

## Assessing the Impact of a Non-Randomized Educational Intervention on Dapivirine Vaginal Ring Uptake among Female University Students in Nigeria

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### Abstract

This investigation examined whether providing structured information on the dapivirine vaginal ring (DPV-VR) could modify levels of understanding, user acceptance, and monetary valuation of the product among female undergraduates enrolled at the University of Nigeria (UNN). Data were generated through a cross-sectional survey administered with a rigorously validated questionnaire comprising 23 items. A projected total of 1,500 participants was drawn from five academic faculties using systematic selection procedures. Participants' perceptions of the dapivirine vaginal ring were measured at two points—before and after delivery of an educational session on the intervention. Economic valuation of the product was captured in Nigerian currency, applying a conversion rate of N490 per US dollar, through a contingent valuation framework. Summary statistics were used to describe the dataset, while faculty-level differences were evaluated using the Chi-square statistical test.

A total of 1017 undergraduate students completed the survey. Participants were predominantly within the 18–24-year age group (754 [74.1%]), and the majority were unmarried (886 [87.1%]). HIV testing had been undertaken by more than half of the respondents (531 [52.2%]). Among those tested, positive HIV status was reported by 3 (1.5%) students from Arts, 3 (1.7%) from Biological Sciences, 2 (0.6%) from Pharmaceutical Sciences, 2 (1.8%) from Social Sciences, and 1 (0.5%) from Veterinary Medicine. Prior awareness of the dapivirine vaginal ring (DPV-VR) was limited, with only 304 (29.9%) participants indicating previous knowledge of the product. Following the educational intervention, acceptability of the DPV-VR increased markedly, rising from 294 before the intervention to 596 afterward, representing approximately a two-fold increase ( $p \leq 0.001$ ). Regarding cost preferences, the largest proportion of respondents (466 [45.8%]) stated they would be willing to pay less than ₦410.00 for a single DPV-VR. The findings indicate a generally favorable disposition toward the use of the dapivirine vaginal ring among female students at UNN, which was substantially strengthened after they received targeted information about its benefits. Additionally, the results suggest that most students would prefer to obtain the ring at a personal cost of less than one US dollar.

**Keywords:** Non-randomized educational intervention, Vaginal ring, Female university students, Nigeria

### Introduction

Despite decades of biomedical advancement, Human Immunodeficiency Virus (HIV) continues to exert a substantial toll on global health systems. First recognized in the early 1980s, HIV has progressed into a long-standing global epidemic, with an estimated 38 million

people living with the virus worldwide as of 2019 [1]. The distribution of new infections is highly uneven, with sub-Saharan Africa bearing the greatest share. In 2018, this region accounted for approximately two-thirds of all new HIV cases, and the risk was particularly pronounced among adolescent girls and young women [2]. Within this context, Nigeria remains heavily affected, ranking among the ten countries with the highest HIV burden globally, with an adult incidence rate of nearly 1.4%. Infection patterns show marked concentration in urban areas and among specific populations, including men who have sex with men, sex workers, and people who inject drugs [3, 4].

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The elevated vulnerability of women and girls to HIV infection is closely linked to structural and socio-cultural determinants rather than biological factors alone. Issues such as gender-based violence, limited autonomy in sexual decision-making, and restricted access to prevention information and services significantly heighten risk. The scale of this inequity is evident in Nigeria, where research has documented HIV prevalence as high as 60% among female sex workers [5]. These realities highlight the necessity of expanding female-initiated HIV prevention options, particularly in sub-Saharan Africa, where meeting global targets such as the 95:95:95 goals requires intensified and inclusive prevention strategies.

One innovation developed to address women's prevention needs is the dapivirine vaginal ring (DPV-VR). This product is a long-acting intravaginal device that delivers the antiretroviral drug dapivirine in a controlled manner over a one-month period, offering sustained protection without requiring daily adherence [6, 7]. The DPV-VR is designed for discreet use and can complement other prevention measures, including male condoms.

Evidence from randomized clinical trials supports the protective effect of the dapivirine vaginal ring. Studies published in 2016 demonstrated that consistent use of the ring was associated with a 27% reduction in HIV risk in one trial [6] and a 30% reduction in another [7]. Beyond efficacy, studies conducted in Malawi, South Africa, Uganda, and Zimbabwe indicate that women generally regard the ring as acceptable, tolerable, and feasible for regular use [8].

However, the existence of an effective prevention tool does not automatically translate into widespread adoption. In many low- and middle-income countries, including Nigeria, uptake of the dapivirine vaginal ring remains limited due to low awareness, restricted availability, and financial constraints. Knowledge gaps have previously been identified as a major barrier to the use of pre-exposure prophylaxis (PrEP) among individuals at elevated risk of HIV infection [9]. Additionally, young women's decisions to pay for HIV prevention products—such as antiretroviral agents and HIV self-testing kits—are shaped by multiple considerations, including perceived benefit, usability, stigma, and cost [10]. Although HIV prevention has been widely studied, empirical evidence focusing specifically on dapivirine vaginal ring use is still limited. Cost remains a particularly influential factor in settings like

Nigeria, where out-of-pocket payment is the dominant mode of healthcare financing and frequently constrains access to preventive services [11].

