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Assessing the Impact of Educational Interventions on Prostate Cancer Screening Awareness and Attitudes among Agrochemical-Exposed Farmers in Rural Nigeria

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Abstract

This quasi-experimental study evaluated the effectiveness of an educational intervention on prostate cancer screening awareness and attitudes among 120 pesticide-exposed rural farmers in Benue State, Nigeria. Using pre- and post-intervention surveys, data were analyzed with descriptive and inferential statistics. Results demonstrated a statistically significant improvement in the experimental group compared to the control. Knowledge of prostate cancer and screening increased by over 40%, and attitudes, measured through Health Belief Model constructs, showed significant positive shifts in perceived susceptibility, severity, benefits, and reduced barriers. The study concluded that a context-specific educational intervention was highly effective in improving both awareness and attitudes toward prostate cancer screening, underscoring its potential as a vital public health strategy for this high-risk, under-served population. It is therefore suggested that public health programmes should incorporate targeted education on prostate cancer, using Health Belief Model constructs to improve knowledge and attitudes, while exploring digital platforms and community involvement for sustained behavior change.

Keywords: Educational interventions, Farmers, Benue, Awareness, Prostate cancer

Introduction: Educational interventions are widely recognized as essential strategies for promoting public health awareness and encouraging preventive behaviours (Hahn & Truman, 2015; Raghupathi & Raghupathi, 2020). Such interventions not only inform but also empower individuals to make evidence-based health decisions, especially in low-resource settings where misconceptions and health illiteracy are prevalent. In the context of prostate cancer screening, educational initiatives have been shown to increase awareness, correct misinformation, and promote early detection, thereby improving survival outcomes (Abhar et al., 2020; Benedict et al., 2023; Khalil et al., 2024). Prostate cancer is the second most commonly diagnosed cancer among men and the fifth leading cause of cancer-related deaths worldwide, underscoring its significant public health burden (Rawla, 2019). Despite this, screening participation remains markedly low in low- and middle-income countries (LMICs) due to factors such as limited awareness, poor access to healthcare facilities, and low perception of risk (Sekhoacha et al., 2022). Targeted and culturally appropriate educational interventions are therefore crucial to encourage screening uptake, particularly among high-risk occupational groups such as farmers who experience frequent exposure to agrochemicals known to have endocrine-disrupting properties (Adedeji et al., 2021; Mbugua et al., 2021; Cavalier et al., 2023).

In Nigeria, agriculture remains the backbone of the economy, with millions of farmers depending on chemical pesticides and fertilizers to sustain productivity (Apeh et al., 2024). However, many rural farmers lack awareness of the long-term health implications of chronic agrochemical exposure, including its potential link to prostate cancer (Moda et al., 2022; Adedeji et al., 2021). These communities are doubly disadvantaged, facing both environmental exposure and systemic barriers such as low literacy, poor health-seeking behaviour, and limited access to screening facilities. Moreover, national prostate cancer awareness campaigns tend to focus on urban populations, leaving rural areas under-served and under-informed (Odubia et al., 2025).

Existing studies suggest that stigma, fatalistic beliefs, and socio-cultural taboos surrounding male reproductive health further discourage open discussion and screening among rural men (Tolani et al., 2024; Odubia et al., 2025). Weak healthcare infrastructure and poor health communication channels in these areas exacerbate delayed diagnosis and late presentation, contributing to higher mortality rates (Umeh et al., 2022; Marima et al., 2022). Therefore, there is a pressing need for context-specific educational programs that are culturally sensitive, linguistically appropriate, and tailored to the lived realities of rural farmers. This study focused on rural farming communities in Benue State, Nigeria, a region where pesticide use is widespread and healthcare access remains limited. By assessing the effectiveness of an educational intervention, the study sought to evaluate its impact on awareness and attitudes toward prostate cancer screening among pesticide-exposed farmers. The intervention was designed to address not only informational deficits but also the underlying social and behavioural determinants influencing men's willingness to participate in screening. Ultimately, the study underscores the vital role of locally grounded educational efforts in fostering preventive health behaviours and reducing prostate cancer morbidity and mortality among vulnerable populations.

