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ORIGINAL ARTICLE

Effects of a structured health education on prevention of HIV risky behaviours among adolescents in Nigeria – a pragmatic randomized controlled trial

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ABSTRACT

Infection with HIV/AIDS continues to be a major public health concern around the world, particularly in low- and middle-income nations. To assess the effectiveness of structured health education on the prevention of HIV/AIDS risky behaviours among adolescents in secondary school. A pretest-posttest-control group randomized controlled trial where a sample of 647 adolescents was drawn from the population of 2,890 secondary school students and was block-randomized into the intervention (n = 400) and control (n = 224) groups. Data were collected using a content-validated (CVI = 4.2/5) and reliable (k = 0.791) self-developed structured questionnaire. Data were analyzed using descriptive statistics and with inferential statistics of independent and paired t-tests at α = 0.05. Pre-intervention risky behaviours in both groups were below average though lower in the intervention than in the control group. Pre-intervention risky behaviour was significantly higher among males than females in the rural school ($p < 0.001$) and in both schools together ($p < 0.001$). Health education significantly affected risky behaviour with the intervention group being associated with lesser risky behaviour than the control group. There was no significant difference in the post-intervention risky behaviour between males and females in the rural (0.285), urban (0.179) and both schools together ($p = 0.956$). Post-intervention reduced risky behaviours more significantly in the intervention than in the control groups. HIV/AIDS health education should be part of schools' curriculum, guidance and counsellor teachers should be trained as HIV counsellors

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Health education; HIV/AIDS; prevention of risky behaviours; secondary school; adolescents

1. Introduction

HIV/AIDS infection remains a historic public health issue globally, especially in low and middle-income countries like Nigeria where access to HIV/AIDS education and the use of Voluntary Counseling and Testing (VCT) is low [1]. Adolescents' risky behaviour was conceptualized in this study as those lifestyles that possibly expose them to increase chances of contracting HIV/AIDS and other sexually transmitted diseases. These risky behaviours are on the increase due to factors such as the absence of HIV/AIDs education and sexual information, lack of access to VCT [1], promiscuity/multiple sexual partners [2,3], drugs and alcohol use, early sexual exposure [1,3], unprotected sex, sharing sharp objects, homosexuality, having sex with HIV infected person and having injury with sharp materials susceptible to HIV infection [1,2]. In widespread epidemic situations, the predominant route of HIV transmission among adolescents is unprotected heterosexual behaviour, which is sometimes forced or coerced [1]. A study in North-Central Nigeria revealed low rates of condom use during sex and a history of multiple sexual partners [2]. Also, a study in Malaysia not revealed that risky sexual behaviours were relatively high among adolescents and more importantly that the lack of awareness regarding sexual health problems among these cohorts was high. They thereafter recommended that sexual health education was vital to preventing sexual-health related issues among adolescents [3]. Furthermore, an Ethiopian study reported that adolescents engaged in risky sexual behaviours even when they had heard about HIV/AIDS [4]. This may imply that adolescents' perceived risk for acquisition of HIV infection and utilization of Voluntary Counselling and Testing (VCT) was low. Thus, educational intervention with a focus on adolescents may likely be an effective approach to confronting the scourge of the HIV epidemic in Sub-Saharan Africa; moreso, Nigeria, the most populous black nation.

In 2018, 37.9 million people were living with HIV globally, 18.8 million adolescents and young adults