Against this background, the present study was undertaken to examine how a targeted educational intervention influences knowledge, acceptability, and willingness to pay (WTP) for the dapivirine vaginal ring among undergraduate students at the University of Nigeria.

## Materials and Methods

### *Setting and study design*

The study was carried out in June 2022 among female undergraduate students enrolled at the University of Nigeria, Nsukka, using a before-and-after educational intervention framework. A single-arm, non-randomized approach was adopted to allow participants to serve as their own comparators when evaluating changes in awareness of, and willingness to pay for, the dapivirine vaginal ring (DPV-VR). This design was considered appropriate because the primary interest was the effect of the educational intervention on the same individuals rather than differences between separate study groups; therefore, a control arm was not included.

The University of Nigeria, Nsukka is the first federally owned indigenous university established in Nigeria following independence in 1960. The main campus is located in Nsukka, a semi-urban area in Enugu State, southeastern Nigeria. The institution provides undergraduate and postgraduate education across a wide range of academic disciplines, including the arts, sciences, social education, sciences, engineering, law, and medicine. In addition to its teaching role, the university maintains a strong research profile, supported by multiple specialized research institutes and centres. Students at the University of Nsukka, Nigeria are drawn from across the country and beyond its borders, resulting in a heterogeneous student population. The university community reflects broad socioeconomic variation, encompassing students from both low- and high-income households. It is also characterized by religious diversity, although Christianity represents the dominant faith among the student body.

### *Study population*

The target population for this study consisted of female undergraduate students enrolled at the Nsukka campus of the University of Nigeria. Female students were

deliberately selected because the dapivirine vaginal ring (DPV-VR) is a female-controlled HIV prevention method and is intended for use exclusively by women.

#### *Sampling technique*

Faculty selection was carried out using a systematic random approach to identify the academic units from which participants would be drawn. The University of Nigeria, Nsukka comprises ten faculties covering a wide range of academic disciplines. For sampling purposes, the faculties were arranged alphabetically, after which every second faculty was selected, beginning with the first on the list. This approach was adopted to ensure that students were recruited from a broad spectrum of academic backgrounds, thereby enhancing representativeness. A total sample size of 1,500 students was determined based on statistical considerations to provide sufficient analytical power while remaining practical and manageable for the study.

#### *Study instrument*

Data were collected using a structured, self-completed questionnaire comprising 23 items, which was specifically developed for this study. Multiple steps were taken to ensure the tool measured the intended outcomes accurately and consistently. Content validation was achieved through review by HIV research specialists at the University of Nigeria, who assessed each item for relevance, appropriateness, and clarity. To further refine the instrument, face validation was conducted with a group of 10 undergraduate students, whose feedback on wording, comprehension, and sequencing informed minor adjustments to the questionnaire. Internal consistency reliability was assessed using Cronbach's alpha, which yielded a value above 0.7, confirming acceptable reliability for the study variables.

The questionnaire was organized into three distinct sections (A–C) and included both closed- and open-ended items. Section A contained six questions addressing respondents' socio-demographic characteristics, including age, marital status, and level of study. Section B consisted of five questions focused on HIV-related variables, such as testing history, HIV status, and sexual behavior. Section C comprised twelve items designed to evaluate participants' awareness of the dapivirine vaginal ring (DPV-VR), willingness to pay for the product, the maximum amount they were willing to pay, and, where applicable, reasons for unwillingness to pay.

Following completion of baseline data collection, participants were exposed to an educational intervention delivered in the form of a professionally developed visual poster. The poster was designed to convey key information about the dapivirine vaginal ring and addressed five core components: the appearance and physical characteristics of the ring, its drug composition, how it works to prevent HIV infection, instructions on usage and duration of effectiveness, and potential side effects. Development of the educational material involved close collaboration with experts in HIV research and clinical management at the University of Nigeria, who reviewed the content to ensure scientific accuracy, clarity of language, and suitability for a student audience. The poster also underwent validation to confirm that it met educational quality standards and effectively communicated information in a clear, engaging, and accessible manner.

#### *Data collection procedure*

Data collection was carried out using an electronic survey format. The study questionnaire was adapted into a Google Form, and access links were distributed to eligible participants through WhatsApp platforms. Prior to distribution, permission was obtained from class representatives, who facilitated access to class groups and assisted in verifying that only legitimate class members received the survey links. Participation proceeded in a stepwise manner, beginning with completion of the baseline questionnaire. Only after submission of the initial responses were participants provided with the educational material.

Following confirmation that the educational content had been viewed and reviewed, participants were sent the post-intervention questionnaire. Reminder notifications were issued at each stage of the process to encourage timely participation and completion. A one-week interval was maintained between successive stages of data collection in order to capture immediate changes in knowledge, perceptions, and attitudes attributable to the educational intervention, while minimizing the influence of external factors over time.

