



RESEARCH ARTICLE

REVISED

Knowledge and attitude of secondary school students in Nakaseke, Uganda towards HIV transmission and treatment

[version 2; peer review: 2 approved]

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Abstract

Background: One of the major health concerns in Nakaseke district, Uganda is the high prevalence of HIV/AIDS. According to the Joint United Nations Programme on HIV/AIDS (UNAIDS), as of March 2014, the prevalence rate of the disease in the district was estimated at about 8%, compared to the national average of 6.5%, making Nakaseke district have the sixth-highest prevalence rate of HIV/AIDS in the entire country. We set out to explore the knowledge and attitude of secondary school students in Nakaseke, Uganda on HIV transmission and treatment.

Methods: This was a cross sectional survey-based study with data collected during the month of February 2020. Data were analyzed using R programming language version 3.6.2.

Results: A total of 163 participants volunteered for the study, 53.37% males and 46.63% females with ages ranging from 12 – 20 years. Participants came from 5 senior classes (S1, S2, S3, S4 and S6). In total, 87.73% participants were aware of HIV/AIDS while 12.27% were not. The major source of information was through teachers/schools. 96.50% knew the mode of transmission of HIV/AIDS and 95.11% were conversant with HIV/AIDS prevention. 63.6% were aware of the terms DNA and genes whereas 36.36% were not.

Discussion: Generally, the students in Nakaseke district, Uganda had a high level of awareness of HIV/AIDS based on Bloom's cut-off point. However, with regards to aspects such as the cause and modern prevention methods like taking prep and prevention of mother to child transmission were less known to them. Efforts to find a cure for HIV/AIDS are still in vain. Therefore, strong emphasis on up to date

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Any reports and responses or comments on the article can be found at the end of the article.

control and prevention methods should be implemented to fight the HIV/AIDS scourge.

Keywords

Attitude, Knowledge, HIV/AIDS, School, Transmission, Treatment, Uganda

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REVISED Amendments from Version 1

Within the abstract, we have included the criteria (Bloom's cut-off point) that we assessed one to have knowledge and awareness about HIV/AIDS

In the Introduction, more information about community based Interventions has been added

Under study design and setting, more information about the school where the study was conducted has been included

Tables have been merged as; Tables 3, 4 and 6 into Table 1; Table 5, 7 merged into Table 2; Table 8, 9, merged into Table 3; Table 10, 11 merged into Table 4; Table 12 to Table 5; Table 13 to Table 6

In the Discussion section, the "Knowledge and attitude about HIV/AIDS diagnosis, symptoms, transmission, prevention, treatment, and cure by participants in a rural school" sub-heading has been divided into 3 sub-headings

The reference named "Salam RA, Haroon S, Ahmed HH, *et al.*: Impact of community-based interventions on HIV knowledge, attitudes, and transmission" and its corresponding citations have been deleted from the article

Any further responses from the reviewers can be found at the end of the article

Introduction

The vast majority of people living with human immunodeficiency virus (HIV) are located in low- and middle- income countries, with an estimated 68% living in sub-Saharan Africa¹. Among this group, 20.6 million are living in East and Southern Africa which saw 800,000 new HIV infections in 2018¹. HIV and acquired immunodeficiency syndrome (HIV/AIDS) has remained a challenge in Uganda among adolescents despite the ABC (Abstinence, Be faithful, use a Condom) strategy². Globally, the most vulnerable group of individuals to HIV infection are reported to be the youth in the reproductive age group of 15 – 24 years with adolescents contributing to a large percentage³⁻⁵. Previous research found that only 45.5% of women and men between 15–24 years old correctly identified ways of preventing the transmission of HIV through sex. In 2018, Uganda had 53,000 people newly infected with HIV⁶. There are many political and cultural barriers which have hindered effective HIV prevention programming in Uganda. Consequently, new HIV infections are expected to rise in coming years⁷.

Community-based interventions (CBIs) for the prevention and control of HIV allow increased access and ease availability of medical care to populations at risk, or already infected with HIV by reaching individuals in schools, homes or community centers. School-based delivery of HIV prevention education has also been advocated as potential strategies to target high-risk youth groups^{8,9}. Community engagement activities with Persons Living with HIV in Nakaseke have been utilised to reduce the number of new infections. This is led by local leaders, the sub county chief, religious leaders, Village health team

members, health workers, community decision makers and the community development officers¹⁰. But this is largely targeting adults while students at schools may get HIV/AIDS prevention messages either through their parents, teachers, fellow students and the Presidential Initiative on AIDS Strategy to Youth (PIASCY). Creating awareness among the youth on HIV/AIDS is the key to reducing its spread.

The aim of this study was to evaluate the knowledge and attitude of secondary school students towards HIV transmission and treatment in a rural secondary school in Nakaseke, Uganda.

Methods

Study design and setting

This was a cross-sectional study conducted in a secondary school in a church of Uganda founded school in Nakaseke district of Uganda. This school is both day and boarding and students are supported through a number of mechanisms such as the government of Uganda's universal secondary education quota system, while others are sponsored privately or by non-governmental organisations like World Vision Uganda. Nakaseke district was conveniently chosen to represent a rural setting. It was purposely selected because it had the sixth-highest prevalence rate of HIV/AIDS in 2014 in Uganda. Nakaseke district is bordered by Nakasongola district to the north (Figure 1). The location of the district headquarters lies approximately 66 kilometers (41 mi) by road, north of Kampala, the capital of Uganda and the largest city in the country. It is estimated that 59.2% of the Nakaseke district community is literate, which is largely limited to the local Luganda language. This district has seven health units including a 100-bed public hospital, Nakaseke Hospital, administered by the Uganda Ministry of Health. Nakaseke Hospital is connected to other health units by a radio¹¹. One of the major health concerns is the high prevalence of HIV/AIDS. The prevalence rate of the disease in the district was estimated at about 8%, compared to the national average of 6.5%. Nakaseke district has the sixth-highest prevalence rate of HIV/AIDS in Uganda¹⁰.

Study population and sampling procedures

The sampling procedure was voluntary response participation. It was inexpensive since we needed to utilize students' breakfast and lunch hours as requested by the school administration. Students from classes Senior 1, Senior 2, Senior 3, Senior 4, and Senior 6 were interviewed. Senior 5 students were excluded because they had not yet reported to school. The study was expected to interview a total of 200 students but only 163 of them turned up on the day of the study.

