under investigation at the time of enrolment, thereby reducing hypothesis-guessing and demand characteristic effects.

Assessor/data collection blinding: The five research assistants responsible for administering pretests and posttests were not involved in delivering either educational programme. They were instructed not to discuss intervention content with participants during assessment. This separation of intervention delivery from outcome assessment constitutes partial assessor blinding and reduces the likelihood of interviewer bias.

Principal investigator: The principal investigator was involved in both the design of the intervention and data analysis; full blinding at the analysis stage was therefore not achievable. To mitigate this, the statistical analysis plan was pre-specified prior to data cleaning, and all MANCOVA models were applied uniformly to all outcomes as predetermined. No post-hoc changes to the analysis strategy were made.

Instruments

Three validated, internally developed instruments were used:

- Knowledge of Prostate Cancer Screening Scale (KPCSS): 6 items scored on a 3-point scale (Yes=3, No=2, I don't know=1). Cronbach alpha = 0.78.
- Attitude Towards Prostate Cancer Screening Scale (ATPCSS): Items scored on a 4-point Likert scale (SA=1 to SD=4). Cronbach alpha = 0.81.
- Uptake of Prostate Cancer Screening Scale (UPCSS): Items reflecting behavioural intention and actual screening uptake. Cronbach alpha = 0.77.

An adapted version of the Multidimensional Health Locus of Control (MHLC) Scale was used to classify participants as having internal or external locus of control. Content validity was established by two professional health educators, an oncologist, and a psychometrics expert. Exploratory factor analysis yielded a Kaiser-Meyer-Olkin (KMO) value of 0.73 and a significant Bartlett's test of sphericity ($p<0.001$), confirming factorial adequacy. Items were retained at a loading criterion of ≥ 0.6, yielding a final 31-item questionnaire.

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Data Collection Procedure

Following institutional ethical clearance and approval from college authorities, the researcher explained the study objectives and distributed written consent forms. Only consenting students were enrolled. Pretest was administered on **6–10 September 2021**, prior to commencement of the intervention. Posttest was administered on **10–14 January 2022**, one week following completion of the eight-week programme. Research assistants received standardised training on administration procedures to ensure fidelity of data collection.

Statistical Analysis

Descriptive statistics (frequency counts, percentages, means, and standard deviations) summarised sociodemographic and baseline outcome data. Multivariate Analysis of Covariance (MANCOVA) was used to test all hypotheses, with pretest scores as covariates, at a significance threshold of $p<0.05$. Effect sizes were reported as partial eta-squared (η^2). Adjusted marginal means were examined to indicate the direction of differences between groups. Homogeneity of covariance matrices was assessed using Box's M test prior to MANCOVA.

Ethical Consideration

Ethical approval was obtained from the Ministry of Health Research Ethics Committee with the approval no-AD 13/478/234. Participation was entirely voluntary, and participants were free to withdraw at any time without consequence. All data were treated with strict confidentiality and used solely for research purposes. Written informed consent was obtained from all participants prior to enrolment.

Results

CONSORT Participant Flow

Figure 1 presents the flow diagram showing the progression of participants through each stage of the study: eligibility assessment, enrolment, allocation, follow-up, and analysis.