To maintain data integrity, access restrictions were embedded within the Google Form settings. These measures prevented participation by individuals who did not meet eligibility criteria and blocked multiple submissions from the same respondent. Participants who failed to complete the baseline survey were automatically excluded from subsequent stages of the study. Overall,

the data collection process spanned a period of approximately two months.

#### *Data management and analysis*

Once the data collection phase was completed, access to the Google Form was closed to prevent additional submissions. The collected responses were then exported into Microsoft Excel (2019), where they were reviewed carefully to identify and correct inconsistencies or incomplete entries. After cleaning, the dataset was transferred into Statistical Product and Service Solutions (SPSS) version 27 for statistical analysis.

Descriptive statistical techniques, including frequencies and percentages, were applied to summarize both the independent and dependent variables of the study. Differences in participants' acceptability of the dapivirine vaginal ring before and after the educational intervention were examined using the chi-square test. Binary logistic regression analysis was conducted to identify sociodemographic factors associated with post-intervention acceptability and willingness to pay for the DPV-VR. For this analysis, both outcome variables were recoded into two categories: "yes" and "others," with the latter combining "no" and "not sure" responses.

Willingness to pay was assessed in Nigerian Naira using a contingent valuation approach, applying an exchange rate of N490 to 1 US dollar, which represented the prevailing average rate during the 2022 study period. This conversion was selected to ensure that respondents' stated amounts accurately reflected local economic

conditions. Contingent valuation was considered appropriate because it enables estimation of the monetary value individuals assign to health technologies that are not yet widely accessible, such as the dapivirine vaginal ring. This method allowed participants to realistically assess and express the amount they would be prepared to pay, providing insight into potential demand and affordability. Statistical significance for all analyses was determined at a p-value of less than 0.05.

#### **Results and Discussion**

Out of the eligible population, 1017 students completed the survey, corresponding to a response rate of 67.8%. Participants were drawn from five faculties, including Arts with 196 students (19.3%), Biological Sciences with 173 students (17%), Pharmaceutical Sciences with 342 students (33.6%), Social Sciences with 113 students (11.1%), and Veterinary Medicine with 193 students (19%). Significant differences were observed across faculties with respect to age distribution, marital status, and level of study ( $P < 0.001$ ).

The majority of respondents were aged between 18 and 24 years, accounting for 754 participants (74.1%). Most of the students were single, representing 886 individuals (87.1%), and 751 respondents (73.8%) reported the Senior School Certificate Examination (SSCE) as their highest educational qualification. A comprehensive summary of the respondents' sociodemographic characteristics is presented in **Table 1**.

**Table 1.** Sociodemographic characteristics of the respondents

Characteristic	Category	Biological Sciences n (%)	Arts n (%)	Pharmaceutical Sciences n (%)	Veterinary Medicine n (%)	Total n (%)	Social Sciences n (%)	P-Value
<b>Year of Study</b>	100 level	3 (1.7)	31 (15.8)	21 (6.1)	27 (14.0)	90 (8.8)	8 (7.1)	< 0.001
	200 level	24 (13.9)	65 (33.2)	40 (11.7)	74 (38.3)	221 (21.7)	18 (15.9)	
	300 level	41 (23.7)	47 (24.0)	61 (17.8)	43 (22.3)	233 (22.9)	41 (36.3)	
	400 level	105 (60.7)	53 (27.0)	129 (37.7)	36 (18.7)	369 (36.3)	46 (40.7)	
	500 level	0 (0.0)	0 (0.0)	91 (26.6)	13 (6.7)	104 (10.2)	0 (0.0)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	1017 (100.0)	113 (100.0)	
<b>Age (years)</b>	Under 18	2 (1.2)	21 (10.7)	5 (1.5)	16 (8.3)	47 (4.6)	3 (2.7)	< 0.001
	18–24	141 (81.5)	134 (68.4)	261 (76.3)	139 (72.0)	754 (74.1)	79 (69.9)	
	25–29	28 (16.2)	36 (18.4)	71 (20.8)	33 (17.1)	194 (19.1)	26 (23.0)	
	30 and older	2 (1.2)	5 (2.6)	5 (1.5)	5 (2.6)	22 (2.2)	5 (4.4)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	1017 (100.0)	113 (100.0)	
<b>Highest Qualification</b>	SSCE	125 (72.3)	136 (69.4)	283 (82.7)	140 (72.5)	751 (73.8)	67 (59.3)	< 0.001

