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Level of comprehensive knowledge about HIV & AIDS among university students in Malawi

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ABSTRACT

Malawi continues to face a substantial HIV burden. However, little empirical evidence from a multi-institutional, nationally representative point of view exists on the level of HIV/AIDS knowledge among university students, a population that is vulnerable and central to national HIV prevention goals. This study addressed the gap by assessing the levels of HIV/AIDS knowledge and associated factors among full-time undergraduate students across six public and private universities in Malawi. A cross-sectional survey involving 526 students was conducted using stratified random sampling and a self-administered questionnaire, with data analysed through descriptive statistics, chi-square tests, Analysis of Variance (ANOVA), and t-tests. Findings showed that students possessed a generally high level of HIV/AIDS knowledge (82.3 %), with significant differences observed by sex, programme of study, and year of study. Knowledge of behavioural prevention measures was strong, yet notable gaps remained, particularly regarding biomedical prevention methods such as pre-exposure prophylaxis (PrEP) and misconceptions about sterilised needle sharing and non-sexual transmission. These findings indicate that while progress has been made in HIV awareness, important knowledge deficits persist, especially in emerging HIV science. The study contributes new evidence that can inform the design of structured, standardised, and integrated HIV education within higher-learning institutions. Strengthening HIV knowledge among university students is essential for reducing vulnerability to new infections and directly contributes to national and global targets, including SDG 3.3 on ending AIDS by 2030 and Agenda 2063 aspirations for healthy and well-nourished citizens.

Introduction

The Human Immunodeficiency Virus (HIV) continues to be a significant global public health issue [27] and a leading disease burden in Sub-Saharan Africa, where over half of new HIV infections occur in young individuals [3]. Worldwide, 40.4 million people have died from AIDS-related illnesses, and 85.6 million people have contracted the virus since the epidemic began [31]. It is estimated

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that there would be about 75 million cumulative AIDS-related deaths globally by 2030 if trends continue [31]. Further to this, if global progress in reaching young people ceases, the new infection rate is predicted to increase from 250,000 in 2015 to approximately 400, 000 among adolescents yearly by 2030 [13].

Malawi continues to be one of the countries with high HIV prevalence rates in the SSA, with adults 15 years and above at 8.9 % HIV [23]. This translates to over 946,000 adult HIV positive people in Malawi. In addition, women have a greater prevalence of HIV (10.5 %) than men (7.1 %). Variations in HIV prevalence also occur at the regional and sub-regional levels in Malawi. The worst-affected region is the South (13.3 %), followed by the centre (9.0 %), and anchored by the north (5.6 %).

The prevalence of HIV in Malawi also varies significantly according to educational attainment, age, sex, wealth status, geographical location, and other associated factors [23]. Although attainment of secondary or higher education (tertiary) is linked to a decreased susceptibility to HIV infection [10], the Malawi population-based HIV Impact Assessment (MPHIA 2020–2021) indicates that HIV prevalence among individuals aged 15 and above in Malawi with post–secondary or tertiary education is 5.5 %, which is still on the higher side as compared to adolescents aged between 15–19 years with no post-secondary education which is at 1.7 % for girls and 1.4 % for boys [23]. Again, individuals aged 15 and above with no post-secondary education have a prevalence of 11.1 %, about double the post-secondary group [23].

The majority of university students are between the ages of 15 and 24, which is a population that is biologically and socially susceptible to HIV infection. Peer pressure, immaturity, experimentation with drugs and alcohol misuse, increased likelihood of unprotected sex, multiple partners with shorter relationships, and low knowledge of issues of HIV&AIDS are some of the risk factors for HIV acquisition [2]. Moreover, Studies indicate that universities are high-risk settings for HIV transmission since they are places where young people from many origins and sexual orientations come and live together, with little to no parental and administrative restrictions [4].