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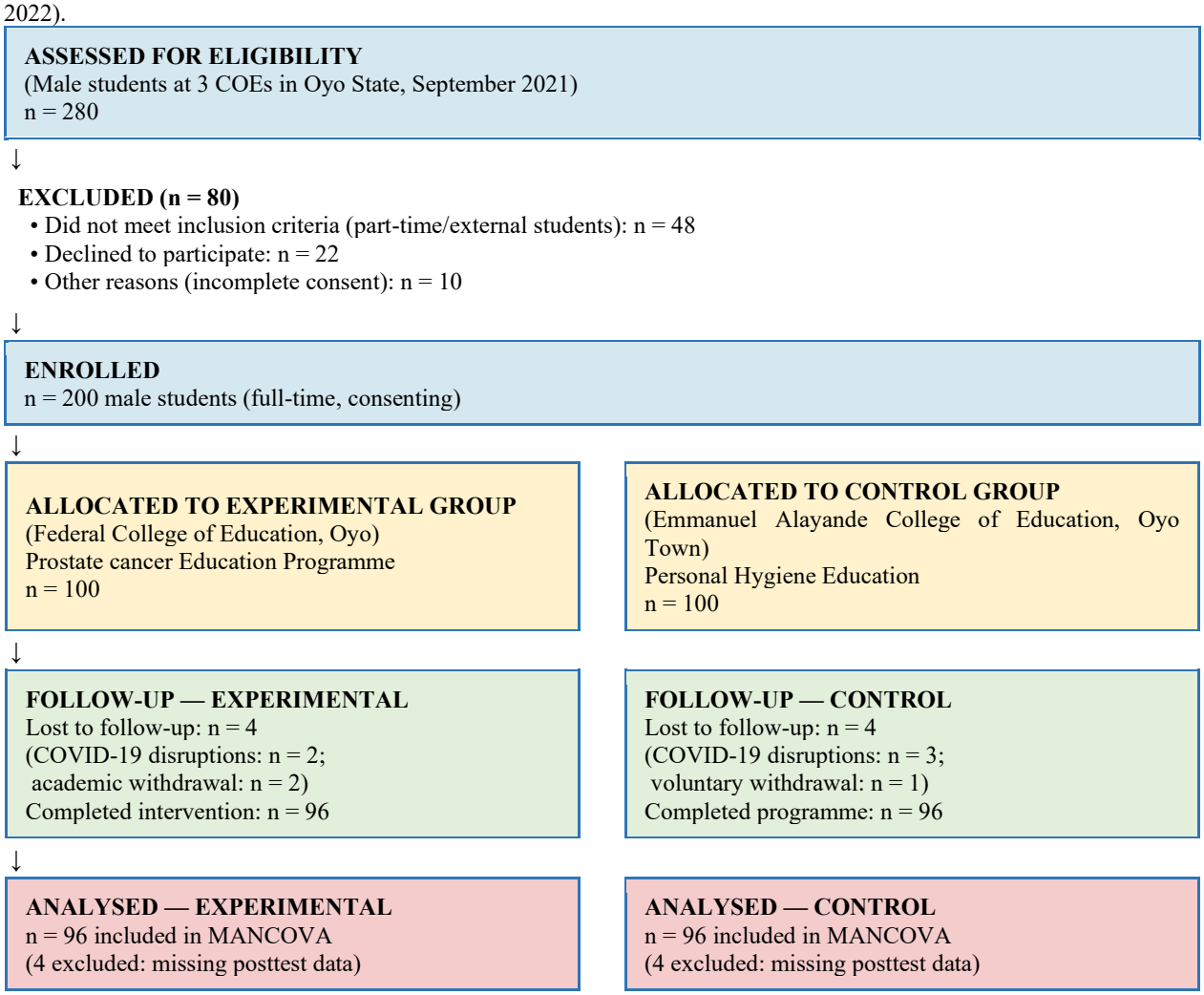
Figure 1. Flow diagram showing participant enrolment, allocation, follow-up, and analysis (September 2021 – January 2022).



A total of 280 male students were assessed for eligibility. Of these, 80 were excluded: 48 did not meet inclusion criteria (part-time or external students), 22 declined to participate, and 10 were excluded for incomplete consent documentation. Two hundred eligible participants were enrolled. Following college-level random allocation, 100 were assigned to the experimental group (Federal College of Education, Oyo) and 100 to the control group (Emmanuel Alayande College of Education, Oyo Town). During the intervention period, eight participants were lost to follow-up (n=4 per group), primarily due to COVID-19 disruptions (n=5) and academic withdrawal (n=3). The final analysis was conducted on 192 participants (96 per group).

Demographic and Baseline Clinical Characteristics

Table 1 presents the demographic and baseline outcome characteristics of both groups. The two groups were broadly comparable at baseline across all demographic variables and across pretest scores on the primary outcome measures, supporting the assumption of pre-intervention equivalence.