Prior to Admission								
	NCE/ND	8 (4.6)	22 (11.2)	14 (4.1)	31 (16.1)	87 (8.6)	12 (10.6)	
	Bachelor's Degree	40 (23.1)	38 (19.4)	45 (13.2)	22 (11.4)	179 (17.6)	34 (30.1)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	1017 (100.0)	113 (100.0)	
Mode of Entry								
	UTME	154 (89.0)	177 (90.3)	280 (81.9)	154 (79.8)	861 (84.7)	96 (85.0)	0.012
	Direct Entry/Transfer	19 (11.0)	19 (9.7)	62 (18.1)	39 (20.2)	156 (15.3)	17 (15.0)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	1017 (100.0)	113 (100.0)	
Marital Status								
	Single	153 (88.4)	151 (77.0)	318 (93.0)	160 (82.9)	886 (87.1)	104 (92.0)	< 0.001
	Married	3 (1.7)	13 (6.6)	15 (4.4)	15 (7.8)	51 (5.0)	5 (4.4)	
	Divorced	0 (0.0)	4 (2.0)	0 (0.0)	4 (2.1)	8 (0.8)	0 (0.0)	
	Engaged	17 (9.8)	28 (14.3)	9 (2.6)	14 (7.3)	72 (7.1)	4 (3.5)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	1017 (100.0)	113 (100.0)	

HIV status awareness was reported by 531 (52.2%) of the 1017 students who participated in the study. When examined by faculty, awareness levels were 98 (50.0%) among Arts students, 103 (59.5%) in Biological Sciences, 170 (49.7%) in Pharmaceutical Sciences, 69 (61.1%) in Social Sciences, and 91 (47.2%) in Veterinary

Medicine. Among respondents who had previously taken an HIV test, confirmed positive status was reported by 11 (1.1) individuals, whereas 129 (12.7%) indicated that they were unable to recall the outcome of their test. Further breakdowns of HIV serostatus for both respondents and their partners are provided in **Table 2**.

**Table 2.** HIV serostatus of respondents and their partners

Characteristic	Category	Biological Sciences n (%)	Arts n (%)	Pharmaceutical Sciences n (%)	Veterinary Medicine n (%)	Social Sciences n (%)	Total n (%)	P-Value
Any sexual partner tested positive for HIV in the past 4 weeks	Yes	18 (10.4)	15 (7.7)	19 (5.6)	8 (4.1)	11 (9.7)	71 (7.0)	0.015
	No	100 (57.8)	101 (51.5)	208 (60.8)	102 (52.8)	72 (63.7)	583 (57.3)	
	Do not know	55 (31.8)	80 (40.8)	115 (33.6)	83 (43.0)	30 (26.5)	363 (35.7)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	
Ever been tested for HIV	Yes	103 (59.5)	98 (50.0)	170 (49.7)	91 (47.2)	69 (61.1)	531 (52.2)	0.033
	No	70 (40.5)	98 (50.0)	172 (50.3)	102 (52.8)	44 (38.9)	486 (47.8)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	
Current HIV status (among those ever tested)	Positive	3 (1.7)	3 (1.5)	2 (0.6)	1 (0.5)	2 (1.8)	11 (1.1)	0.198
	Cannot remember	18 (10.4)	28 (14.3)	36 (10.6)	35 (18.1)	12 (10.6)	129 (12.7)	
	Negative	152 (87.9)	165 (84.2)	303 (88.9)	157 (81.3)	99 (87.6)	876 (86.2)	
	<b>Total</b>	173 (100.0)	196 (100.0)	341 (100.0)	193 (100.0)	113 (100.0)	1016 (100.0)	

<b>Engaged in anal sex in the past 1 year</b>	Yes	9 (5.2)	29 (14.8)	17 (5.0)	20 (10.4)	10 (8.8)	85 (8.4)	< 0.001
	No	159 (91.9)	125 (63.8)	315 (92.1)	121 (62.7)	98 (86.7)	818 (80.4)	
	Cannot remember	5 (2.9)	42 (21.4)	10 (2.9)	52 (26.9)	5 (4.4)	114 (11.2)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	
<b>Male partner used condom during vaginal sex in the past 4 weeks</b>	Yes	46 (26.6)	47 (24.0)	75 (21.9)	41 (21.2)	41 (36.3)	250 (24.6)	0.007
	No	45 (26.0)	52 (26.5)	62 (18.1)	44 (22.8)	24 (21.2)	227 (22.3)	
	Do not have a partner	82 (47.4)	97 (49.5)	205 (59.9)	108 (56.0)	48 (42.5)	540 (53.1)	
	<b>Total</b>	173 (100.0)	196 (100.0)	342 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	

Awareness of the dapivirine vaginal ring among the study population was generally low. Out of 1017 participants, only 304 (29.9%) reported having prior knowledge of the DPV-VR. Correct understanding of the intended user was particularly limited, as just 12 (1.2%) respondents accurately identified the ring as a female-used HIV prevention method ( $p < 0.001$ ). In contrast, a larger proportion of students demonstrated correct knowledge

regarding duration of use, with 486 (47.8) correctly stating that a single DPV-VR is designed for one month of use. Analysis further revealed a statistically significant association between students' academic faculty and their baseline knowledge of the dapivirine vaginal ring. Detailed findings on participants' pre-intervention knowledge of DPV-VR are presented in **Table 3**.