Data collection

The students were interviewed using structured questionnaires^{12,13}, with the help of trained research assistants in the students' language of preference (English or Luganda). The questionnaire had closed-ended questions, presented in two formats: yes or no, and multiple choice or objective responses with an aim of accessing the knowledge of students about HIV/AIDS and their attitudes towards HIV transmission, prevention and stigma.

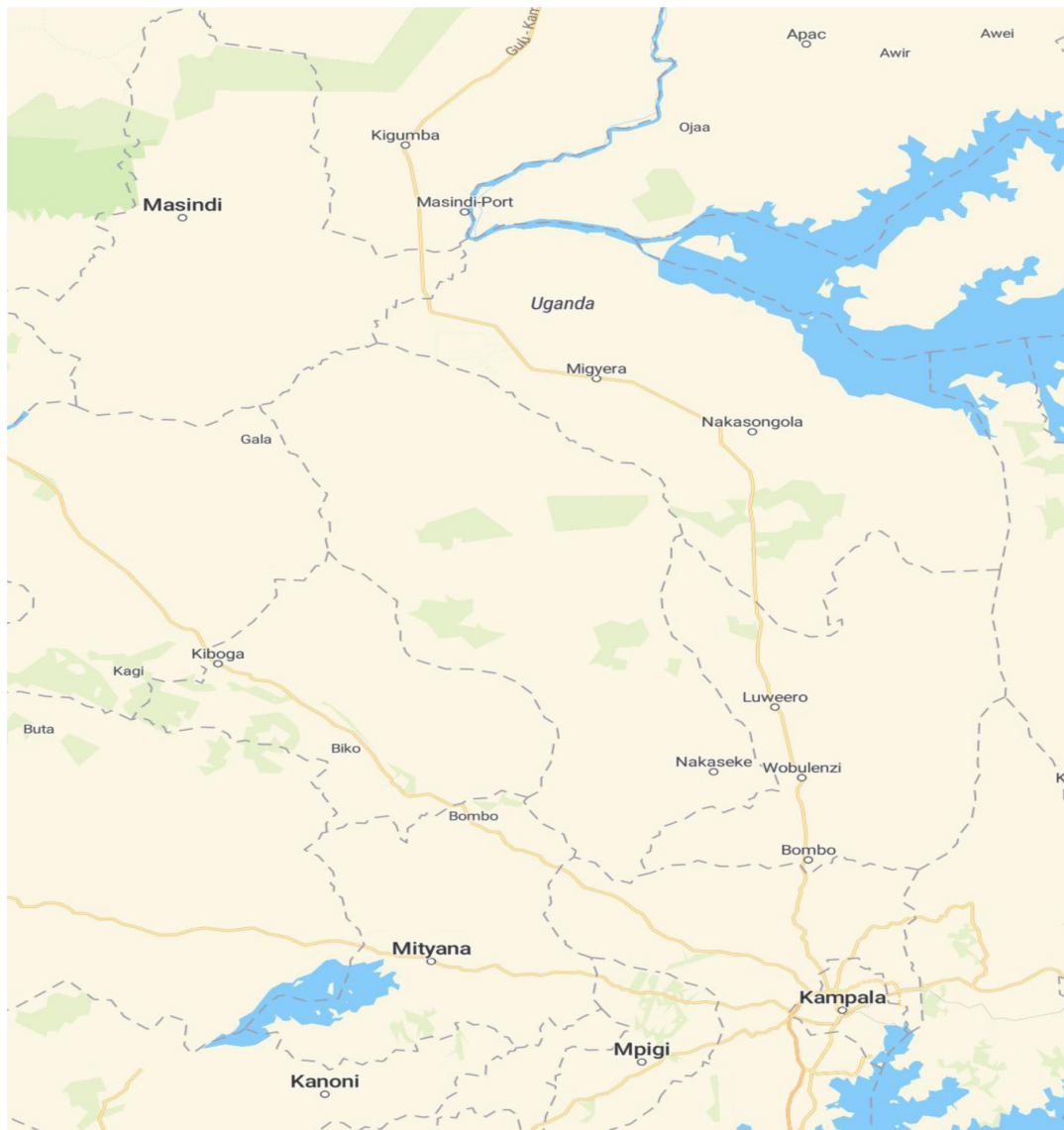


Figure 1. Map of Nakaseke district and its borders (Source: <https://www.maptiler.com/maps>).

Study variables

Treatment, transmission, prevention, cure, and diagnosis were the variables used to evaluate the degree of knowledge about HIV. This was done through computing percentages for every correct response and the KAP was categorised using Bloom's cut-off point where Bloom's cut-off of ($\geq 80\%$) was used to determine sufficient knowledge. The demographic characteristics: age, gender and class were also considered.

Data quality control

Trained research assistants interviewed the participants in their preferred language of communication (English or Luganda) to ensure comprehension and better expression while responding to the questions. Questions were simple and easy to understand. The data was entered using an excel spreadsheet,

triple checked for errors, saved as a comma-separated values file (CSV) and later imported into R.

Data analysis plan

All questions in the questionnaires were entered into the excel spreadsheet and the data was imported and analyzed using R version 3.6.2. All questionnaires with missing data were regarded as invalid and excluded from the analysis. The frequencies and percentage responses for each question was computed and the data was transformed into tables.

Ethical considerations

Ethical clearance and approval for project was obtained from the School of Medicine Research and Ethics Committee (SOMREC) at Makerere University College of Health Sciences

with approval number, #REC REF 2019–028. Administrative permission was obtained from both the Ugandan Ministry of Education and Sports (assigned reference number, ADM. 217/323/01) as well as the school. For participants in the age group 12 to 17 years, consent was sought from the school administrator and then assent was obtained from individual students. For mature and emancipated minors (between ages of 16 to 17), written informed consent was independently sought from them. For the age group of 18 years and above, consent was sought from the students themselves. Confidentiality of information was ensured by the principal investigator during and after the study by blinding the participants’ names and replacing them with arbitrarily chosen IDs.

Results

163 participants volunteered for the study with more males (87, 53.37%) than females (76, 46.63%)¹⁴. The participants were aged between 12 – 20 years, with a modal age group of 15 – 17 years and an average age of 15.45 ± 1.82.