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Table 1. Demographic and Baseline Clinical Characteristics of Experimental and Control Groups.

Characteristic	Experimental Group (n = 100)	Control Group (n = 100)	Total (N = 200)
Age (years)			
18–20	28 (28.0%)	25 (25.0%)	53 (26.5%)
21–25	52 (52.0%)	54 (54.0%)	106 (53.0%)
26–30	14 (14.0%)	15 (15.0%)	29 (14.5%)
>30	6 (6.0%)	6 (6.0%)	12 (6.0%)
Mean ± SD	22.3 ± 2.8	22.1 ± 2.6	22.2 ± 2.7
Religion			
Christianity	50 (50.0%)	50 (50.0%)	100 (50.0%)
Islam	50 (50.0%)	50 (50.0%)	100 (50.0%)
Health Locus of Control			
Internal	48 (48.0%)	49 (49.0%)	97 (48.5%)
External	52 (52.0%)	51 (51.0%)	103 (51.5%)
School/Faculty			
Sciences	25 (25.0%)	25 (25.0%)	50 (25.0%)
Education	25 (25.0%)	25 (25.0%)	50 (25.0%)
Arts & Social Sciences	25 (25.0%)	25 (25.0%)	50 (25.0%)
Languages	25 (25.0%)	25 (25.0%)	50 (25.0%)
Year of Study			
Year 1	31 (31.0%)	29 (29.0%)	60 (30.0%)
Year 2	38 (38.0%)	40 (40.0%)	78 (39.0%)
Year 3	31 (31.0%)	31 (31.0%)	62 (31.0%)
Baseline Outcome Scores (Mean ± SD)			
Knowledge (KPCSS)	9.4 ± 2.1	9.6 ± 2.3	9.5 ± 2.2
Attitude (ATPCSS)	54.2 ± 7.8	53.9 ± 8.1	54.1 ± 7.9
Uptake (UPCSS)	10.3 ± 3.4	10.5 ± 3.2	10.4 ± 3.3
Prior Awareness of Prostate Cancer			
Yes	38 (38.0%)	40 (40.0%)	78 (39.0%)
No	62 (62.0%)	60 (60.0%)	122 (61.0%)
Family History of Cancer			
Yes	12 (12.0%)	11 (11.0%)	23 (11.5%)
No	88 (88.0%)	89 (89.0%)	177 (88.5%)

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Note: KPCSS = Knowledge of Prostate Cancer Screening Scale; ATPCSS = Attitude Towards Prostate Cancer Screening Scale; UPCSS = Uptake of Prostate Cancer Screening Scale; SD = Standard Deviation. Values are n (%) unless otherwise indicated. Baseline scores represent pretest means before the intervention.

Effect of Treatment (Prostate Cancer Education) on Outcomes

Table 2 presents the MANCOVA results for all tested effects. Disease education had a statistically significant main effect on all three outcomes. Knowledge scores improved significantly in the experimental group compared to controls ($F(1,192) = 139.204$, $p<0.001$, $\eta^2=0.420$), indicating that the treatment accounted for 42% of the variance in posttest knowledge. Attitude towards prostate cancer screening also improved significantly ($F(1,192) = 184.553$, $p<0.001$, $\eta^2=0.490$), and uptake of prostate cancer screening showed significant improvement ($F(1,192) = 143.890$, $p<0.001$, $\eta^2=0.428$).

Table 2. MANCOVA Summary of Effects on Knowledge, Attitude and Uptake of Prostate Cancer Screening