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aged 15–24, mostly women, and roughly 1.6 million adolescents between the ages of 10 and 19 living with HIV. By the end of 2018, Nigeria had an estimated 1.9 million HIV-positive people [5]. Nigeria (following South Africa) has the second largest HIV burden in the world with a staggering 2.8% prevalence [5]. A recent estimate ear-marked seven states in Nigeria that were considered to have a high prevalence of 2.0% or more; including Enugu as one of these states with high HIV prevalence [6]. This appears to substantiate the need to beam the searchlight crusade of adolescent education in Enugu. It also encourages the need to understudy the sexual behavioural exposures of adolescents in this environment. Conventionally, adolescents in Nigeria are not allowed to discuss information on sexual matters; it is considered unmentionable, distasteful and unpleasant, as such information is considered secret until marriage [7]. Hence, most information adolescents obtain are usually from the internet, social media, peer groups, families and friends; most of this information are dearth, dubious and devoid of the right information on sexuality and may be delivered inappropriately. As a result, proper information remains an important component of HIV prevention measures, and it is a key weapon in combating the HIV/AIDS pandemic among adolescents in low and middle-income countries. evidence-based suggested the need for increased attention towards adolescents, particularly in the provision of comprehensive, functional sexuality education, including HIV at the family- and school levels [7]. The majority of adolescent death and illness are caused by risky behaviours that can be grouped into many categories such as earlier sexual exposure, use of drugs and alcohol, sharing sharps objects and multiple sexual partners [1,5,6]. Health education remains an integral part of the overall prevention of risky behaviours among adolescents [7]. In an attempt to eradicate HIV, there is a need to educate adolescents on the prevention of risky behaviours, hence the need for the study. Thus far, available literature suggested a need for interventional study [7–10]. More so, a study in Wuhan China suggested that HIV/AIDS education should be continuous with long-term strategies not devoid of realistic objectives. HIV education remains a strong factor in improving adolescents' health by building adolescents' ability to process and understand risky behaviours related to HIV/AIDS [9].

Prevention of HIV/AIDS-related risky behaviours, as well as the use of voluntary counselling, is an effective and fundamental approach for both HIV/AIDS prevention and care [5], and it is a key entry point for all adolescents, especially those not living with HIV/AIDS to continue to stay negative, promote healthy behaviours, and receive care and support [9]. The use of VCT services by young people has been shown also to be limited, and under-used; primarily due to lack of confidentiality, cost of services and unfriendly attitudes of clinical staff [11]. A substantial body of evidence has demonstrated that a comprehensive sexuality education plays a central role in the preparation of young people for a safe, productive and fulfilling life in a world where HIV, sexually transmitted infections (STIs), unintended pregnancies, gender-based violence and gender inequality still pose serious risks to their wellbeing [12].

Despite these known potentials for behavioural change by adolescents, political instability, terrorism, poverty and the recent HIV spread in Nigeria, there is a paucity of known literature on the provision of HIV education in the prevention of risk behaviours among adolescents in secondary schools in Nigeria; thus, the need for this study. The study hypothesized that HIV education will significantly reduce risky sexual behaviours among secondary school adolescents in southeast Nigeria. Further, it hypothesized that there will be a non-significant difference in the level of HIV risky behaviour between male and female adolescents after the intervention.

2. Materials and method

A pretest-posttest-control group experimental design was conducted from September 2020 – to May 2021. The study was conducted in three phases, baseline survey, intervention and post-intervention. The intervention group received HIV/AIDs education with onsite voluntary counselling and testing in addition to their usual academic programmes while the control group had only their usual academic programmes.

2.1. Sample size

A sample size of 647 students was drawn from the total population of 2,890 adolescents in senior secondary school (equivalent to high school, college etc.), using a finite population formula by Kerjcie and Morgan [13]. Participanting schools were selected using simple random selection (fish-bowl method) and the participants were thereafter block-randomized based on their institutions and classes. Only participants who were mentally and physically stable were included in the study. Students in the senior classes who have attended menarche with mental fitness and obtained written consent from parents or guardians were included in the study while those without parental consent and not willing to participate were excluded from the study.

2.2. Ethical consideration

Ethical clearance was obtained from the Health Research and Ethical Committee of the University of

Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu. Informed consent, voluntary participation, confidentiality, and anonymity were ensured all through the study period in line with Helsinki's declaration. Written informed consent was sought and obtained from the parents or guardians of the students that participated in this study. Also, the administrative permit was obtained from the Ministry of Education Enugu State, while further gateway approvals were obtained from the principals of each selected school.