In total, 143 (87.73%) participants were aware of HIV/AIDS while 20 (12.27%) were not. The mean age of those who were aware of the disease was 15.37 ± 1.77 years whereas those who were not had a mean age of 16.05 ± 2.06 years. The downstream analysis after the question regarding awareness of HIV/AIDS was exclusive of participants that were not aware of the

disease. Most of the participants (109, 76.22%) were aware of HIV treatment (antiretroviral drugs; ARVs) while 34 (23.78%) were not aware. In total, 65 (60.75%) knew that HIV can be transmitted through sexual intercourse with an HIV infected person without using a condom, 5 (4.67%) mentioned sharing injecting equipment, and 68 had multiple responses (contaminated blood transfusion or organs/tissues, sexual intercourse with an HIV infected person without using a condom, sharing injecting equipment and mother to child transmission during childbirth and breastfeeding). Only 5 (4.67%) participants didn’t know of any mode of transmission (Table 1). Blood (65, 53.72%) was the most known bodily fluid in which HIV is transmitted. Others mentioned breastmilk (1, 0.83%), vaginal fluids (4, 3.31%) and 33 (27.27%) participants did not know (Table 2).

In regards to the cause of HIV/AIDS, most of the participants (88, 61.54%) knew that it was caused by a virus, 9 (6.29%) said that it was caused by bacteria and the rest 46 (32.17%) didn’t know the cause (Table 1). For the signs and symptoms of HIV/AIDS, 105 (73.43%) individuals pointed out frequent illnesses and 38 (26.57%) did not know the signs and symptoms one could identify a person infected with HIV/AIDS. 85 (59.44%) participants had ever seen someone with HIV/AIDS whereas the rest 58 (40.56%) had never. Among those that had ever seen someone infected with the disease, 52 (61.18%) had

Table 1. Sources of information (multiple responses).

Response item	Response	Frequency	Percentage
From which sources have you heard about HIV/AIDS	Church or Mosque	2	1.92
	Family or Friends	20	19.23
	Health professionals	29	27.88
	TV or Radio	22	21.15
	Teachers or schools	31	29.81
Total		104	100.00
Response on modes of HIV/AIDS transmission			
How is HIV transmitted	Sexual intercourse without a condom	65	60.75
	Share injecting equipment	5	4.67
	Mother to Child transmission	27	25.23
	Contaminated blood transfusion	5	4.67
	Do not know	5	4.67
Total		107	100.00
Response to the cause of HIV/AIDS			
What is the cause of HIV/AIDS	Virus	88	61.54
	Bacteria	9	6.29
	Do not Know	46	32.17
Total		143	100.0

Table 2. Response on bodily fluids that contain HIV virus.

Response item	Response	Frequency	Percentage
Which bodily fluids contain HIV	Blood	65	53.72
	Breast milk	1	0.83
	Vaginal Fluids	4	3.31
	semen and rectal fluids or anal mucous	18	14.88
	Do not know	33	27.27
Total		121	100.00
Distribution of knowledge about HIV/AIDS patient			
Signs and symptoms	Frequent illness	105	73.43
	Do not Know	38	26.57
Total		143	100.0
Have you ever seen HIV patient	Yes	85	59.44
	No	58	40.56
Total		143	100.0
If Yes, how did you Know	Guessed	52	61.18
	Hospital	3	3.53
	Teachers/Schools	1	1.18
	Patient told you	26	30.59
	Family	3	3.53
Total		85	100.01

guessed, 26 (30.59%) were told by the patient, 3 (3.53%) got to know through their families, 3 (3.53%) knew through the hospitals and 1 (1.18%) got to know through their teachers/schools (Table 2).

When participants were asked whether there was a cure for HIV, 116 (81.12%) knew that there was no cure for HIV whereas 27 (18.88%) thought that there was a cure for HIV. Those that said there is a cure for HIV claimed to have heard from different sources of information. 5 (18.52%) from health professionals, 5 (18.52%) from friends/family, 8 (29.63%) from TV/Radio, 6 (22.22%) from Teachers/school, 2 (7.41%) from church/mosque and 1 (3.71%) from both health professionals and TV/ Radio. None got to know from the internet and newspapers (Table 3). HIV prevention methods were generally known. Most responses (52, 46.02%) were for appropriate and consistent condom use, 48 (42.48%) were for abstinence, 2 (1.77%) for avoiding sharing sharp objects and the rest (1, 0.88%) were for taking prep consistently, checkups and avoiding blood contact with an infected person (Table 3). Most of the participants (126, 88.11%) knew that HIV/AIDS was diagnosed using a blood test, 1 (0.70%) said that it was diagnosed through the urine test

and 16 (11.19%) did not know how the disease is diagnosed (Table 4).

With regards to knowledge on HIV transmission from parent to child, most of the students were not sure whether the children would get infected in case at least one of the parents was HIV positive (Table 4). Over two thirds (99, 69.23%) of students said they would not marry a person infected with HIV and 92 (69.70%) would discontinue the relationship if they discovered that the person they were dating was infected with HIV. Though 44 (30.77%) respondents were willing to marry a person infected with HIV, 9 (6.82%) would continue the relationship and 28 (21.21%) would seek counselling and treatment (Table 5).

Concerning knowledge on Host Genetics in HIV infection, 91 (63.64%) students had heard about the terms “DNA” or “Genes” and 52 (36.36%) hadn’t. For those who had heard about the terms, their major sources of information included; TV or radio (33, 38.37%), health professionals (29, 33.72%), family/friends (11, 12.79%), teachers/schools (11, 12.79%), church/mosque (1, 1.16%) and movies (1, 1.16%). Those who

Table 3. Response to the HIV cure presence.