Source	Outcome	SS	df	MS	F	η^2
Treatment	Knowledge	1318.46	1	1318.46	**139.204*** **	.420
	Attitude	3376.71	1	3376.71	**184.553*** **	.490
	Uptake	2234.06	1	2234.06	**143.890*** **	.428
Religion	Knowledge	0.003	1	0.003	0.000	.012
	Attitude	6.656	1	6.656	0.364	.002
	Uptake	0.525	1	0.525	0.033	.003
Locus of Control	Knowledge	4.398	1	4.398	0.463	.002
	Attitude	3.398	1	3.398	0.186	.001
	Uptake	56.961	1	56.961	**3.624***	.019
Treatment x Religion	Knowledge	1.059	1	1.059	0.111	.001
	Attitude	11.853	1	11.853	0.648	.003
	Uptake	4.126	1	4.126	0.262	.001
Treatment x LoC	Knowledge	5.814	1	5.814	0.612	.003
	Attitude	13.891	1	13.891	0.760	.004
	Uptake	30.868	1	30.868	1.964	.010
Religion x LoC	Knowledge	4.189	1	4.189	0.441	.002
	Attitude	41.435	1	41.435	2.267	.012
	Uptake	2.762	1	2.762	0.176	.001
Treatment x Religion x LoC	Knowledge	1.353	1	1.353	0.142	.001
	Attitude	8.878	1	8.878	0.486	.003
	Uptake	6.156	1	6.156	0.392	.002

Note: *p<0.05; ***p<0.001; LoC = Locus of Control; SS = Sum of Squares; MS = Mean Square

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Effect of Religion on Outcomes

The main effect of religion was not statistically significant for knowledge ($F(1,192) = 0.000$, $p = 0.985$, $\eta^2 = 0.012$), attitude ($F(1,192) = 0.364$, $p = 0.547$, $\eta^2 = 0.002$), or uptake ($F(1,192) = 0.033$, $p = 0.855$, $\eta^2 = 0.003$). Adjusted marginal means indicated that Muslim participants in the experimental group recorded marginally higher mean scores on attitude (35.68) and uptake (22.47) compared to Christian participants (attitude: 34.37; uptake: 21.88), but these differences were not statistically significant.

Effect of Health Locus of Control on Outcomes

Health locus of control had no significant main effect on knowledge ($F(1,192) = 0.463$, $p = 0.497$, $\eta^2 = 0.002$) or attitude ($F(1,192) = 0.186$, $p = 0.667$, $\eta^2 = 0.001$). However, it had a significant main effect on uptake of prostate cancer screening ($F(1,192) = 3.624$, $p = 0.048$, $\eta^2 = 0.019$). Adjusted marginal means showed that participants with external locus of control in the experimental group had higher mean uptake scores (23.60) than those with internal locus of control (20.75). In the control group, participants with external locus of control also recorded higher mean uptake (12.22) than those with internal locus (11.79).

Interaction Effects

None of the two-way or three-way interaction effects were statistically significant. The treatment x religion interaction was non-significant for all outcomes (knowledge: $F(1,192) = 0.111$, $p = 0.739$; attitude: $F(1,192) = 0.648$, $p = 0.422$; uptake: $F(1,192) = 0.262$, $p = 0.609$). The treatment x locus of control interaction was also non-significant (knowledge: $F(1,192) = 0.612$, $p = 0.435$; attitude: $F(1,192) = 0.760$, $p = 0.384$; uptake: $F(1,192) = 1.964$, $p = 0.163$). The religion x locus of control interaction and the three-way interaction were similarly non-significant across all outcomes. Eta-squared values for all interaction effects were below 2%, reflecting negligible practical significance.

Discussion

This study demonstrated that a structured eight-week disease education programme significantly improved knowledge, attitude, and uptake of prostate cancer screening among male college students in Nigeria. The large effect sizes observed ($\eta^2 = 0.420$ for knowledge; $\eta^2 = 0.490$ for attitude; $\eta^2 = 0.428$ for uptake) confirm that the intervention was substantively potent, accounting for 42–49% of outcome variance. These findings are consistent with the broader literature demonstrating the effectiveness of educational interventions in promoting cancer-related health behaviour in African contexts [10, 18, 19].

The magnitude of improvement in this study is particularly meaningful given the documented low baseline knowledge among Nigerian male populations. A 2023 cross-sectional study in Ido-Ekiti found that more than 74% of adult men had poor knowledge of prostate cancer and its screening methods, with a median knowledge score of just 30% [10]. Similarly, a 2022 Lagos urban study confirmed persistently low screening practices despite moderate disease awareness [11]. These studies used observational designs and could not assess whether educational input would alter behaviour; the present quasi-experimental design addresses that gap by demonstrating that intentional structured education, when sustained over eight weeks, produces significant and practically meaningful change across all three outcomes.