**Table 3.** Respondents' knowledge on dapivirine vaginal ring

Characteristic	Arts n (%)	Category	Pharmaceutical Sciences n (%)	Biological Sciences n (%)	Veterinary Medicine n (%)	Social Sciences n (%)	Total n (%)	P-Value
<b>Who uses the dapivirine vaginal ring</b>	6 (3.1)	Males	0 (0.0)	1 (0.6)	3 (1.6)	2 (1.8)	12 (1.2)	< 0.001
	94 (48.0)	Females	263 (76.9)	104 (60.1)	42 (21.8)	59 (52.2)	562 (55.3)	
	16 (8.2)	Do not know	2 (0.6)	1 (0.6)	14 (7.3)	3 (2.7)	36 (3.5)	
	80 (40.8)	Both	77 (22.5)	67 (38.7)	134 (69.4)	49 (43.4)	407 (40.0)	
	196 (100.0)	<b>Total</b>	342 (100.0)	173 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	
<b>Ever heard of the dapivirine vaginal ring</b>	30 (15.3)	Yes	160 (46.8)	55 (31.8)	30 (15.5)	29 (25.7)	304 (29.9)	< 0.001
	137 (69.9)	No	173 (50.6)	114 (65.9)	123 (63.7)	81 (71.7)	628 (61.8)	
	29 (14.8)	Cannot remember	9 (2.6)	4 (2.3)	40 (20.7)	3 (2.7)	85 (8.4)	
	196 (100.0)	<b>Total</b>	342 (100.0)	173 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	
<b>Duration of use for a single dapivirine vaginal ring</b>	81 (41.3)	One vaginal sex act	81 (23.7)	59 (34.1)	57 (29.5)	37 (32.7)	315 (31.0)	< 0.001
	65 (33.2)	One month	220 (64.3)	85 (49.1)	71 (36.8)	45 (39.8)	486 (47.8)	
	21 (10.7)	Six months	19 (5.6)	15 (8.7)	23 (11.9)	11 (9.7)	89 (8.8)	
	13 (6.6)	One year	9 (2.6)	8 (4.6)	16 (8.3)	4 (3.5)	50 (4.9)	
	16 (8.2)	Lifetime	13 (3.8)	6 (3.5)	26 (13.5)	16 (14.2)	77 (7.6)	

	196 (100.0)	<b>Total</b>	342 (100.0)	173 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	
<b>Time for dapivirine vaginal ring to become effective</b>	27 (13.8)	Less than 24 hours	47 (13.7)	22 (12.7)	21 (10.9)	7 (6.2)	124 (12.2)	< 0.001
	44 (22.4)	24 hours or more	124 (36.3)	28 (16.2)	25 (13.0)	20 (17.7)	241 (23.7)	
	125 (63.8)	Do not know	171 (50.0)	123 (71.1)	147 (76.2)	86 (76.1)	652 (64.1)	
	196 (100.0)	<b>Total</b>	342 (100.0)	173 (100.0)	193 (100.0)	113 (100.0)	1017 (100.0)	

At baseline, prior to receiving any structured information, 294 participants indicated a willingness to use the dapivirine vaginal ring despite lacking adequate knowledge of its purpose and function. Following exposure to the educational intervention, willingness to use the product increased sharply to 596, representing a statistically significant shift in acceptability ( $p < 0.001$ ). In parallel, uncertainty declined considerably: the number of students who reported being undecided about DPV-VR use fell from 517 before the intervention to 255 afterward ( $p < 0.001$ ).

When the possibility of out-of-pocket payment was explored in the absence of free provision, 572

respondents stated that they would be prepared to pay for the dapivirine vaginal ring. However, responses varied once specific price options were introduced, with the largest group (466 students) selecting a payment amount below ₦410. Among participants who expressed unwillingness to pay, the dominant justification was the expectation that the product should be supplied at no cost by the government, a position reported by 381 (53.7%) respondents. Comprehensive results detailing changes in acceptability and payment preferences before and after the educational intervention are presented in **Tables 4, 5 and 6**.

**Table 4.** Respondent's acceptance of dapivirine vaginal ring before the intervention

Characteristic	Arts n (%)	Category	Pharmaceutical Sciences n (%)	Biological Sciences n (%)	Veterinary Medicine n (%)	Social Sciences n (%)	Total n (%)	P-Value
<b>Reasons for willingness (among those who said Yes)</b>	85 (16.4)	Not sure	167 (32.3)	95 (18.4)	107 (20.7)	63 (12.2)	517 (100.0)	< 0.001
	58 (27.8)	It can prevent other STDs	39 (18.7)	27 (12.9)	65 (31.1)	20 (9.6)	209 (100.0)	
	24 (22.9)	It would prevent pregnancy	18 (17.1)	10 (9.5)	49 (46.7)	4 (3.8)	105 (100.0)	
	150 (21.0)	<b>Total (multiple responses possible)</b>	225 (31.5)	101 (14.1)	168 (23.5)	70 (9.8)	714 (100.0)	
<b>Willingness to use the dapivirine vaginal ring</b>	54 (18.4)	Yes	115 (39.1)	43 (14.6)	52 (17.7)	30 (10.2)	294 (100.0)	0.019
	57 (27.7)	No	60 (29.1)	35 (17.0)	34 (16.5)	20 (9.7)	206 (100.0)	
	196 (19.3)	<b>Total</b>	342 (33.6)	173 (17.0)	193 (19.0)	113 (11.1)	1017 (100.0)	