Knowledge of issues of HIV&AIDS includes a thorough understanding of transmission routes of HIV, how HIV can be prevented, and where to access HIV&AIDS services. Knowledge is a predictor of health attitudes towards infections, as it influences attitudes. Knowledge also helps in correcting misconceptions and myths about a disease, as well as increasing an individual's perception of their susceptibility to an infection. Knowledge of HIV&AIDS also helps to reduce stigma and discrimination towards people infected and affected by HIV. Furthermore, knowledge of HIV&AIDS helps individuals living with HIV to adhere to antiretroviral treatment., [20]. Therefore, the importance of HIV&AIDS knowledge in preventing HIV transmission cannot be overemphasized. However, in Malawi, there is still limited coverage in curricula since HIV&AIDS education is often emphasized at the primary and secondary level but not systematically included in the university programs [14]. Further to this, most of the HIV information provided in the Malawi curricula does not reflect a shift from behavioral approaches since biomedical HIV prevention approaches such as Pre-Exposure Prophylaxis (PrEP), and Undetectable=Untransmittable (U = U) were introduced in 2020 and 2021, respectively [7]

Although several studies have been conducted on HIV knowledge in Malawi, none have attempted to look at HIV and AIDS knowledge among university students in Malawi from a multi-institutional, nationally representative point of view. Previous studies have been confined to one or two institutions, with small sample sizes, and focusing on behavioral frameworks that did not capture recent biomedical prevention strategies such as PrEP, HIV self-testing, and U = U. Therefore, this study offers multiple significant advancements as follows: Firstly, it analyzes HIV knowledge levels and related factors among students by broadening the geographical and institutional scope, through sampling of study participants from six public and private universities across Malawi. Secondly, it combines behavioral and biomedical knowledge indicators, such as PrEP, to promote assessment of current HIV literacy. Thirdly, the study advances understanding by analyzing knowledge disparities across different academic programs and assessing the influence of sociodemographic and institutional factors on HIV knowledge. The integration of scope and modern preventive emphasis strategies yields deeper insights and reflects a methodological and empirical advancement beyond past Malawian and regional research studies, to provide new evidence for focused programming and policy formulation.

Methods

Study design and sites

A cross-sectional quantitative study was conducted from October 2, 2023, to November 2, 2023. The study was conducted in 6 purposively selected universities, namely the University of Malawi (UNIMA), the Catholic University of Malawi (CUNIMA), Lilongwe University of Agriculture and Natural Resources (LUANAR), Malawi Assemblies of God University (MAGU), Mzuzu University (MZUNI), and the University of Livingstonia (UNILIA). The study focused on these six institutions to represent both public and private universities in all three regions across Malawi.

Study population

The study was conducted across first to final year university students to ensure a broader coverage in assessing their level of comprehensive knowledge towards HIV&AIDS issues. The respondents included both male and female students from the six selected universities (three public and three private). Only full-time undergraduate students were considered to participate in the study. This was done because full-time undergraduate students often share similar lifestyles, schedules, and social interventions which can impact their knowledge, risk factors, and behaviors related to HIV&AIDS issues, whilst part-time and block release students might have different life circumstances, e.g., employment, family responsibilities, or varying social networks, which can affect study variables. As such, this study excluded individuals on a part-time basis, those enrolled in a block-and-release program, and postgraduate students.

Approximately, the 6 selected Universities had a total student population of 20,767, as follows: UNIMA (6000), CUNIMA (3287), LUANAR (4000), MAGU (1280), MZUNI (5000), and UNILIA (1200). Data on generic students by year and programme of study were accessed by the principal investigator from the registrar's office of these institutions after presenting an ethical clearance letter issued by Mzuzu University Research Ethical Committee (MZUNIREC).

Sampling methods

Stratified random sampling was used to ensure that specific elements, which defined the population under study, were included. The study divided the population into strata, and random sampling was conducted within each stratum to ensure that the individuals selected were a true representation of the total population. At each university, students were proportionally stratified by year of study and gender.

Sample size

Using a precision of 5 % margin error (e) and the total students' population, a sample size formula [33] for a known population, Eq. (1) was used to compute the sample size of 392. Adding 30 % of the non-response rate, the sample size yielded 510. However, 526 students participated in the survey. This was due to the high turnout rate of the respondents, who had shown interest in the subject area during briefing meetings. However, the increase in the sample size is <5 % of the calculated sample size and is therefore insignificant in affecting the findings and conclusions drawn in the study.

$$n = \frac{N}{1 + N(e^2)} \tag{1}$$

where N is the total student population in all six universities, and e is the margin of error set for the estimate, set at 0.05.