Despite the increasing prevalence of prostate cancer and the heightened occupational risk associated with pesticide exposure, awareness and screening rates among Nigerian rural farmers remain critically low. Many of these farmers frequently handle agrochemicals containing endocrine-disrupting compounds but lack adequate knowledge of their carcinogenic potential and the importance of early detection through screening. Cultural misconceptions, fear, and stigma surrounding prostate examination (Ogbetere et al., 2024; Ofori et al., 2025), coupled with logistical challenges such as poor transportation networks, inadequate screening facilities, and weak healthcare infrastructure (Tolani et al., 2024; Marima et al., 2022), further discourage participation. Moreover, pervasive misinformation, fatalistic beliefs, and the perception that prostate cancer is a "disease of the wealthy or elderly" exacerbate reluctance toward screening. Previous awareness campaigns in Nigeria have rarely addressed the intersection between occupational exposure and men's health, leaving farmers, one of the most exposed groups, largely neglected. Consequently, the absence of context-specific, culturally tailored educational interventions has allowed misinformation and low-risk perception to persist, resulting in delayed diagnosis, poor treatment outcomes, and preventable deaths. Consequently, the problem of this study captured in an interrogative form is: "How effective is a context-specific educational intervention in improving awareness and attitudes toward prostate cancer screening among pesticide-exposed rural farmers in Benue State, Nigeria?"

This study investigated the effectiveness of educational interventions in improving awareness and attitudes toward prostate cancer screening among pesticide-exposed farmers in rural communities in Benue State, Nigeria.

Methodology: Study Design: We adopted a quasi-experimental design with pre- and post-intervention study to evaluate the impact of educational interventions on prostate cancer screening awareness and attitudes among agrochemical-using farmers in rural Nigeria. The quasi-experimental design enabled the measurement of changes in participants' knowledge and attitudes after an intervention without randomisation to control or experimental groups (Creswell & Creswell, 2018; White & Sabarwal, 2014). This approach was chosen because it allows for the measurement of intervention success in a real-world setting while taking into account practical limitations in the research context, such as farmer accessibility and desire to participate. This study was conducted in Owukpa and Otukpo, rural communities in Benue State, Nigeria, where intensive farming and pesticide use heighten cancer risks (Abakpa et al., 2024; Pii et al., 2019). These areas, located in Ogbadibo and Otukpo LGAs, were selected due to farmers' limited access to health information (Adu et al., 2024). Field observations and preliminary surveys helped identify villages with high agrochemical usage, enabling context-specific, effective educational interventions (Marshall & Rossman, 2016).

Population and Samples : Sampling Procedure: We purposively selected 120 farmers in Benue State, with 60 participants each from an experimental group and a control community. All participants regularly applied agrochemicals, were over 18 years old, and agreed to complete both pre-intervention and post-intervention surveys (Etikan, Musa, & Alkassim, 2016). This sampling approach ensured the inclusion of high-risk individuals directly exposed to pesticides. The sample size was chosen to balance statistical power with logistical feasibility in rural quasi-experimental studies (Teddlie & Yu, 2007). Participants in the experimental group attended an educational session on prostate cancer risks and screening. Surveys conducted before and after the intervention measured changes in awareness and attitudes. A multistage purposive and stratified sampling approach was employed to select participants for this study, ensuring the inclusion of high-risk individuals directly exposed to agrochemicals while maintaining representativeness within the rural farming population (see Figure 1). First, Benue State was chosen due to its high agricultural activity and widespread pesticide use, with particular focus on the LGAs of Otukpo and Ogbadibo, which have documented intensive farming practices and limited access to healthcare facilities. Within these LGAs, a preliminary community mapping exercise was conducted to identify villages where pesticide application is common and where farmers actively cultivate crops, rear livestock, or engage in mixed farming.