The significant improvement in attitude warrants particular emphasis. Attitudinal change is generally considered harder to achieve than cognitive change [20]. Prior studies in Nigeria have highlighted that favourable attitudes towards prostate cancer screening do not necessarily translate to uptake, partly due to the persistence of barriers including stigma, fear of diagnosis, and cultural norms around masculinity [13, 14]. 2024 cultural factors review in urban Ogun State documented that masculinity norms frequently portrayed screening as a sign of vulnerability, while cultural misconceptions framed prostate cancer as either spiritual or incurable [14]. The present study suggests that a sustained educational programme targeting these belief systems, grounded in the Health Belief Model's mechanisms of perceived susceptibility and severity, can produce measurable attitudinal shifts an important prerequisite for behaviour change.

The finding that health locus of control significantly predicted screening uptake but not knowledge or attitude is theoretically noteworthy. Participants with external locus of control demonstrated greater uptake post-intervention, suggesting that externally oriented individuals may be particularly responsive to structured programmes that provide clear, authoritative guidance. This is consonant with Wallston and Wallston's original conceptualisation that external HLoC, specifically orientation towards powerful others such as health educators and physicians, can be leveraged in educational programmes to promote preventive health behaviour [15].

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In the Nigerian healthcare context, a 2024 qualitative study confirms this dynamic: direct healthcare professional recommendations were among the most influential facilitators of screening uptake, often serving as the decisive push for hesitant individuals [13]. The present findings reinforce that educator-led programmes are particularly well-matched to the motivational architecture of externally oriented men.

Contrary to expectation, internal locus of control did not predict superior outcomes in this study. This diverges from some earlier literature and may be explained by the nature of the intervention itself. A structured, educator-directed programme provides authoritative external scaffolding that empowers externally oriented participants, rather than relying on intrinsic self-motivation. Murray and McMillan's observation that the effect of locus of control is context-dependent varying with the type of health action and the delivery model is directly applicable here [16]. An internally oriented student may already possess some dispositional drive towards health behaviour, but the mechanism by which the intervention activates uptake appears more potent for those who look to trusted external sources for guidance.

Religion had no significant main or interaction effect on any of the three outcomes. This finding suggests that in this student cohort, religious affiliation did not differentially mediate the effectiveness of disease education on prostate cancer screening behaviour. While prior African literature has identified religious belief as a potential barrier or facilitator of cancer screening particularly where cancer is interpreted through supernatural frameworks [17] the present results indicate that a well-designed educational programme may transcend religious heterogeneity in its effectiveness. This has positive implications for programme scalability across Nigeria's religiously diverse population, suggesting that a single educational package need not be separately tailored by religious affiliation.

The non-significance of all two-way and three-way interaction effects further supports the robustness of the disease education intervention. The treatment effect was consistent across subgroups defined by religion and locus of control, indicating that the programme is broadly effective without requiring individualised targeting by these psychosocial characteristics an important consideration for scalable public health programming in resource-limited settings. The study contributes several methodological strengths: an experimental design enabling causal inference, validated instruments with acceptable reliability, pretest scores as covariates to control for baseline differences, and an active control condition (personal hygiene education) that reduces demand characteristics and attentional bias. However, several limitations must be acknowledged. First, participant attrition, exacerbated by COVID-19 disruptions and academic pressures, may have introduced selection effects. Second, residential camping of participants during the intervention, while necessary for logistical control, may have facilitated extraneous exposures through peer discussion and media access that could not be fully monitored. Third, the study is limited to Colleges of Education male students in Oyo State, Nigeria which restricts generalisability to university students, other institution types, and other geopolitical zones. Fourth, the uptake measure is scale-based and may reflect behavioural intention rather than verified actual screening. Future research using biomarker-verified or appointment-confirmed screening uptake would strengthen causal claims. A recent scoping review of Nigerian prostate cancer evidence (2020–2024) observed that none of the included studies reported implementation outcomes, and calls were made for intervention studies with longer follow-up periods [12] recommendations that future replications of this study should address.