Data collection and management

The study collected quantitative data from the respondents. The data were collected using a structured questionnaire, which was programmed in KoboToolbox, and fourteen (14) tablets and Android phones were distributed to the students to respond on their own, facilitating maximum expression and confidentiality. Fourteen (14) graduates were recruited and trained to facilitate data collection and provide help whenever the respondents face challenges with the tool and any related issue during the filling in of the questionnaire. Pretesting of the questionnaire was conducted on 5 % of the sample size at MUBAS, which was not part of the selected institutions but included participants with similar characteristics to those in the sample. The pretest was conducted to assess the clarity of the tool and allocate a reasonable amount of time for respondents to complete the questionnaire. The questionnaire was anonymized to encourage open expression and confidentiality of the information provided by the respondents.

Data processing and analysis

Quantitative data was cleaned up, recoded, and analysed using SPSS (version 28). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed for the variables. A chi-square test was conducted to identify a significant association between the level of HIV&AIDS-related knowledge and the students' characteristics. One-way ANOVA and independent *t*-tests were also conducted to examine the differences in the level of HIV&AIDS-related knowledge among students of different characteristics.

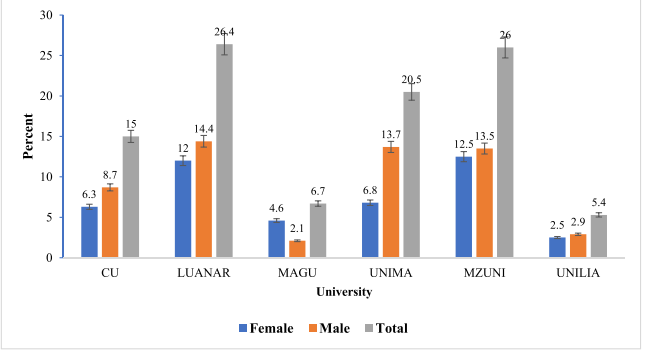

Fig. 1. Distribution of students per university (CU: Catholic University; LUANAR: Lilongwe University of Agriculture and Natural Resources; MAGU: Malawi Assembly University; UNIMA: University of Malawi; MZUNI: Mzuzu University; UNILIA: University of Livingstonia).

Results

The study achieved a 100 % response rate, as all 526 participants completed the questionnaire.

Sample characteristics

The study surveyed a total of 526 students. Among 526 students, 44.7 % (235) were females and 55.3 % (291) were males, due to a gender imbalance in the total number of enrolled students. The average age of the respondents was 22.62 years, with a minimum age of 15 and a maximum age of 49. The majority of the respondents were Christians (475, 90.3 %), followed by Muslims (34, 6.5 %). Only 10 (1.9 %) were international students.

Fig. 1 shows that majority of the surveyed students were from Lilongwe University of Agriculture and Natural Resources (LUANAR) (139, 26.4 %), followed by students from Mzuzu University (137, 26 %), University of Malawi (108, 20.5 %), Catholic University of Malawi (CU) (79, 15 %), Malawi Assemblies of God University (MAGU) and the least University of Livingstonia (28, 5.3 %). In terms of year of study, 23.4 % (123) of the students were enrolled in Year 1, 29.8 % (157) in Year 2, 18.4 % (99) in Year 3, 25.3 % (133) in Year 4, and 2.7 % (14) in Year 5.

Knowledge of HIV/AIDS among students

Table 1 presents the proportion of students who answered correctly from the eleven (11) questions that were asked in this section. The Table shows that the majority of the students were able to know the transmission mode of HIV infections. The majority of the students were also able to tell that HIV is a serious health issue that requires medical treatment. The majority of the students (92.2 %) indicated that a healthy-looking person can have HIV and not show any symptoms.

The total current responses were scored out of 11. The overall mean score was 9.05, indicating that university students possess more HIV and AIDS-related knowledge (Table 2). Proportionally, the current level of knowledge was at 82.3 % ((9.05/11) * 100). The study found a significant difference in mean scores between male and female students ($t = 0.31$, $p = 0.031$). Female students significantly had more HIV & AIDS-related knowledge ($M = 9.19$, S.D.=1.34) than their male counterparts ($M = 8.90$, S.D.=1.43).

Similarly, students who were not affiliated with any religion had more HIV/AIDS-related knowledge ($M = 9.64$, $SD = 1.03$) than students affiliated with Christianity ($M = 9.05$, $SD = 1.40$), Islam ($M = 9.03$, $SD = 1.22$), and traditional beliefs ($M = 7.83$, $SD = 1.39$). Although it was observed that students affiliated with traditional beliefs had the lowest mean scores, the study found no statistically significant differences in mean scores among students with different religious beliefs.