Response item	Response	Frequency	Percentage
Is there cure for HIV	Yes	27	18.88
	No	116	81.12
Total		143	100.00
If yes, how did you know about it	Church or Mosque	2	7.41
	Family or Friends	5	18.52
	Health Professionals	5	18.52
	Radio or TV	8	29.63
	Teachers or schools	6	22.22
	Health professionals and TV	1	3.71
Total		27	100.00
Response to knowledge about HIV/AIDS prevention strategy			
How do you prevent getting or transmitting HIV/AIDS	Abstain	48	42.48
	Avoid sharing sharp objects	2	1.77
	Taking Prep or treatment consistently	1	0.88
	Checkups	1	0.88
	Do not know	7	6.19
	Appropriate condom use	52	46.02
	Avoid blood contact with infected person	1	0.88
	Testing for HIV/AIDS	1	0.88
Total		113	100.00

knew about DNA or genes were further asked whether their DNA or genes would determine if they would get infected with HIV or not; 56 (61.54%) said no, 31 (34.07%) said yes and 4 (4.40%) did not know. In addition, they were also asked whether their DNA or Genes would affect the outcome of their HIV treatment; 60 (65.93%) responded no to the question, 26 (28.57%) knew that DNA would affect HIV treatment whereas 5 (5.50%) were undecided (Table 6).

Discussion

Demographic characteristics

The study assessed the knowledge, attitudes and perception of secondary school students in Nakaseke, Uganda. Of the 163 participants, 143 (87.73%) were aware of HIV/AIDS and 20 (12.27%) were not. The mean age of those who were aware of the disease was 15.37 ± 1.77 years while those who were not aware of the disease had a mean age of 16.05 ± 2.06 . Similar results were seen in other studies^{15,16}

Knowledge and attitude about HIV/AIDS treatment by participants in a rural school

Since awareness hinges on the knowledge about HIV/AIDS, what our participants knew about HIV was very key. The source of information about HIV was also important as it conveyed the basic information about HIV/AIDS and in this study. Teachers or schools (29.81%), and health professionals (27.88%) were the most used avenues to convey the message to the participants¹⁷. The Presidential Initiative on AIDS Strategy to Youth (PIASCY) started in 2001, and was introduced in all primary and post primary schools' education curriculum¹⁸. This program was designed to prevent the spread of HIV/ AIDS and to mitigate its impact on primary and post-primary education institutions in Uganda. It is no surprise that the participants received most information about HIV/AIDS through their teachers¹⁸. None of the participants got information through the internet and newspapers. This is typical of rural secondary schools as such services do not reach rural areas¹⁹. A substantial

Table 4. Response on knowledge about HIV diagnosis.

Response item	Response	Frequency	Percentage
How is HIV diagnosed	Blood test	126	88.11
	Urine test	1	0.70
	Don't know	16	11.19
Total		143	100.00
Response on knowledge of HIV infected parent to child transmission			
One parent infected	All	25	17.48
	Half	20	13.99
	Quarter	5	3.50
	None	79	55.24
	Do not know	14	9.79
Total		143	100.00
All parents infected	All	53	37.06
	Half	11	7.69
	None	60	41.96
	Do not know	19	13.29
Total		143	100.00

Table 5. Response on knowledge about dealing with HIV partners.

Response item	Response	Frequency	Percentage (%)
Can you marry an HIV patient	Yes	44	30.77
	No	99	69.23
Total		143	100.00
What happens when you discover you are dating an HIV patient	Continue with the relationship	9	6.82
	Discontinue the relationship	92	69.70
	Seek counselling and treatment	28	21.21
	Do not know	3	2.27
Total		132	100.00

number of students (87.73%) were aware of HIV/AIDS and its treatment (76.22%) except for a few. The bodily fluids through which HIV is spread were also known, with blood taking the biggest share (53.72%) hence being in concordance with other studies^{20,21}. In spite of that, there were some misconceptions where some students thought HIV is spread through saliva, tears, vomitus and pus. These need to be addressed as

they can cause stigma and discrimination towards patients with HIV.

Knowledge and attitude about HIV/AIDS cure, symptoms and diagnosis

A small number of students (18.88%) thought HIV/AIDS is curable. They might have mistaken the available drugs for

Table 6. Response on knowledge on host genetics in HIV infection.

Response item	Response	Frequency	Percentage (%)
Aware of the term DNA/genes	Yes	91	63.64
	No	52	36.36
Total		143	100.00
If yes, how did you hear them	Church or Mosque	1	1.16
	Friends or Family	11	12.79
	Health professionals	29	33.72
	Teachers or schools	11	12.79
	TV or Radio	33	38.37
	Movies	1	1.16
Total		86	100.00
Is HIV infection DNA determined	Yes	31	34.07
	No	56	61.54
	Do not know	4	4.40
Total		91	100.00
Does your DNA determine the outcome of your HIV treatment	Yes	26	28.57
	No	60	65.93
	Do not know	5	5.50
Total		91	100.00

having a curative effect. To remedy this, more emphasis should be put on the microorganism that causes HIV because then, they would know the gravity of the disease and that it is incurable. Quite a number of students (32.17%) didn't know what causes HIV/AIDS and others (6.29%) thought HIV/AIDS was caused by bacteria. Concerning the signs and symptoms of HIV/AIDS, several students knew them, showing that HIV/AIDS is not a rare disease. Most (61.18%) have known that someone has HIV/AIDS through guessing, 30.59% told by a patient, 3.53% told by family, and 3.53% have seen them in hospitals. Although there are several means through which students have known peoples' HIV status, it is unethical for health practitioners to disclose a patient's status as his/her confidentiality is violated²². Therefore, people should be encouraged to take an HIV/AIDS test despite the way someone looks.

Knowledge and attitude about HIV/AIDS prevention and transmission

Despite a vast knowledge on HIV/AIDS prevention like abstinence (42.48%), appropriate and consistent use of a condom (46.02%) to mention but a few, modern methods like taking prep (0.88%) in case of accidental infection or rape and mother to child transmission were less known to students. This was reflected by the few students that mentioned taking prep and their responses concerning a child's chances of getting HIV/AIDS if either or both of the parents were infected. There was a

difference in the responses to chances of a child getting HIV/AIDS if only one or both parents were infected showing that the students do not quite know that a child can be born without HIV/AIDS irrespective of the parents' HIV status. It is important to sensitize the population on the recent advances in HIV/AIDS such as those mentioned above as they greatly help to control transmission of the disease and thus reduce the number of people infected with HIV/AIDS¹³. Most participants were not willing to marry someone infected with HIV however there was a small percentage (4.90%) of people that were willing to continue the relationship and seek counseling and treatment. Nonetheless, even those (2.80%) that would discontinue the relationship were willing to encourage their partner to seek counseling and treatment. Despite that, there was still a huge number (69.70%) of people that didn't want to have a relationship with someone with HIV. Therefore, there is still a lot of work needed to be done to change the attitude of these people towards HIV patients due to limited knowledge about HIV/AIDS in schools in remote areas.