In the second stage, villages were purposively selected based on the density of farming households and accessibility for field implementation. This ensured that participants would likely have regular occupational exposure to agrochemicals and be representative of the local farming population. A total of four villages were selected: two for the experimental group and two for the control group; minimizing contamination while reflecting similar socio-economic and

demographic profiles. At the third stage, participants within these villages were selected using purposive criteria. Eligible participants were male farmers aged 18 years and above who had at least one year of experience handling agrochemicals, were permanent residents of the selected villages, and voluntarily consented to participate in both pre-intervention and post-intervention surveys. Efforts were made to balance age distribution, farming type (crop, livestock, or mixed), and educational background within each group to reduce potential confounding variables. Community leaders, farmer associations, and extension officers assisted in identifying eligible individuals, enhancing recruitment efficiency and local buy-in. Finally, participants were stratified by age and farming type to ensure comparable representation in both experimental and control groups. This stratification allowed for fair comparison of intervention effects across different subgroups and mitigated potential bias arising from demographic differences. In total, 120 participants were recruited, with 60 individuals assigned to the experimental group and 60 to the control group. While random assignment was not feasible due to logistical and ethical considerations, this purposive-stratified approach provided a practical, context-sensitive method for including participants most likely to benefit from the educational intervention while maintaining scientific rigour.

Data Analysis: We analysed data using descriptive and inferential statistical approaches to compare changes in prostate cancer screening awareness and attitudes between the experimental and control groups. First, we used descriptive statistics (means, standard deviations, and frequencies) to summarise participants' socio-demographic characteristics as well as baseline knowledge and attitudes about prostate cancer. Chi-square tests were conducted to compare the extent of knowledge and awareness regarding prostate cancer and its screening between the experimental and control groups. To evaluate the intervention's effectiveness, we used paired-sample t-tests to compare pre- and post-intervention scores within the experimental group, and independent-sample t-tests to analyse differences between groups. To assess the effects of the intervention, we reported effect sizes where necessary. To guarantee robust results, all analyses were undertaken at a significance level of $p < .05$ in SPSS.

Results: Summary of Demographic Characteristics: The demographic characteristics of the participants are presented in two categories (see Table 1): the experimental and control groups. As to the age category of participants, the highest proportions belong to age 40 through to 49 years, with 30% in the experimental group and the 28.3% in the control group. There was a comparable distribution among participants in terms of their farming practices. For example, crop farming was most commonly practiced by 43.3% and 41.7% in the control and experimental group respectively. Livestock faming was also practiced by 28.3% and 30% of those in the experimental and control groups respectively. Finally, 30% and 26.7% of those respectively from experimental and control groups practiced mixed farming.

Impact of Educational Intervention on Knowledge: To compare awareness and knowledge of prostate cancer and screening between experimental and control groups, a Chi-square test of independence was conducted after calculating differences in proportions over time (see Table 2). Results revealed statistically significant improvements ($p < 0.001$) in the experimental group across all measures. Awareness increased by 45% in the experimental group, compared to just 5% in the control group. Knowledge of screening methods rose by 47.5% in the experimental group versus 5% in the control. Understanding of risk factors improved by 40% compared to 10% in the control group. Similarly, knowledge of available screening methods increased by 40% in the experimental group, while the control group showed only a 7.5% gain. Perceived importance of regular screening improved by 37.5% in the experimental group, compared to 12.5% in the control. These findings demonstrate the significant positive impact of the educational intervention, with minimal changes observed in the control group, underscoring the intervention's effectiveness.

Impact of Educational Intervention on Attitude: In a bid to determine the impact of the intervention on attitude using the items developed in line with the HBM constructs, we performed independent-sample to compare pre-intervention scores between the experimental and control groups. Findings (as shown in Table 3) did not show significant differences between both groups at baseline, alluding to the fact that both groups had similar directions in terms of attitudes regarding prostate cancer screening (all p-values > 0.05). Paired-sample t-tests were conducted to ascertain the baseline and endline scores for each of the HBM constructs across the experimental group who had received intervention. Findings as shown in Table 4, showed statistically significant improvements across all constructs for perceived susceptibility ($t = -5.88$, $p < 0.001$), perceived severity ($t = -5.03$, $p < 0.001$), perceived benefits ($t = -6.12$, $p < 0.001$), perceived barriers ($t = -4.76$, $p < 0.001$), and overall HBM constructs ($t = -6.43$, $p < 0.001$). As shown in Table 5, independent samples t-test results at endline revealed statistically significant differences between the experimental and control groups across all Health Belief Model (HBM) constructs. The experimental group recorded higher scores in perceived susceptibility ($t = 3.42$, $p = 0.001$), severity ($t = 3.18$, $p = 0.002$), benefits ($t = 3.93$, $p < 0.001$), and lower perceived barriers ($t = 2.41$, $p = 0.018$). Overall HBM scores were also significantly higher ($t = 2.13$, $p = 0.035$), confirming the intervention's effectiveness.