2.3 Instrument

The instrument used for data collection was a self-developed questionnaire structured in two (2) sections. Section A covered demographic data, Section B on HIV risky behaviours presented on a four-point Likert type scale ranging from always to never and the four subscale measures. The content validity index was determined based on the rating of 7 experts who rated the originality and necessity of each item based on the overall use of the instrument. The experts were to score over 5 (0 = not required and 5 = absolutely necessary). From these, the content validity index was calculated. The instrument gave a CVI of 4.2. The reliability of the instrument was also tested using Cohen Kappa (k = 0.791). Therefore, the instrument had excellent content validity and reliability. For this study and given that the instrument used a Likert scale (1,2,3,4), 2.5 was the calculated [(1 + 2 + 3 + 4)/4] the cut-off points below which is less than average and above which is more than average.

2.4 Procedure/ 1ntervention

Six hundred and forty-seven participants were recruited using the multistage sampling technique from a total population of 2,890 adolescents in Senior Secondary Schools (SSS) levels 1 and 2 from schools in both rural and urban centres in Enugu state, Nigeria. The schools were randomly selected using computer-generated random numbers. The selected participants were blocked randomized based on schools into the intervention group (n = 406) and control group (n = 241) using the fish-bowl method as illustrated in figure 1.

A pre-test survey was administered to both groups (intervention and control) to acquire baseline data. The health education module developed by the researchers was used to provide lessons to the intervention group. The educational programme commenced one week after the collection of baseline data and took the form of face-to-face interactive lectures lasting one hour per session in a week

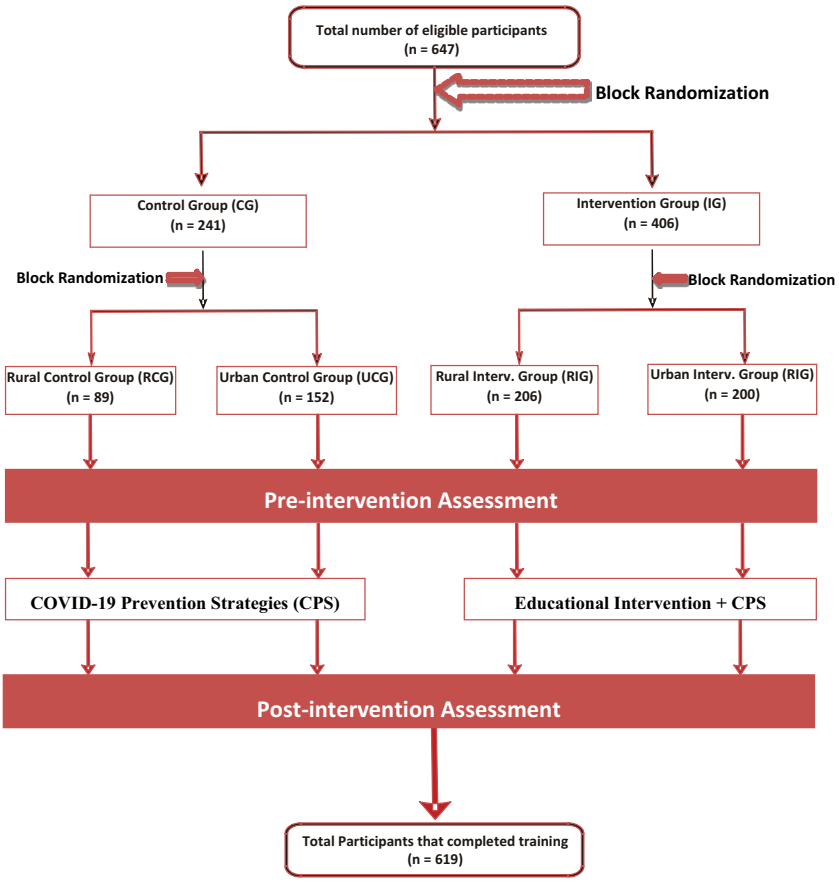

Figure 1. Flowchart of Participants through the Study.