Table 2 also showed that year five students had more HIV/AIDS-related knowledge ($M = 9.29$, $SD = 0.99$) than students in lower classes. However, there was no statistically significant difference in mean scores between the two. As such, the study found that HIV/AIDS-related knowledge was positively associated with the level of study among the students ($p = 0.027$).

The findings also showed a statistically significant difference in mean scores among students pursuing different programs ($p = 0.040$) (see Table 2). Students pursuing health-related programs had significantly more HIV and AIDS-related knowledge ($M = 9.30$, $SD = 1.00$) than students pursuing other programs, such as Social Science ($M = 9.29$, $SD = 1.31$), Engineering ($M = 8.77$, $SD = 1.26$), Agricultural Studies ($M = 8.79$, $SD = 1.52$), and Education ($M = 11$, $SD = 1.19$). Although the mean scores of international students ($M = 9.33$, $SD = 1.41$) were slightly higher than those of local students ($M = 9.04$, $SD = 1.39$), the difference was not statistically significant. Similarly, there was no significant difference in mean scores between students studying in public and private universities ($p = 0.196$).

Knowledge on HIV&AIDS risk behaviours and prevention

This section contained eight questions with a total of 8 scores. Table 3 presents the proportion of students who answered each question correctly. The Table shows that the majority of students were able to answer all the questions correctly.

Table 4 presents the mean difference in knowledge of HIV/AIDS risk behaviors and prevention among students with different

Table 1
Students' knowledge about HIV/AIDS.

#	Question	Frequency	Percent (answered correctly)
1	Can HIV be transmitted through Saliva?	130	24.7
2	Can HIV be transmitted through sharing needles with an infected person?	490	93.2
3	Is there a cure for HIV&AIDS?	358	68.1
4	Is HIV&AIDS the same thing?	452	85.9
5	Can the use of a condom during sexual intercourse prevent the transmission of HIV?	445	84.6
6	Can a healthy-looking person have HIV and not show any symptoms?	485	92.2
7	Can HIV be transmitted from mother to child during pregnancy, childbirth, or breastfeeding?	521	99.0
8	Is HIV only transmitted through sexual contact?	437	83.1
9	Is heterosexual sex the most common way of HIV transmission?	326	62.0
10	Is HIV a serious disease, and does it require medical treatment?	483	91.8
11	Is it true that sexual abstinence can prevent a person from contracting HIV?	479	91.1

Table 2
Students' characteristics and differences in HIV / AIDS knowledge.

Variable	N	%	Mean (S.D.)	Test used	p-value
Sex				**0.31**[b]	**0.031**
Male	291	55.32	8.90 (1.43)		
Female	235	44.68	9.19 (1.34)		
Religion				**2.21**[a]	**0.086**
Christianity	475	90.3	9.05 (1.40)		
Islam	34	6.46	9.03 (1.22)		
No religion	11	2.09	9.64 (1.03)		
Tradition	6	1.14	7.83 (1.39)		
Year of study				**1.78**[a]	**0.132**
Year 1	123	23.38	9.23 (1.44)		
Year 2	157	29.85	9.15 (1.28)		
Year 3	99	18.82	8.86 (1.31)		
Year 4	133	25.29	8.88 (1.53)		
Year 5	14	2.65	9.29 (0.99)		
Area of program				**2.36**[a]	**0.040**
Agricultural studies	86	16.35	8.79 (1.52)		
Education	117	22.24	8.89 (1.70)		
Engineering	35	6.65	8.77 (1.26)		
Health sciences	77	14.64	9.30 (1.00)		
Social sciences	101	19.20	9.29 (1.31)		
Other studies	110	20.91	9.11 (1.19)		
Locality				**−0.627**[b]	**.531**
Local students	516	98.1	9.04 (1.39)		
International students	10	1.9	9.33 (1.41)		
Ethnic group				**1.77**[a]	**0.091**
Chewa	124	23.57	8.81 (1.52)		
Lomwe	111	21.1	9.05 (1.42)		
Tumbuka	93	17.68	9.05 (1.44)		
Ngoni	80	15.68	9.04 (1.48)		
Yao	31	5.89	9.39 (1.09)		
Sena	23	4.37	8.83 (1.11)		
Ngonde	21	3.99	9.19 (1.97)		
Other	43	8.17	9.56 (1.18)		
University type				**−1.293**[b]	**0.196**
Public	384	73.0	9.00 (1.40)		
Private	142	27.0	9.18 (1.35)		
Overall Total	**526**	**100**	**9.05**	**-**	**-**

[a] F-values from one-way ANOVA.
[b] independent *t*-test.