Discussion: This study demonstrates that a context-specific educational intervention significantly improved both knowledge of and attitudes toward prostate cancer screening among pesticide-exposed farmers in rural Nigeria. The findings provide crucial empirical evidence for a population that has been largely neglected in intervention research, despite bearing a disproportionate burden of risk. The dramatic post-intervention increases in awareness and knowledge align with successes from other African settings. The knowledge leap observed in our experimental group mirrors the outcomes of a Kenyan trial where Community Health Worker (CHW) led education raised knowledge from

49% to 76% (Mbugua et al., 2022). This consistency underscores that direct, culturally-tailored education is a powerful tool to overcome the profound informational deficits documented in rural Nigerian populations (Ogbetere et al., 2024; Izueke et al., 2024).

Furthermore, the significant positive shifts across all Health Belief Model (HBM) constructs are particularly telling. The increases in perceived susceptibility and severity directly counter the pervasive fatalistic beliefs identified by Mbugua et al. (2024) and Uncu et al. (2025) as major barriers to screening. By helping farmers contextualize their occupational risk, the intervention empowered them to move beyond the notion that cancer is purely a matter of fate. The rise in perceived benefits and the reduction in perceived barriers echo the results of Khalil et al. (2024), whose HBM-based workshops in Egypt also led to a sharp rise in screening intentions. Our results validate that the HBM is a robust framework for designing interventions in similar low-resource, high-stigma contexts. The success of this focused intervention confirms the recommendations from prior descriptive studies in Nigeria, which have long called for targeted education and community engagement to address misconceptions and fear (Tolani et al., 2024; Adedeji et al., 2021). By empirically testing and validating such an approach specifically among farmers, this study fills a critical gap. It moves beyond merely describing the problem to providing an evidence-based strategy that can be integrated with agricultural extension services or CHW programs, offering a scalable model to reduce prostate cancer mortality in these vulnerable communities.

Conclusion: The marked and statistically significant post-intervention improvements in knowledge and across all Health Belief Model constructs, including perceived susceptibility, severity, benefits, and a reduction in barriers within the experimental group, contrasted with the minimal changes in the control group, provide robust evidence for the power of targeted health education. These findings underscore that addressing informational deficits while simultaneously leveraging behavioural change models can successfully overcome deep-seated cultural and psychological obstacles, thereby fostering a conducive environment for preventive health actions. Ultimately, this research affirms the critical role of locally grounded educational strategies as a viable and essential public health tool for empowering high-risk, under-served populations, with the potential to reduce late-stage diagnoses and decrease prostate cancer mortality through increased early detection.

Recommendations: To enhance prostate cancer awareness and screening, public health programs should implement targeted educational interventions, especially for underserved populations. Integrating Health Belief Model principles can improve attitudes and increase screening participation. For sustained impact, future efforts should engage community leaders, utilize digital platforms for broader outreach, and include long-term follow-up to reinforce positive behaviour change.