(a total of 5 sessions) with approximately 50 participants per class. Information, Education and Communication (IEC) materials such as Microsoft power points, posters, charts, and pamphlets were used to enhance learning. The health education package was provided to the students in the intervention group for five consecutive weeks. Subsequently, three months after the educational programme, post-test data were collected from both the intervention and the control group. Meanwhile, health talks on COVID-19 prevention strategies (Hand hygiene, social distancing, signs and symptoms etc.) were provided as a standard measure for both the intervention and control groups. The intervention and questionnaire were delivered using the English language medium. After obtaining the post-intervention data, participants in the control group were provided with the same health education lessons delivered to the intervention group as compensation. Data collection lasted for three (3) months.

4.1. Data analysis

Data collected were transferred into Microsoft Excel using numerical code. Continuous variables were expressed as mean and standard deviation (SD), categorical variables as frequency and percentages. Inferential statistics were used to compare the groups and test the effects of the intervention. Independent sample t-test was used for comparison between the intervention and control group. Chi-square homogeneity of proportion test was used for comparison between groups (intervention vs. control and rural vs urban) which was dependent on the variable type and whether assumptions were met or violated. Level of significance was set at 0.05

5. Results

A total of 647 were eligible to participate in the study. Two hundred and forty-one (241) were recruited into the control group (rural = 89, urban = 152) while four hundred and six (406) were recruited into the intervention group (rural = 206, urban = 200). As the study progressed 28 (Intervention = 11, control = 17) participants were lost to follow up at 3 months post-intervention due to: the second wave of COVID-19 restrictions, change of school, illnesses and other unknown reasons.

5.1. Socio-demographic characteristics of participants

Participants' ages ranged from 11 to 24 yrs and 14–25 yrs with a mean and standard deviation of 16.36 ± 1.40 and 16.80 ± 1.34 for the intervention and the control group respectively. Females were slightly higher in the intervention group (55.7%) and likewise in the control group (51.3%). The students by their classes were SS1 (52.4%) and SS2 (47.6%) for intervention and SS1 (52.2%) and SS2 (47.8%) for control. Other characteristics of students are shown in Table 1.

Table 1. Demographic Characteristics of the Students.

	Intervention (n = 395)	Control (n = 224)	X^2/t	p-value
Age				
• ≤ 15	96 (24.3)	28(12.5)		
• 16–20	271(68.6)	187(83.5)	−3.700	<0.001*
• 21 +	3(0.8)	1(0.4)		
• *No response*	25(6.3)	8(3.6)		
Range	11–24	14–25		
M± SD	16.36 ± 1.40	16.80 ± 1.34		
Sex				
• Male	175(44.3)	107(47.8)		
• Female	220(55.7)	115(51.3)	0.869	0.351
– *No response*	-	2(0.9)		
Tribe				
• Igbo	375(94.9)	215(96.0)		
• Hausa	6(1.5)	1(0.4)	4.860	0.182
• Yoruba	5(1.3)	1(0.4)		
• Others (Tiv, Calabar, Edo, Igede, Efik)	9(2.3)	7(3.1)		
Religion				
• Christian	389(98.5)	219(97.8)		
• African tradition	5(1.3)	2(0.9)	0.167	0.683
• *No response*	1(0.3)	3(1.3)		
Class				
• SS 1	207(52.4)	117(52.2)		
• SS 2	188(47.6)	107(47.8)	0.002	0.967
Location				
• Rural	190(48.1)	72(32.1)		
• Urban	205(51.9)	152(67.9)	14.912	<0.001*

Rural-Intervention (Ozalla HS), Urban-Intervention (Day SS), Rural-Control (Community SS) and Urban-Control (Coal Camp SS)

5.2. Summary of HIV risky behaviour prevention of the intervention and control groups pre- and post-intervention

Table 2 shows risky behaviours, the exchange of sharp objects with peers and family members was most practised although practised below average in both groups (Intervention = 2.05 ± 0.90; Control = 2.08 ± 1.11); other listed risky behaviours were far from practice. For the positive behaviours, practices were also below average (<2.5) in both

Table 2. HIV risky behaviours before and after health education among the intervention and control groups.