Table 3
Knowledge on HIV / AIDS risk behaviours and prevention.

#	Question	Frequency	Percent (answered correctly)
1	Are people who use drugs at higher risk of contracting HIV?	385	73.2
2	Is getting tested for HIV regularly important for preventing the spread of the virus?	456	86.7
3	Is it important to use condoms during every sexual encounter to prevent the transmission of HIV?	466	88.6
4	Can being in a monogamous relationship lower the risk of contracting HIV?	391	74.3
5	Is it safe to share needles as long as they are sterilized?	315	59.9
6	Are people who engage in unprotected sex at higher risk of contracting HIV?	510	97.0
7	Can sharing needles with an infected person increase the risk of contracting HIV?	497	94.5
8	Can the use of pre-exposure prophylaxis (PrEP) reduce the risk of contracting HIV?	346	65.8

characteristics. The overall mean score was 6.40 (SD = 1.39) among the students who participated in the survey (Table 4). The study found a statistically significant difference in mean scores among students pursuing different programme areas (p = 0.008). Surprisingly, students pursuing Agricultural Studies had more knowledge of HIV/AIDS risk behaviours and prevention ($M = 6.73$, SD = 1.49), followed by students pursuing health-related programs (M = 6.69, SD = 1.17), Social Sciences (M = 6.50, SD = 1.32), Engineering (M = 6.49, SD = 1.50), and Education Studies (M = 6.10, SD = 1.56).

Table 4 also shows that male students relatively had more knowledge on HIV&AIDS risk behaviours and prevention (M = 6.51, S.D.=1.33) than female students (M = 6.27, S.D.=1.44); students not affiliated to any religion had relatively more knowledge (M = 6.45, S.D.=1.54) than students affiliated to different religious beliefs; fourth year students had relatively more knowledge (M = 6.50, S.D.=1.25); and local students had relatively more knowledge (M = 6.45, S.D.=1.54) than international students (M = 6.22, S.D.=1.48). However, the study found no statistically significant differences in mean scores among the students in these categories. Furthermore, no significant difference in mean scores was observed between students attending public and private universities.

Table 4
Test of mean differences on knowledge of HIV/AIDS risk behaviours and prevention.

Variable	N	(%)	Mean (S.D.)	Test used	p-value
Gender				**1.96**[b]	**0.051**
Male	291	55.32	6.51 (1.33)		
Female	235	44.68	6.27 (1.44)		
Religion					
Christianity	475	90.3	6.40 (1.37)	**0.064**[a]	**0.979**
Islam	34	6.46	6.38 (1.58)		
No religion	11	2.09	6.45 (1.54)		
Tradition	6	1.14	6.17 (2.14)		
Year of study					
Year 1	123	23.38	6.37 (1.49)	**0.441**[a]	**0.779**
Year 2	157	29.85	6.41 (1.28)		
Year 3	99	18.82	6.30 (1.61)		
Year 4	133	25.29	6.50 (1.23)		
Year 5	14	2.65	6.14 (1.41)		
Area of program				**3.18**[a]	**0.008**
Agricultural studies	86	16.35	6.73 (1.49)		
Education	117	22.24	6.10 (1.56)		
Engineering	35	6.65	6.49 (1.50)		
Health sciences	77	14.64	6.61 (1.17)		
Social sciences	101	19.20	6.50 (1.32)		
Other studies	110	20.91	6.18 (1.81)		
Locality				**0.38**[b]	**0.704**
Local students	516	98.1	6.40 (1.39)		
International students	10	1.9	6.22 (1.48)		
University type				**1.04**[b]	**0.298**
Public	384	73.0	6.44 (1.45)		
Private	142	27.0	6.30 (1.20)		
Overall Total	**526**	**100**	**6.40 (1.39)**		

[a] F-values from one-way ANOVA.
[b] independent *t*-test.