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Appendix I

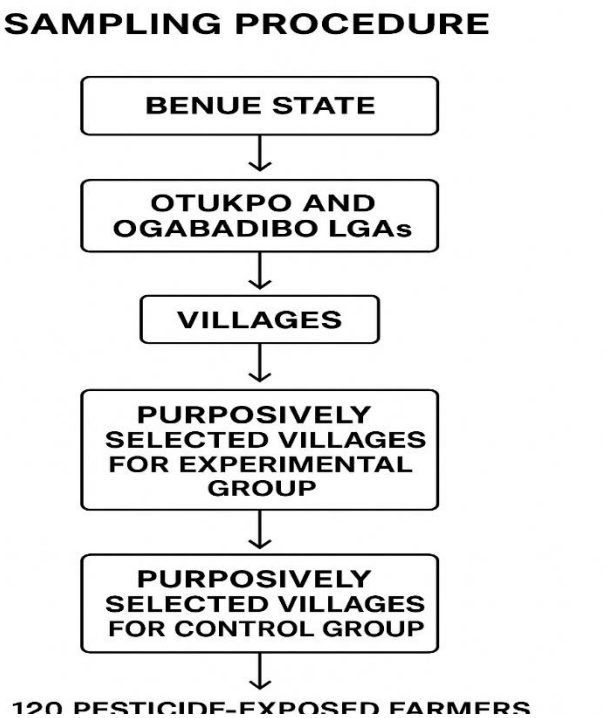

Figure 1. sampling procedure for the study

Table 1: Participants' Demographics

Demographic Characteristic	Experimental Group (N = 60)	Control Group (N = 60)
Age (years)		
20-29	12 (20%)	10 (16.7%)
30-39	15 (25%)	18 (30%)
40-49	18 (30%)	17 (28.3%)
50+	15 (25%)	15 (25%)
Farming Practices		
Crop Farming	25 (41.7%)	26 (43.3%)
Livestock Farming	17 (28.3%)	18 (30%)
Mixed Farming	18 (30%)	16 (26.7%)

Table 2: Pre- and Post-Intervention Awareness and Knowledge of Prostate Cancer and Prostate Cancer Screening

Knowledge/Understanding Topic	Experimental Group Pre-Intervention (%)	Experimental Group Post-Intervention (%)	Control Group Pre-Intervention (%)	Control Group Post-Intervention (%)	χ^2-value
Awareness of Prostate Cancer	40.0	85.0	45.0	50.0	23.62**
Awareness of Prostate Cancer Screening	35.0	82.5	40.0	45.0	22.42**
Understanding of Risk Factors for Prostate Cancer	38.3	78.3	30.0	40.0	20.15**
Knowledge of Screening Methods Available	40.0	80.0	35.0	42.5	21.73**
Perceived Importance of Regular Screening	47.5	85.0	35.0	47.5	24.15**

Note: ** = p<.001

Table 3: Comparison of Pre-Intervention Scores Between Experimental and Control Groups

HBM Construct	Experimental Group Mean (SD)	Control Group Mean (SD)	t-value	p-value
Perceived Susceptibility	3.50 (0.82)	3.48 (0.80)	0.18	0.86
Perceived Severity	4.08 (0.85)	4.02 (0.83)	0.43	0.67
Perceived Benefits	4.25 (0.88)	4.18 (0.86)	0.39	0.70

Perceived Barriers	3.32 (0.78)	3.30 (0.79)	0.15	0.88
Overall HBM Constructs	3.79 (0.84)	3.75 (0.82)	0.24	0.81

Table 4: Pre- and Post-Intervention Scores for the Experimental Group on HBM Constructs

HBM Construct	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	t-value
Perceived Susceptibility	3.50 (0.82)	4.20 (0.70)	-5.88**
Perceived Severity	4.08 (0.85)	4.60 (0.73)	-5.03**
Perceived Benefits	4.25 (0.88)	4.75 (0.61)	-6.12**
Perceived Barriers	3.32 (0.78)	3.75 (0.72)	-4.76**
Overall HBM Constructs	3.79 (0.84)	4.33 (0.64)	-6.43**

Note: ** = p<.001

Table 5: Post-Intervention Scores for the Experimental and Control Groups on HBM Constructs

HBM Construct	Experimental Group Mean (SD)	Control Group Mean (SD)	t-value	p-value
Perceived Susceptibility	4.20 (0.70)	3.80 (0.75)	3.42	0.001
Perceived Severity	4.60 (0.73)	4.15 (0.80)	3.18	0.002
Perceived Benefits	4.75 (0.61)	4.30 (0.72)	3.93	< 0.001
Perceived Barriers	3.75 (0.72)	3.45 (0.74)	2.41	0.018
Overall HBM Constructs	4.33 (0.64)	4.13 (0.68)	2.13	0.035