	Pre-test (M± SD)		Post-test (M± SD)	
Risky behaviours	Intervention (N = 395)	Control (N = 224)	Intervention (N = 395)	Control (N = 224)
Have sex without a condom	1.59 ± 0.97	1.71 ± 1.07	1.15 ± 0.53	2.05 ± 1.21
Share needles to inject drugs	1.38 ± 0.82	1.38 ± 0.81	1.16 ± 0.54	1.60 ± 1.06
Have multiple sexual partners	1.32 ± 0.70	1.41 ± 0.82	1.09 ± 0.47	1.81 ± 1.10
Take alcohol and drugs before sexual intercourse	1.52 ± 0.97	1.44 ± 0.87	1.08 ± 0.41	1.81 ± 1.11
Practice anal intercourse	1.11 ± 0.51	1.20 ± 0.65	1.08 ± 0.43	1.28 ± 0.81
Exchanges sharp objects with peers and family members	2.05 ± 0.90	2.08 ± 1.11	1.77 ± 0.89	2.23 ± 1.15
Use drugs like marijuana, etc., and alcohol	1.40 ± 0.89	1.36 ± 0.83	1.10 ± 0.46	1.43 ± 0.92
Have sex with an older partner	1.15 ± 0.57	1.18 ± 0.61	1.08 ± 0.45	1.34 ± 0.78
Positive (non-risky) behaviour				
Practice sexual abstinence	2.17 ± 1.43	1.48 ± 1.08	2.88 ± 1.32	1.62 ± 1.20
Take safety measures when in contact with body fluids	2.34 ± 1.33	1.84 ± 1.23	2.64 ± 1.23	1.63 ± 1.11
Do voluntary HIV screening periodically	1.65 ± 1.07	1.65 ± 1.08	1.95 ± 1.11	1.49 ± 0.92
Ask about the HIV/AIDS status of the partner	1.81 ± 1.17	1.90 ± 1.25	1.15 ± 0.53	2.05 ± 1.21
****Overall risky behaviour**	**1.97 ± 0.58**	**2.09 ± 0.60**	**1.69 ± 0.43**	**2.28 ± 0.70**

*****Positive behaviours were reversed when computing overall risky behaviour***

groups (pre- and post-intervention) except in the post-intervention scores on the practice of taking safety measures when in contact with body fluids (2.88 ± 1.32) and sexual abstinence (2.64 ± 1.23) of the intervention group only. Though the pre-intervention scores on the practice of taking safety measures when in contact with body fluids (2.34 ± 1.33) and sexual abstinence (2.17 ± 1.43) in the intervention group were closer to the average compared to other items. The overall risky behaviour was below average in both groups though lesser in the intervention group than in the control group [Int. (1.97 ± 0.58), Con. (2.09 ± 0.60)].

5.3. Effect of health education on prevention of risky behaviour among adolescents

The effect of health education on the prevention of HIV risky behaviour was assessed by comparing the means of these behaviours between the intervention and control groups as shown in Table 3. All the risky behaviours were practised below average (i.e < 2.5). However, among the control group, exchange of sharp objects with peers and family members (2.23 ± 1.15) as well as having sex without a condom (2.05 ± 1.21) were the greatest HIV risky behaviour reported. For the positive behaviours, only the practice of sexual abstinence (2.88 ± 1.32) and taking safety measures when in contact with body fluids (2.64 ± 1.23) was practised above average, and only in the intervention group.