Generalisability of Findings

The findings of this study are primarily generalisable to full-time male students enrolled in government-owned Colleges of Education in Nigeria**.** Several factors limit broader extrapolation:

Colleges of Education attract a specific student profile pre-service teachers whose academic exposure, health literacy baseline, and institutional culture may differ markedly from students in conventional universities, polytechnics, or vocational institutions. The results should not be assumed to apply to university students without empirical replication in those settings. Cultural, linguistic, and health system factors may vary substantially across Nigeria's six geopolitical zones and across sub-Saharan Africa. Extrapolating findings to other states or countries requires caution and ideally empirical validation.

College students are predominantly in a younger age bracket (18–30 years), below the typically recommended screening age of 40–50 years for average-risk men. Screening uptake outcomes in this sample reflect behavioural intention and early-stage health literacy rather than immediate clinical screening need. The relevance of this age group lies in their future role as health educators and community decision-makers. Future multisite studies encompassing university populations,

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different geopolitical zones, and longer follow-up periods are needed to establish broader generalisability.

Limitations

Several limitations of this study must be acknowledged and should inform interpretation of the findings:

The Uptake of Prostate Cancer Screening Scale (UPCSS) is a self-report instrument that captures behavioural intention and self-declared screening engagement. No objective verification such as PSA test records, clinic attendance logs, or biomarker confirmation was used to corroborate reported uptake. Self-report measures are susceptible to social desirability bias, particularly in educational settings where participants may over-report health-promoting behaviours they believe are expected of them following an educational intervention. Future studies should incorporate verified attendance records or biological confirmation of screening to strengthen the validity of uptake assessments.

The sample does not represent the full diversity of Nigerian tertiary education settings, geopolitical zones, or student populations. Conclusions should not be extrapolated to university students.

Eight participants (4 per group) were lost to follow-up, primarily due to COVID-19-related disruptions and academic withdrawal. While this attrition rate (4%) is modest and unlikely to have introduced substantial bias, the pandemic context may have influenced participants' health anxiety, media exposure to health information, and general receptivity to health education in ways that are difficult to fully disentangle from the intervention effect.

Conclusions

This study provides experimental evidence that a structured disease education programme significantly improves knowledge, attitude, and uptake of prostate cancer screening among young Nigerian males enrolled in Colleges of Education. Health locus of control specifically external orientation predicts higher screening uptake following such an intervention. Religion did not moderate outcomes. These findings support the integration of prostate cancer education into the health curricula of Nigerian tertiary institutions and recommend that programme designers incorporate locus of control assessments to identify participants who may benefit from externally directed health guidance. Future studies should replicate these findings in university populations across different geopolitical zones and explore longer-term follow-up to assess durability of behaviour change.

Recommendations

- The Federal and State Ministries of Health and Education should integrate prostate cancer disease education into the health curricula of Colleges of Education and other tertiary institutions across Nigeria.
- Health educators should consider participants' locus of control orientation when designing cancer screening promotion programmes, leveraging external orientation through explicit endorsement from trusted health authorities.
- This study should be replicated among university students in multiple geopolitical zones to confirm and extend the findings.
- Future research should evaluate the longer-term durability of screening uptake behaviour beyond the immediate post-intervention period, including verification of actual screening attendance.
- Disease education should be explored as an intervention strategy for other male-relevant cancer screening programmes, such as colorectal cancer.
- Community-based prostate cancer early detection programmes should incorporate culturally responsive psychosocial components, including locus of control profiling, to optimise screening uptake.

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Authors' Contributions

BOJ designed the study, conducted data collection and analysis, drafted the manuscript, and approved the final version.

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Availability of Data and Materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Ministry of Health Research Ethics Committee (Approval No: AD 13/478/234). Written informed consent was obtained from all participants prior to enrolment.

Consent for Publication

Not applicable.

Competing Interests

The author declares no competing interests.

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