**Table 5.** Post-intervention willingness and acceptability to pay for the dapivirine vaginal ring among respondents

Characteristic	Arts n (%)	Category	Pharmaceutical Sciences n (%)	Biological Sciences n (%)	Veterinary Medicine n (%)	Social Sciences n (%)	Total n (%)	P-Value
<b>Willingness to pay for provision of the vaginal ring by a clinician</b>	83 (14.5)	Yes	232 (40.6)	115 (20.1)	71 (12.4)	71 (12.4)	572 (100.0)	< 0.001
	113 (25.4)	No	110 (24.7)	58 (13.0)	122 (27.4)	42 (9.4)	445 (100.0)	

	196 (19.3)	<b>Total</b>	342 (33.6)	173 (17.0)	193 (19.0)	113 (11.1)	1017 (100.0)	
<b>After learning about the dapivirine vaginal ring, willingness to use it</b>	95 (15.9)	Yes	193 (32.4)	97 (16.3)	148 (24.8)	63 (10.6)	596 (100.0)	< 0.001
	56 (33.7)	No	56 (33.7)	28 (16.9)	13 (7.8)	13 (7.8)	166 (100.0)	
	45 (17.6)	Not sure	93 (36.5)	48 (18.8)	32 (12.5)	37 (14.5)	255 (100.0)	
	196 (19.3)	<b>Total</b>	342 (33.6)	173 (17.0)	193 (19.0)	113 (11.1)	1017 (100.0)	
<b>Reasons for not being willing to pay (multiple responses possible)</b>	46 (28.6)	It may not be effective	36 (17.7)	28 (26.4)	31 (18.0)	12 (17.9)	153 (21.6)	0.071
	36 (22.4)	It may be expensive	56 (27.6)	29 (27.4)	35 (20.3)	19 (28.4)	175 (24.7)	
	79 (49.1)	It should be provided by the government at no cost	111 (54.7)	49 (46.2)	106 (61.6)	36 (53.7)	381 (53.7)	
	161 (100.0)	<b>Total</b>	203 (100.0)	106 (100.0)	172 (100.0)	67 (100.0)	709 (100.0)	
<b>Maximum amount willing to pay per year for dapivirine vaginal rings</b>	78 (16.7)	Less than ₦410	151 (32.4)	83 (17.8)	99 (21.2)	55 (11.8)	466 (100.0)	< 0.001
	20 (22.0)	₦410–₦8,200	39 (42.9)	11 (12.1)	9 (9.9)	12 (13.2)	91 (100.0)	
	1 (4.0)	₦8,700–₦16,500	15 (60.0)	4 (16.0)	3 (12.0)	2 (8.0)	25 (100.0)	
	7 (41.2)	₦16,800–₦24,700	4 (23.5)	2 (11.8)	3 (17.6)	1 (5.9)	17 (100.0)	
	3 (42.9)	₦25,100–₦32,900	3 (42.9)	1 (14.3)	0 (0.0)	0 (0.0)	7 (100.0)	
	0 (0.0)	₦33,300–₦41,100	4 (57.1)	2 (28.6)	1 (14.3)	0 (0.0)	7 (100.0)	
	42 (20.1)	More than ₦41,100	80 (38.3)	40 (19.1)	20 (9.6)	27 (12.9)	209 (100.0)	

**Table 6.** Pre- and post-intervention differences in acceptability of the dapivirine vaginal ring

Pre-intervention acceptability	Post-intervention : Yes (%)	Post-intervention : Yes (n)	Post-intervention : No (%)	Post-intervention: Not sure (%)	Post-intervention : No (n)	Post-intervention: Not sure (n)	Total (%)	Total (n)	P-value
No	10.4	62	54.8	20.8	91	53	20.3	206	
Yes	43.3	258	9.0	8.2	15	21	28.9	294	≤ 0.001
Not sure	46.3	276	36.1	71.0	60	181	50.8	517	
<b>Total</b>	<b>100.0</b>	<b>596</b>	<b>100.0</b>	<b>100.0</b>	<b>166</b>	<b>255</b>	<b>100.0</b>	<b>1017</b>	

Among students in the Pharmacy faculty, the year of study was the sole significant predictor of dapivirine vaginal ring (DPV-VR) acceptability following the educational intervention. Students in their fifth year or second year had approximately three times higher odds (OR = 2.999,  $p = 0.044$ ; and OR = 3.050,  $p = 0.046$ ,

respectively) of accepting the DPV-VR compared to those in their first year.

Regarding willingness to pay for the DPV-VR, the only sociodemographic factor that emerged as a significant predictor was marital status. Married respondents

showed a 14.1% greater likelihood of being willing to pay compared to single respondents (Tables 7 and 8).