Knowledge and attitude about the role of an individual's genetics on HIV/AIDS in acquisition and effect on treatment

Despite more than half (63.64%) of the total number of participants being familiar with the terms DNA and genes, 34.07% knew these terms in accordance with HIV transmission

and 65.93% were informed about the terms in terms of HIV treatment

Limitations of the study

Having carried out the study during the time senior five-students hadn't resumed school, it reduced the classes interviewed thus affecting our study indirectly. Inaccurate responses from some participants could have limited the study as well. This would have been due to their fear to disclose what they knew

Conclusion

This study provides preliminary data from a country and region where current information on the knowledge of young adults about HIV/AIDS and their attitude toward infected persons are sparse. This study highlights the basic knowledge of HIV/AIDS among young students, modes of transmission, treatment and management; it also indicates that stigma about the disease and discrimination of affected individuals in society is common among students. The basic approach for control and prevention of HIV/AIDS remains prevention through better knowledge and awareness since an effective cure or vaccine is not yet available.

Generally, the secondary school students had a high level of awareness of HIV/AIDS. However, with regards to aspects such

as the cause and modern prevention methods like taking prep and prevention of mother to child transmission were less known to them. Efforts to find a cure for HIV/AIDS are still in vain. Therefore, strong emphasis on up to date control and prevention methods should be implemented to fight the HIV/AIDS scourge.

Data availability

Underlying data

Figshare: N_Raw_data.xlsx. <https://doi.org/10.6084/m9.figshare.14399453>¹⁴.

This project contains the following underlying data:

- N_Raw_data.xlsx (Raw survey data)

Extended data

Figshare: Questionnaire.docx. <https://doi.org/10.6084/m9.figshare.14399393>¹².

This project contains the following extended data:

- Questionnaire.docx

Data is available under terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

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Nchangwi Syntia Munung 

Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa

Evelyn Ngwa Lumngwena

Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa

I have no further comments.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Two reviewers are involved and their areas of research include 1) Ethical legal and social Issues in Health research. 2) Infectious disease (HIV and RHD)-immunology and proteomics.

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 19 July 2021

<https://doi.org/10.21956/aasopenres.14393.r28742>

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Vincent Mubangizi 

Mbarara University of Science and Technology, Mbarara, Uganda

Thank you for submitting the revised version.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Primary health care, Family planning, HIV/AIDS and dementia

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 27 May 2021

<https://doi.org/10.21956/aasopenres.14327.r28570>

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Nchangwi Syntia Munung 

Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa

Evelyn Ngwa Lumngwena

Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa

This manuscript describes the results of a survey on “Knowledge of HIV transmission and treatment amongst School Children in the Nakaseke district, Uganda”. As reported by the authors, there is a rise in new HIV cases in Uganda especially amongst young people, and it is therefore critical to gain an understanding of current knowledge on HIV transmission and care, in that population group. The results may inform HIV health promotion and education activities in the region. Below, for the authors’ consideration, are some suggestions for improving the manuscript.

Major comments:

1. The introduction needs more information to give context to readers on the current state of HIV awareness in Uganda, existing educational programs for youths and secondary school students in Uganda, generally and in schools in the Nakaseke district; and the potential of this study to inform HIV educational programs in Nakaseke and/or Uganda generally. Some of this information is in the discussion, but should have come earlier on in the introduction to provide the reader with some context on HIV awareness and education in Uganda and why it was important for the researchers to carry out this study.
2. The title of the questionnaire suggests that the study was on students’ awareness of host genomics and anti-retrovirals. This is an important and topical issue and one that has been less studied. However, in reporting the results of the study, less emphasis is given on this aspect of the study, including why it was important to survey students’ knowledge on host genomics and anti-retrovirals and if students had previously been exposed to such information, either as part of public health awareness programs, research, or educational programs in school. This should ideally be covered in the introduction and results section.

Currently the main information is that the low awareness on HIV-host genomics and anti-retroviral therapy is not alarming as genomics is not thought in secondary schools. If that is the case, and that information was known, why did this section form part of the study?

Methods:

1. It is mentioned that the Nakaseke district was purposely selected because it has the sixth-highest prevalence rate of HIV/AIDS in Uganda. What is not clear is why the 1st five districts with the highest prevalence were not selected or if similar studies have been carried out in this region. This information needs to come out clearly in the methods section, otherwise the justification for the study site is not convincing.
2. It is stated that sampling was voluntary. Kindly include a sentence, or two, and references, on what this sampling strategy involves and why it was used.
3. For readers who may not be familiar with the Ugandan school system, it is important to provide basic information on what S1 S2 is, in terms level of education (e.g. 5 years post primary, the age group etc) and possible HIV educational activities they may have been exposed to either in school, in their communities to suppose that this class is expected to have such knowledge etc.
4. The sentence "The prevalence rate of the disease in the district was estimated at about 8%, compared to the national aver-age of 6.5%" -needs a reference.
5. Kindly include more information on how the sample size of 200 students was reached, as well as what is meant by 163 students turn up for the study? Is this the number that consented, while the remaining 37 students did not? Or what were the reasons the other 37 did not complete the questionnaire? Information on how parental consent was obtained will be useful for including measures put in place to ensure that participation in the study was voluntary and that the students did not feel compelled to complete the study especially if it was administered in school.
6. Provide details on the administration of the questionnaire; was it done in school, or self-administered in some cases?
7. It is stated that the students were interviewed using structured questionnaires adopted from... (a reference is provided). For improved readability it is better to state what the questionnaire is and why that questionnaire was chosen over those that have been used in similar studies around the world. If any changes were made to the questionnaire, what were these changes and why was there a need to make these changes?