On the effect of health education on the overall prevention of HIV risky behaviour, there was a significant difference between the 2 groups ($t = -12.871$, $p < 0.001$). Post-education, the intervention group (1.69 ± 0.43) had significantly lower risk behaviour than the control group (2.28 ± 0.70). For the positive behaviours for preventing HIV, there was also a significant difference between the groups ($p < .001$) except in asking about the HIV/AIDS status of their partner ($t = 1.829$, $p = 0.068$). The intervention group, showed higher positive behaviour than the control group in all the items as shown in Table 3.

3.4 HIV risky behaviour between male and female adolescents before and after intervention in secondary schools in Enugu state

Table 4 for urban and rural, a significant difference existed between males and females before intervention in the level of risky behaviour ($p < .001$), with males associated more with the risky behaviour than

Table 3. Between Group Comparison of Post-test Prevention of HIV Risky Behaviours.

Risky behaviours	Intervention M± SD	Control M± SD	T	p-value
Have sex without a condom	1.15 ± 0.53	2.05 ± 1.21	−12.402	< 0.001*
Share needles to inject drugs	1.16 ± 0.54	1.60 ± 1.06	−6.412	< 0.001*
Have multiple sexual partners	1.09 ± 0.47	1.81 ± 1.10	−10.901	< 0.001*
Take alcohol and drugs before sexual intercourse	1.08 ± 0.41	1.81 ± 1.11	−11.224	< 0.001*
Practice anal intercourse	1.08 ± 0.43	1.28 ± 0.81	−3.672	< 0.001*
Exchanges sharp objects with peers and family members	1.77 ± 0.89	2.23 ± 1.15	−5.325	< 0.001*
Use drugs like marijuana, etc., and alcohol	1.10 ± 0.46	1.43 ± 0.92	−5.600	< 0.001*
Have sex with an older partner	1.08 ± 0.45	1.34 ± 0.78	−4.864	< 0.001*
Positive behaviour				
Practice sexual abstinence	2.88 ± 1.32	1.62 ± 1.20	10.505	< 0.001*
Take safety measures when in contact with body fluids	2.64 ± 1.23	1.63 ± 1.11	9.239	< 0.001*
Do voluntary HIV screening periodically	1.95 ± 1.11	1.49 ± 0.92	5.006	< 0.001*
Ask about the HIV/AIDS status of the partner	1.89 ± 1.19	1.69 ± 1.08	1.829	0.068
****Overall risky behaviour**	**1.69 ± 0.43**	**2.28 ± 0.70**	**−12.871**	**<0 .001***

**** = Significant; ** = Positive behaviours were reversed when computing overall risky behaviour***

Table 4 Pre-Post Comparison of the Male and Female Risky Behaviour based on Setting (Urban and/or Rural) Among the Intervention Participants (N = 395)

	Intervention Group (M± SD)			
Setting	Male	Female	T	p-value
Urban and Rural				
• Before	2.11 ± 0.61	1.86 ± 0.53	4.216	<0 .001*
• After	1.68 ± 0.40	1.69 ± 0.44	−0.056	0.956
Urban only				
• Before	1.82 ± 0.44	1.79 ± 0.49	0.512	0.609
• After	1.58 ± 0.37	1.67 ± 0.51	−1.350	0.179
Rural only				
• Before	2.34 ± 0.64	1.97 ± 0.56	4.205	<0 .001*
• After	1.76 ± 0.41	1.70 ± 0.33	1.071	0.285

***** = ***Significant***

females. There was however no significant difference between both after intervention (p = .956).