**Table 7.** Association between respondents' sociodemographic characteristics and acceptability of the dapivirine vaginal ring after educational intervention

Variable	Category	B	Wald	S.E.	df	Exp(B)	Sig.	95% C.I. for Exp(B) Upper	95% C.I. for Exp(B) Lower
<b>Level of study</b>	100 level (Reference)						8.027		
	200 level	1.115	3.987	0.559	1	3.050	0.046	9.114	1.021
	300 level	0.473	0.783	0.535	1	1.605	0.376	4.583	0.562
	400 level	0.819	2.451	0.523	1	2.268	0.117	6.324	0.814
	500 level	1.098	4.044	0.546	1	2.999	0.044	8.750	1.028
	600 level	1.285	1.646	1.002	1	3.616	0.200	25.771	0.507
<b>Highest qualification</b>	(Coded variable)	-0.418	2.022	0.294	1	0.659	0.155	1.171	0.370
<b>Marital status</b>	Single (Reference)						1.090		
	Engaged	0.107	0.030	0.618	1	1.113	0.862	3.739	0.332
	Married	-0.810	1.049	0.790	1	0.445	0.306	2.095	0.095
<b>Constant</b>		-0.075	0.006	0.981	1	0.928	0.939		

**Table 8.** Association between respondents' sociodemographic factors and their willingness to pay for the dapivirine vaginal ring

Variable	S.E.	B	df	Wald $\chi^2$	p-value	95% CI for AOR (Lower–Upper)	Adjusted Odds Ratio (AOR)
<b>Level of Study</b>			5	6.488	0.262		
100 level (Reference)	–	–	–	–	–	–	1.000
200 level	0.597	–0.213	1	0.128	0.721	0.251–2.604	0.808
300 level	0.575	–0.498	1	0.751	0.386	0.197–1.875	0.607
400 level	0.564	–0.320	1	0.323	0.570	0.240–2.193	0.726
500 level	0.601	0.368	1	0.376	0.540	0.445–4.690	1.445
600 level	1.020	–0.230	1	0.051	0.822	0.108–5.867	0.794
<b>Age (years)</b>			3	0.708	0.871		

< 18 (Reference)	–	–	–	–	–	–	1.000
18–24	0.891	0.060	1	0.005	0.946	0.185–6.095	1.062
25–29	0.941	–0.220	1	0.055	0.815	0.127–5.075	0.802
≥ 30	10,000	21.653	1	0.000	0.999	0.000–∞	2.0 × 10 <sup>9</sup>
Single (Reference)	–	–	–	–	–	–	1.000
Engaged	0.643	0.252	1	0.154	0.695	0.365–4.537	1.287
Married	0.876	–1.958	1	4.997	<b>0.025</b>	0.025–0.786	0.141
<b>Constant</b>	0.991	0.896	1	0.817	0.366	–	2.450
<b>Highest Educational Qualification</b>	0.313	0.047	1	0.023	0.880	0.568–1.937	1.049
<b>Marital Status</b>			2	5.187	0.075		

This study assessed how an educational intervention influenced awareness and willingness to pay for the dapivirine vaginal ring among female undergraduates at the University of Nigeria. Most respondents fell within the 18–24-year age group, while participants aged 30 years and above were relatively few. This pattern aligns with Nigeria's university entry age, which commonly starts at 16 years, and the typical duration of undergraduate training, which ranges from four to six years. Despite a high proportion of students reporting recent HIV testing prior to the study, very few indicated a positive HIV status. Reluctance to disclose HIV status, likely driven by stigma and fear of discrimination, may explain this finding and could limit students' ability to seek timely and appropriate HIV-related care and support.

#### *Key findings*

Prior to the educational intervention, awareness of the dapivirine vaginal ring (DPV-VR) among respondents was generally low. A large proportion of students had no prior knowledge of the product and were unfamiliar with its intended users, recommended duration of use, or the timeframe for achieving protective effects. Awareness levels varied notably by faculty or field of study, with students in the pharmaceutical sciences demonstrating significantly greater knowledge than those in other disciplines. This difference may be explained by the inclusion of HIV prevention and management topics within pharmacy training, which could have exposed these students to relevant information before their participation in the study.

Initially, many respondents expressed uncertainty about their willingness to use the DPV-VR. Following the educational intervention, however, more than half indicated a readiness to adopt the vaginal ring if it were

made available. Among those who remained unwilling to use the product, concerns about possible side effects were the most commonly cited reason, with the nature of these concerns differing across faculties. In addition, the majority of participants reported a willingness to pay for the DPV-VR when prescribed or provided by a healthcare professional, although nearly half preferred to pay only a minimal amount. Willingness to pay also varied by academic discipline, with a higher proportion of students from the Arts and Veterinary Medicine indicating unwillingness to pay. Notably, more than half of the respondents believed that the DPV-VR should be supplied free of charge by the government, which was the primary reason given for their reluctance to pay.