Results:

1. The results section has way too many tables (n=12) and this could distract from the main text. Some of the tables can be merged or deleted. For example, Table 1 and 2 can be deleted as that information has already been provided in the text in a clear fashion, therefore a table is not required. Also, some of the summary statistics in the tables could be deleted. Tables should have just key information for each response option rather than separately (option one and two). That is, it is better to provide percentages of people who selected abstinence, irrespective of whether that was selected together with another option,

say appropriate condom use. The tables should give the reader an idea of how many persons ticked a particular response irrespective of whether they also selected another response. The methods already make it clear that in some cases participants selected more than one response. Table 3, 4 and 6 and 6 can be one table and should only contain information for each response not X and Y combined.

2. Table 7: The question "Have you ever seen an HIV patient" is ambiguous and could propagate stigma. The phrasing suggests that people with HIV look a specific way and can therefore be identified by merely looking at someone. That is disturbing for a study that looked at attitudes towards HIV. Was the question meant to be "Do you know of anyone living with HIV? If so, what was the purpose of the question - that information needs to be provided.
3. The referencing style and the way it is used in the article is very confusing, taking the reader away from the main text to the references. For example, page 8, (similar to 13) and page 10 (in concordance with 16 and 17). Our suggestion is that the authors should state the precise information they are referring to and then cite the text.

Discussion and Conclusion:

1. The discussion section could be shortened and streamlined to how the results obtained compare to similar studies in Uganda and globally and the implications that it may have for public health management of HIV/AIDS in Uganda. For example, one and two of the discussion section is a repetition of the results and that is the case for most of the paragraphs in that section. The authors repeat the results.
2. Given the low awareness of HIV/AIDS transmission, did the team introduce any educational intervention, pre or post survey? If so, what were these interventions and how was it received by the students? If not, are there plans to do awareness campaigns in the school - and what are the details particularly so on the role of host genomics in HIV transmission and therapy especially as this was the topic of the questionnaire? It will be a missed opportunity for a research program to take advantage of to raise awareness on HIV transmission and treatment especially as the authors note that there is rise in prevalence of HIV among young people in Uganda and that the district is one of those with the highest HIV prevalence in the country.

We thank the authors for sharing their results on this interesting study and look forward to reading their response to the comments that we have made.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Two reviewers are involved and their areas of research include 1) Ethical legal and social Issues in Health research . 2) Infectious disease (HIV and RHD)-immunology and proteomics

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.

Author Response 03 Jul 2021

Stephen Kanyerezi, The African Center of Excellence in Bioinformatics and Data-Intensive Sciences, the Infectious Disease Institute, Makerere University, Kampala, Uganda

Major comments:

The introduction needs more information to give context to readers on the current state of HIV awareness in Uganda, existing educational programs for youths and secondary school students in Uganda, generally and in schools in the Nakaseke district; and the potential of this study to inform HIV educational programs in Nakaseke and/or Uganda generally. Some of this information is in the discussion, but should have come earlier on in the introduction to provide the reader with some context on HIV awareness and education in Uganda and why it was important for the researchers to carry out this study.

We have enriched the introduction as suggested.

The title of the questionnaire suggests that the study was on students' awareness of host genomics and anti-retrovirals. This is an important and topical issue and one that has been less studied. However, in reporting the results of the study, less emphasis is given on this aspect of the study, including why it was important to survey students' knowledge on host genomics and anti-retrovirals and if students had previously been exposed to such information, either as part of public health awareness programs, research, or educational programs in school. This should ideally be covered in the introduction and results section. Currently the main information is that the low awareness on HIV-host genomics and anti-retroviral therapy is not alarming as genomics is not thought in secondary schools. If that is the case, and that information was known, why did this section form part of the study?

The students did not have prior awareness of host genomics and antiretrovirals.

Methods:

It is mentioned that the Nakaseke district was purposely selected because it has the sixth-highest prevalence rate of HIV/AIDS in Uganda. What is not clear is why the 1st five districts with the highest prevalence were not selected or if similar studies have been carried out in this region. This information needs to come out clearly in the methods section, otherwise the justification for the study site is not convincing.

We conveniently selected Nakaseke district because it was ranking poorly among in HIV/AIDS prevention

It is stated that sampling was voluntary. Kindly include a sentence, or two, and references, on what this sampling strategy involves and why it was used.

We have included more details under Study population and sampling procedures.

For readers who may not be familiar with the Ugandan school system, it is important to provide basic information on what S1 S2 is, in terms level of education (e.g. 5 years post primary, the age group etc) and possible HIV educational activities they may have been exposed to either in school, in their communities to suppose that this class is expected to have such knowledge etc.

These are classes or grades for Secondary level of education.

The sentence “The prevalence rate of the disease in the district was estimated at about 8%, compared to the national aver-age of 6.5%”-needs a reference.

This was cited with citation 9.

Kindly include more information on how the sample size of 200 students was reached, as well as what is meant by 163 students turning up for the study? Is this the number that consented, while the remaining 37 students did not? Or what were the reasons the other 37 did not complete the questionnaire? Information on how parental consent was obtained will be useful for including measures put in place to ensure that participation in the study was voluntary and that the students did not feel compelled to complete the study especially if it was administered in school.

The study school had a total of 200 students but 163 reported at school on the day of data collection.

Provide details on the administration of the questionnaire; was it done in school, or self-administered in some cases?

It was administered at school within the school main hall, with help of research assistants to interpret to their local languages for those who could not comfortably read English and Luganda.

It is stated that the students were interviewed using structured questionnaires adopted from... (a reference is provided). For improved readability it is better to state what the questionnaire is and why that questionnaire was chosen over those that have been used in similar studies around the world. If any changes were made to the questionnaire, what were these changes and why was there a need to make these changes?

Thank you for this comment, The questionnaire was purposely designed to probe aspects of knowledge and attitude of secondary school students in Nakaseke, Uganda towards HIV/AIDS transmission and treatment.

Results:

The results section has way too many tables (n=12) and this could distract from the main text. Some of the tables can be merged or deleted. For example, Table 1 and 2 can be deleted as that information has already been provided in the text in a clear fashion, therefore a table is not required. Also, some of the summary statistics in the tables could be deleted. Tables should have just key information for each response option rather than separately (option one and two). That is, it is better to provide percentages of people who selected abstinence, irrespective of whether that was selected together with another option, say appropriate condom use. The tables should give the reader an idea of how many persons ticked a particular response irrespective of whether the also selected another response. The methods already make it clear that in some cases participants selected more than one response. Table 3, 4 and 6 and 6 can be one table and should only contain information for each response not X and Y combined.