For the urban only, there was no significant difference between males and females before intervention (p = .609), and likewise after intervention (p = .179). Both the males and females had a comparable level of risky behaviour. For the rural only, there was a significant difference between males and females before intervention (p < .001); males were associated with higher risky behaviour than the females. No significant difference existed between both after intervention (p = .285)

6. Discussion

The majority of the participants were between 16 and 20 yrs old, females, of Igbo tribe, Christians, in SS1 and from urban locations. This is in line with the expected age of high school students and also given that there are more female students enrolled in secondary school education, especially in the study environment, this may be attributed to the increasing number of males who are involved in trading and informal learning called master-apprenticeship [14]. The preponderance of the Igbo tribe among the participants could be explained by the fact study was done in Enugu state which is predominantly an Igbo speaking and also a Christian community. The increased number of participants in urban locations could be due to the rural–urban migration and shift in population as more person prefers to settle in urban areas where there are good schools, better health services and social amenities. These findings are consistent with a study done in Jos Nigeria [15] that showed an increase in female over male participants. It is in contrast with findings of studies done in Ethiopia and Nigeria [4,7] that reported more males than females and an increase in rural participants than urban participants.

The study explored the effect of health education on the prevention of risky behaviours among secondary school adolescents. Most of the participants measured below the average cut off except for the intervention group who scored beyond 2.5 for positive risk behaviours such as practising sexual abstinence and taking safety measures when in contact with body fluids. This may be due to the educational intervention that they received. However, at baseline, the control group had almost similar score of risky behaviours compared to the intervention group but after the intervention, the control group had much higher score than the intervention group for risky behaviours and much lower scores than the intervention group for the positive behaviours. These differences most probably could be attributed to the effect of the educational intervention. Findings may be explained by the possibility that the students are aware of HIV existence but lack major information on HIV/AIDS transmission routes. Findings aligned with studies in Jos Nigeria and Wuhan China [8,9] that reported HIV/AIDS health education is effective, beneficial and reduces adolescent risky behaviours if commenced before their sexual exposure. It also supports the findings in Nigeria [16] which revealed baseline equal risk behaviours between the intervention and control group. The current statistics demonstrated the change in HIV risk behaviours from pre-intervention to post-intervention by the health education intervention which shows improved positive behaviours in the adolescents that received the intervention than those adolescents without the intervention.

There were significant differences between most of the risky behaviours especially those related to sexual activities such as having sex without a condom, having multiple sexual partners, practising anal intercourse, and having sex with an older partner. In all of these, those in the control group reported significantly higher risk behaviours than participants in the

intervention group. This may be implied that the educational intervention was effective in changing sexual risky behaviours. Findings are in line with studies in Wuhan China, Jos and Osun Nigeria which reported that health education was effective and advantageous in reducing secondary school adolescent risky behaviours when commenced early [8,9,17]. The findings far exceed the previous information on risk behaviours especially on having multiple sexual partners and having sex without a condom. This calls for the urgent mobilization of HIV education in low- and middle-income countries.

Similarly, there was also a significant difference in other risky behaviours involving sharing needles to inject drugs, taking alcohol and drugs before intercourse, exchange of sharp objectives with peers and family members and use of drugs like marijuana. Those in the control group also significantly had higher risky behaviours in these categories than those in the intervention group. likewise, this finding may also be associated with the fact that the adolescents may feel that family members and relatives are not exposed to the virus as such they are safe to exchange sharp objects. Hence, the educational intervention was effective in promoting healthy behaviours against drug abuse and other behaviours that potentiates and counteracts HIV risky behaviours against positive behaviours. Findings are in line with a study in Osun Nigeria and Ababa Ethiopia [17,18] that reported a significant risk reduction in the intervention than the control group after post-intervention.

On the other hand, the intervention group had significantly higher positive behaviours such as practising sexual abstinence, taking safety measures when in contact with body fluids and doing Voluntary HIV screening periodically than their counterpart in the control groups. It could be interpreted that the education intervention reinforced positive behaviours among those in the intervention. Findings agree with the result of Ababa Ethiopia [18,19] which reported high positive changes in risky behaviour in the intervention than the control group. There is a huge sameness between the present study with previous intervention studies which shows that interventions promoted a change in behaviours of the adolescent hence this is essential for globally HIV/AIDS education in secondary schools.