#### *Comparison with previous studies*

Pre-exposure prophylaxis (PrEP) is widely recognized as a critical HIV prevention strategy for populations with heightened vulnerability to infection, including women engaged in high-risk sexual activities. The dapivirine vaginal ring represents an important female-controlled PrEP option that complements safer sexual behaviors by providing sustained protection during vaginal intercourse. However, evidence from diverse settings indicates that knowledge and uptake of PrEP remain inconsistent across populations. For example, studies among men who have sex with men (MSM) in high-income countries have demonstrated high levels of awareness but comparatively low utilization. Griffin *et al.* reported that although awareness of PrEP exceeded 80% among MSM in the southeastern United States, actual use was limited to less than 10% [12]. Educational attainment, HIV-related experiences such as testing, and healthcare provider engagement were identified as key determinants of awareness [12]. Comparable trends have been observed in China, where MSM populations

similarly exhibited substantial awareness alongside minimal adoption of PrEP [13]. In contrast, research conducted in Nigeria among gay and bisexual men revealed markedly lower baseline awareness; nevertheless, once provided with information, the majority expressed interest in PrEP use [14]. A similar pattern of low awareness coupled with high willingness has been documented among female sex workers in Nigeria, suggesting that information gaps rather than resistance may drive poor uptake. Among women in the general population, awareness remains limited. In a study from Miami, despite nearly two-thirds of women of reproductive age being aware of PrEP, only a small minority reported current use, with awareness influenced by socioeconomic status, sexual behavior, and prior HIV testing [15]. Nigerian university students have also been shown to possess limited knowledge of PrEP, reinforcing the need for targeted interventions within academic settings [16]. Collectively, these findings underscore the importance of structured educational approaches, including clinician-led workshops and community-based information sessions, as well as tailored promotional strategies to improve awareness of the dapivirine vaginal ring and other PrEP modalities among female undergraduates in Nigeria.

Research specifically addressing awareness and knowledge of the dapivirine vaginal ring remains limited. Nevertheless, findings from the present study indicating a high level of willingness to use the ring are consistent with outcomes reported in clinical trials. Previous studies have documented acceptability rates approaching universality, with one trial reporting that 97% of participants were willing to use the product [17]. Similarly, participants enrolled in the MTN-020/ASPIRE phase III trial across several sub-Saharan African countries demonstrated overall positive perceptions of the vaginal ring, although acceptability varied by country [18]. Despite its favorable safety profile, some women have expressed reservations related to possible interference with sexual activity, menstruation, or bodily comfort [18]. Evidence from a systematic review conducted in low- and middle-income countries further supports high acceptability and continuation of vaginal ring use, with rare adverse effects and occasional concerns about the ring becoming displaced internally [19]. In the current study, apprehension about potential side effects emerged as the primary reason for reluctance to use the ring. However, qualitative findings from the ASPIRE trial suggest that such fears tend to diminish

over time, as continued use fosters familiarity, confidence, and personal ownership of the product [20]. Economic considerations also play a critical role in the uptake of novel HIV prevention technologies. In this study, most participants indicated a willingness to pay for the dapivirine vaginal ring, although the preferred amount was generally below one US dollar. This mirrors findings from a Kenyan study presented at the INTEREST 2022 conference, which reported that while the majority of women were willing to pay for the ring, approximately half were only willing to pay a nominal fee equivalent to less than one dollar [21]. At present, the market price of the dapivirine vaginal ring ranges from \$6 to \$8 per unit, translating to an annual cost of \$72–\$96. Despite evidence from modeling studies demonstrating that the dapivirine ring is a cost-effective HIV prevention intervention—even among high-risk populations such as female sex workers—financial barriers may still hinder widespread adoption in low- and middle-income countries, where healthcare financing relies heavily on out-of-pocket payments [22, 23]. This challenge is particularly salient in Nigeria, where HIV-related services, including oral PrEP, are commonly provided free of charge at public health facilities.

Although this study contributes novel evidence on the acceptability and affordability of the dapivirine vaginal ring among Nigerian female undergraduates, certain methodological constraints should be considered. The focus on a single university limits the extent to which the findings can be generalized to other institutions or regions. Additionally, the short duration between pre- and post-intervention assessments may have influenced participant responses. While extending this interval could reduce the risk of contamination effects, longer gaps may introduce recall bias, and there is no established standard for determining the optimal timing in intervention-based studies. Despite these limitations, this research represents the first investigation into willingness to use and pay for the dapivirine vaginal ring among female university students in Nigeria and provides a valuable foundation for future studies aimed at expanding HIV prevention options for women.

## Conclusion

The findings of this study demonstrate that targeted educational interventions are highly effective in enhancing knowledge and acceptability of the dapivirine vaginal ring as a pre-exposure prophylaxis option among

female undergraduate students. Exposure to structured information not only improved understanding of the product but also increased participants' readiness to use the vaginal ring and their willingness to contribute financially toward its provision. These results highlight the importance of accurate and accessible health education in promoting awareness, adoption, and perceived value of the dapivirine vaginal ring among young women of reproductive age.

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