We have addressed these accordingly as below;

Deleted table 1 and 2

Merged tables 3, 4 and 6 into table 1

Table 5, 7 merged into table 2

Table 8, 9, merged into table 3

Table 10, 11 merged into table 4

Table 12 to table 5

Table 13 to table 6

Table 7: The question "Have you ever seen an HIV patient" is ambiguous and could propagate stigma. The phrasing suggests that people with HIV look a specific way and can therefore be identified by merely looking at someone. That is disturbing for a study that looked at attitudes towards HIV. Was the question meant to be "Do you know of anyone living with HIV? If so, what was the purpose of the question - that information needs to be provided.

We agree. We meant to ask, "Do you know of anyone living with HIV?"

The referencing style and the way it is used in the article is very confusing, taking the reader away from the main text to the references. For example, page 8, (similar to 13) and page 10 (in concordance with 16 and 17). Our suggestion is that the authors

should state the precise information they are referring to and then cite the text.

This has been addressed accordingly.

Discussion and Conclusion:

The discussion section could be shortened and streamlined to how the results obtained compare to similar studies in Uganda and globally and the implications that it may have for public health management of HIV/AIDS in Uganda. For example, one and two of the discussion section is a repetition of the results and that is the case for most of the paragraphs in that section. The authors repeat the results.

We have removed the repetition of the results.

Given the low awareness of HIV/AIDS transmission, did the team introduce any educational intervention, pre or post survey? If so, what were these interventions and how was it received by the students? If not, are there plans to do awareness campaigns in the school - and what are the details particularly so on the role of host genomics in HIV transmission and therapy especially as this was the topic of the questionnaire? It will be a missed opportunity for a research program to take advantage of to raise awareness on HIV transmission and treatment especially as the authors note that there is rise in prevalence of HIV among young people in Uganda and that the district is one of those with the highest HIV prevalence in the country.

The post survey was not done due to school closure as a result of COVID-19 global Pandemic.

Competing Interests: No competing interests among the authors of this article

Reviewer Report 24 May 2021

<https://doi.org/10.21956/aasopenres.14327.r28569>

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Vincent Mubangizi

Mbarara University of Science and Technology, Mbarara, Uganda

- **Is the work clearly and accurately presented and does it cite the current literature?**

A. The referencing style is confusing. For examples:

1. I could not trace the information attributed to citation 5.
2. Under the discussion section; similar results were seen in 11 and 12. ...hence being in concordance with 16 and 17. Similar to 13... etc Are these numbers referring to citations?

3. In the text, citation 9 is followed by citation 22. The same applies to citation 14 which is followed by citation 20.

4. I did not find citation 19 in the text.

B. Please provide current literature on HIV/AIDS prevalence in Uganda. The citation referring to the year 2014 is old. Citation 2 is wrongly cited to have provided information on the contribution of adolescents to HIV/AIDS prevalence globally yet that study was about knowledge, attitudes, and perceptions.

C. Under results section:

1. Many tables could be emerged to make it easy to read.

2. Since knowledge and attitudes are greatly influenced by the level of education, it would be better to indicate how the study participants were spread across the classes and if there was any difference in responses by the level of class attended.

3. The statement "*...with regard to knowledge on HIV transmission from parent to child, the students' response were generally not in line with the scientific facts...*" is not appropriate under this section.

4. Given that this was an interviewed administered tool and participants were in one place, where was there a high non-response rate? Could this affect the results?

D. Under the discussion section, the authors need to discuss how their results compare with the known literature.

1. Your finding of HIV/AIDS awareness is unique given the PIASCY program and that HIV/AIDS is a taught topic in the primary school curriculum. The government documents say that awareness is universal, Please discuss that key finding.

2. The second paragraph under Knowledge, attitudes about HIV/AIDS diagnosis ... have many ideas. It would be better if they were separated. The assertion that "*...n this modern era, ARVs have made it increasingly difficult to identify someone living with HIV/AIDS*" is misleading. When was it appropriate to make a diagnosis of HIV/AIDS by only physically looking at the person?

3. Under known and attitudes about the role of individual genetics, the assertion "*However, their knowledge of the terms was in respect to paternity tests rather than the role they play in acquisition and their effect on HIV/AIDS*" is not supported by data collected according to the data collection tool provided.

○ **Is the study design appropriate and does the work have academic merit?**

The application of the results is affected by the lack of random sampling. The authors need to justify why they did not randomly sample the school and also why the "*sampling procedure was voluntary*". The authors need to show how they arrived at the number to be interviewed (sample size determination). These affect the generalizability of the study findings as well as introducing

bias.

- **Are sufficient details of methods and analysis provided to allow replication by others?**

Under design and setting:

1. More information is required about the schools especially secondary schools in the study area; provide more information on the chosen school (e.g ownership, day/boarding/ or both, school enrollment, etc).
2. For Figure 1; Use of Map tiler is protected under property intellectual rights, did the authors obtain permission to share the map in this publication?

Data collection:

1. It is mentioned that data was adopted from 10, provide a reference.
2. Also, specify if there was a translated version of the local language and how it was done to ensure consistency with the English version.
3. Was the questionnaire pre-tested?
4. Since according to the authors "*questions were simple and easy to understand*", why then did they use research assistants to interview participants.

Study variables:

1. It is not clear to me which study variable(s) was used to measure stigma.
2. Question 10 on the questionnaire seems to be hanging. It does not follow logically from questions 8 and 9.
3. The authors need to justify why they used a cut-off point of more than 50% to be knowledgeable about HIV/AIDS.

Data analysis:

1. Please indicate if any questionnaire (s) were excluded due to missing data.

Ethical considerations:

1. Please explain what you mean by "*mature and emancipated minors*".
 2. Explain how reached the parents /guardians to sign consent forms for those aged 12-17 years.
- **If applicable, is the statistical analysis and its interpretation appropriate?**

Not applicable.