On the contrarily, there was no significant difference in only one HIV risky behaviour (asking about the HIV/AIDS status of the partners). This may imply that the educational intervention did not properly expose the participants to this particular knowledge although, this item was part of the educational package, it is possible that the means dissemination was not well articulated and enforced. It is therefore recommended that subsequent intervention should emphasise more and reinforce teaching the importance of asking and knowing the HIV status of the partners. Finding relates to revealing of Sub-Africa review [20,21] that reported low HIV status disclosure to their sexual partners despite knowing their HIV status.

Overall, the participants in the control groups had significantly higher HIV risky behaviours than those in the intervention group. It can equivocally be said that the educational intervention is very effective for promoting positive behaviours and discouraging negative risky behaviours among the participants. This educational programme is therefore recommended for use in other secondary schools in low and middle-income countries.

Lastly, the study sought to find out the comparison of HIV risky behaviour between male and female adolescents before and after the intervention. At baseline, the male participants combined from both urban and rural settings had significantly higher risk behaviours than their female counterparts. However, after the educational intervention, the male and female participants had no significant difference in HIV risk behaviours (though these scores were reduced). This implies that the intervention was very effective in addressing the HIV/AIDS risky behaviours, especially among the male participants. Findings support the report of UNAID and nationwide studies in Malaysia and Osun Nigeria [3,12,17] that revealed higher HIV-risky behaviours in adolescent males than their female counterparts; likewise, significant urban-rural and gender differences.

For the participants in the urban centres only, there was no significant difference in the HIV risky behaviours between the male and female participants, both before the intervention and after the intervention. However, the intervention was able to decrease their risky behaviours post-intervention, while the male participants had higher risky behaviours than the female participants before the intervention, they had slightly lower risky behaviours than the female participants after the intervention. This may imply that the intervention was more effective for male participants than the female, the reasons may be that males may have been poorly knowledgeable of HIV risky behaviours and their consequences and so may be more enthusiastic to learn and practice new positive behaviours. Findings agree with a study in Ekiti-Nigeria [22] that showed significant urban-rural and gender differences and contradict those of the National Agency for the Control of AIDS and a study in Jos, Nigeria [8,23], which found that adolescent girls had a higher prevalence of HIV/AIDS than boys and that students in urban areas were less likely to engage in risk behaviours at baseline than those in rural areas. There is a lot of overlap between this study and earlier intervention studies, which suggest that interventions help adolescents modify their

attitudes and behaviours, therefore HIV/AIDS education in secondary schools in low and middle-income countries is critical.

7. Conclusion

HIV/AIDS education promoted a change in risky behaviours in the study area. After receiving HIV/AIDS health education, the intervention groups developed positive behaviours, but the control group displayed negative behaviours. Overall, the intervention group had less risky behaviours than the control group. HIV/AIDS health education should be included in school curricula, and guidance and counsellor instructors should be trained as HIV counsellors, therefore this study should be replicated in other low- and middle-income countries.

8. Limitations to the study

Though, this study has been able to highlight the importance and effectiveness of HIV/AIDS education among adolescents in low and middle-income countries. The results of these findings should be interpreted with caution; first, the study was conducted in just one region (Nigeria) among several regions in low and middle-income countries. Only adolescents in public daytime students were included, hence generalization of the findings may be limited. Additionally, only literate adolescents participated in the study limiting those in private schools, illiterates and street adolescents (out of school).

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Disclosure statement

No probable conflict of interest has been declared by the authors

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Ethical approval

This study was approved by the Health and Ethical research of the University of Nigeria Teaching Hospital (approval No: NHREC/05/01/2008B-FWA00002458-IRB00002323)

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon a reasonable request.

Author contributions

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.
Study conception and design were done by IM, NO, IN
The intervention was done by IM, CM, IN
Data collection was done by IM, AF, CM,
Data analysis and interpretation done by all authors
Drafting of the article: done by IN, IM, CM, CM
Critical revision of the article: done by EE, OO, IN, IM

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