- **Are all the source data underlying the results available to ensure full reproducibility?**

Yes

- **Are the conclusions drawn adequately supported by the results?**

Partly. The conclusion about stigma about the disease and discrimination of affected individuals is not supported.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Primary health care, Family planning, HIV/AIDS and dementia

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 03 Jul 2021

Stephen Kanyerezi, The African Center of Excellence in Bioinformatics and Data-Intensive Sciences, the Infectious Disease Institute, Makerere University, Kampala, Uganda

- **Is the work clearly and accurately presented and does it cite the current literature?**

A. The referencing style is confusing. For examples:

- 1. I could not trace the information attributed to citation 5.**

Thank you. Citation 5 shows the current statistics of HIV under the tab "where we work".

- 1. Under the discussion section; similar results were seen in 11 and 12. ...hence being in concordance with 16 and 17. Similar to 13... etc Are these numbers referring to citations?**

Thank you. This has been corrected.

- 1. In the text, citation 9 is followed by citation 22. The same applies to citation 14 which is followed by citation 20.**

Thank you. This has been corrected.

- 1. I did not find citation 19 in the text.**

Thank you. This has been corrected.

B. Please provide current literature on HIV/AIDS prevalence in Uganda. The citation referring to the year 2014 is old. Citation 2 is wrongly cited to have provided information on the contribution of adolescents to HIV/AIDS prevalence globally yet that study was about knowledge, attitudes, and perceptions.

Thank you. We have changed the citation to reflect the current HIV/AIDS prevalence in Uganda.

C. Under results section:

1. Many tables could be merged to make it easy to read.

Thank you. We have merged the tables to make it easy to read

1. Since knowledge and attitudes are greatly influenced by the level of education, it would be better to indicate how the study participants were spread across the classes and if there was any difference in responses by the level of class attended.

Thank you for this feedback however, we have excluded classes in the raw data as this would provide identifying information. This means we wouldn't provide such information in the results/discussion.

1. The statement "...with regard to knowledge on HIV transmission from parent to child, the students' responses were generally not in line with the scientific facts..." is not appropriate under this section.

We have replaced the above statement and reads, "most of the students were not sure whether the children would get infected in case at least one of the parents was HIV positive"

1. Given that this was an interviewed administered tool and participants were in one place, where was there a high non-response rate? Could this affect the results?

We agree that this tool was administered while participants were in one place but there was not a high non-response rate. We believe that this did not affect the results of this study.

D. Under the discussion section, the authors need to discuss how their results compare with the known literature.

1. Your finding of HIV/AIDS awareness is unique given the PIASCY program and that HIV/AIDS is a taught topic in the primary school curriculum. The government documents say that awareness is universal, Please discuss that key finding.

Our study in rural settings also confirmed the above fact as documented by the government of Uganda

1. The second paragraph under Knowledge, attitudes about HIV/AIDS diagnosis ...

have many ideas. It would be better if they were separated. The assertion that "...n this modern era, ARVs have made it increasingly difficult to identify someone living with HIV/AIDS " is misleading. When was it appropriate to make a diagnosis of HIV/AIDS by only physically looking at the person?

"...n this modern era, ARVs have made it increasingly difficult to identify someone living with HIV/AIDS " Statement withdrawn

We have separated the two ideas.

- 1. Under known and attitudes about the role of individual genetics, the assertion "However, their knowledge of the terms was in respect to paternity tests rather than the role they play in acquisition and their effect on HIV/AIDS" is not supported by data collected according to the data collection tool provided.**

We agree that the final tool administered did not have this section therefore the statement has been withdrawn.

- o **Is the study design appropriate and does the work have academic merit?**

The application of the results is affected by the lack of random sampling. The authors need to justify why they did not randomly sample the school and also why the " sampling procedure was voluntary". The authors need to show how they arrived at the number to be interviewed (sample size determination). These affect the generalizability of the study findings as well as introducing bias.

We did not carry out random sampling but instead chose voluntary response participation because it was an inexpensive (no reimbursements) way to conduct this study in a school setting with minimum bias. However, we acknowledge that we could not have control over the makeup of the sample population that turned up to participate.

- o **Are sufficient details of methods and analysis provided to allow replication by others?**

More information is required about the schools, especially secondary schools in the study area; provide more information on the chosen school (e.g ownership, day/boarding/ or both, school enrollment, etc).

We have included these details under design and setting:

- 1. For Figure 1; Use of Map tiler is protected under property intellectual rights, did the authors obtain permission to share the map in this publication?**

Thank you, The source indicates that the citation is sufficient as long as it was not used for commercial purposes

Data collection:

- 1. It is mentioned that data was adopted from 10, provide a reference.**

We have provided the reference.

- 1. Also, specify if there was a translated version of the local language and how it was done to ensure consistency with the English version.**

We did not translate the tool into the local language. The English version was piloted and deemed understandable to most secondary school level participants.

- 1. Was the questionnaire pre-tested?**

The questionnaire was pre-tested in the same school in 2019 prior to the execution of this current study, and included 25 students with a total of 5 students from each of the represented classes attending. During this study, students who had participated in the pretest were requested not to be part of the study. We have included these details in the revised manuscript under Study population and sampling procedures.

1. **Since according to the authors "questions were simple and easy to understand", why then did they use research assistants to interview participants.**

We used research assistants to interview participants to save on the students' school time. Since students were available during their breakfast and lunch time

Study variables:

1. **It is not clear to me which study variable(s) was used to measure stigma.**

This was a mistake on our part in the write-up. It has been replaced with cure and diagnosis

1. **Question 10 on the questionnaire seems to be hanging. It does not follow logically from questions 8 and 9.**

True, we agree that the questionnaire on this section does not follow logically from questions 8 and 9.

1. **The authors need to justify why they used a cut-off point of more than 50% to be knowledgeable about HIV/AIDS.**

The level of KAP was categorized using Bloom's cut-off point where Bloom's cut-off of ($\geq 80\%$) was used to determine sufficient knowledge.

Data analysis:

1. **Please indicate if any questionnaire (s) were excluded due to missing data.**

We did not exclude any questions due to missingness.

Ethical considerations:

1. **Please explain what you mean by "mature and emancipated minors".**

Mature and emancipated minors referred to participants who are allowed to some level of decision making such as adolescents who have the capacity to make decisions but who are not legally emancipated (between ages of 16 to 17).

1. **Explain how reached the parents /guardians to sign consent forms for those aged 12-17 years.**

We have revised this section. The school administration signed on behalf of the parents /guardians under ethical considerations.

Competing Interests: No competing interests among the authors of this article