Discussion

The study offered the first multi-institutional, nationally representative analysis of HIV&AIDS knowledge among full-time undergraduate university students in Malawi. In this study, the level of knowledge about HIV/AIDS among students was 82.3 %, implying that most university students in Malawi are conversant with HIV/AIDS-related issues. On average, the first-year students had 83 % of HIV/AIDS related knowledge. A pilot study conducted by [26], on gender differences in first-year university students' HIV/AIDS-related knowledge and sexual behaviours in Malawi, found that 68.9 % of students were knowledgeable about HIV/AIDS. Altogether, 83.3 % of students reported that they knew where to access HIV testing on campus, but only 19.0 % reported that they knew their HIV status. This shows that between 2008 and 2024, the level of knowledge among the first-year students has slightly increased [26,20] found that 42.2 % of the study participants aged between 15 and 24 had comprehensive HIV/AIDS knowledge. However, the previous studies focused on a few parameters, as they defined comprehensive knowledge as an accurate understanding of two primary methods for preventing the sexual transmission of HIV and refutation of three misunderstandings about HIV [20]. Our finding on the level HIV/AIDS-related knowledge was slightly higher than findings of studies conducted in other countries, such as at Sudanese University 13.8 % [5], Southeast Ethiopia University 51.4 % [13], at Dillah University 53 % [6], at United Arab Emirates University 61 % [9] at Konya University in Turkey 61 % [17] and 64 % at Malaysian University [30]. The notable variations in the findings could be due to the different study methods used, data collection tools, sample sizes, and varying periods of the studies. For example, the study conducted in Eastern Ethiopia defined "comprehensive knowledge." In contrast, the study conducted in Dilla and Southeast Ethiopia used general awareness questions to gauge knowledge of HIV and AIDS. In addition, the current study had a slightly larger sample size of 526, compared to the studies carried out at the Universities of Dilla and Eastern Ethiopia, which had sample sizes of 441 and 442, respectively. In comparison to the general population without post-secondary education, university students in this study demonstrated greater HIV awareness. Empirical research indicates that educational attainment is a significant predictor of HIV knowledge and the adoption of preventative behaviours [28]. Previous studies in Malawi also revealed a positive correlation between education and consistent condom use as well as HIV testing [19,20]. These findings support the current study's observation that higher education promotes accurate HIV knowledge. The increased HIV/AIDS knowledge noted among university students in this study also aligns with the decline in national prevalence and HIV incidence rates among 15 years and older, observed over the last decade, between 2010 and 2021, of 25 % and 0.21 %, respectively [32] with approximately 20,000 new infections per year [18]. Furthermore, HIV incidence has continued to decline roughly from 52,000 new infections in 2010 to 14,000 new infections in 2023 [12]. Empirical studies credit the decline to behavioral modifications [29] and enhanced access to education and information, especially via post-secondary institutions [20,22]. As such, these findings are consistent with long-term national investments in HIV awareness and education, as well as improved access to prevention services.

The study further contributes to the existing literature by highlighting systematic gaps in knowledge according to gender, academic

program, and year of study. The current study has revealed that female students have markedly higher knowledge levels, contrary to a prior study, which found no gender differences in HIV-related knowledge among students in Malawi Ntata et al. [26]. This study is consistent with other studies indicating that women frequently demonstrate heightened HIV awareness compared to men in Southern Africa [11]. The high level of knowledge among female students also confirms recent regional evidence that implementation of targeted programs for adolescent girls and young women, such as DREAMS, also being implemented in Malawi, has enhanced HIV awareness among females [15]. Furthermore, the present study also revealed that students pursuing health-related programs had significantly more HIV/AIDS-related knowledge than students pursuing other programs such as Social Science, Engineering, Agricultural Studies and Education. These findings are in line with other studies, which found that health-science students were 16 times more likely to have good knowledge of HIV/AIDS compared to non-health science students., [13], and exhibited a more profound comprehension of HIV transmission and prevention [11]. The most likely explanation is that students studying programmes in Health Sciences had access to HIV/AIDS information in their courses and were better educated about sex, reproductive health, and infectious diseases. This is so because information regarding infectious diseases in general and HIV&AIDS in particular is included in Health Science programme curricula. The study also showed a significant positive association ($p = 0.027$) between HIV/AIDS-related knowledge and the year of study of students, where it was found that year five students had relatively more HIV/AIDS-related knowledge than students in lower years. The differences observed among males, females, program and year of study suggest the need for a structured, standardised and integrated HIV education curriculum across all university programs.

Despite a generally high level of awareness, many misconceptions were identified, particularly concerning HIV transmission via saliva, the availability of HIV cure, and heterosexual transmission as the primary mode. Previous studies documented persistent ambiguity regarding non-sexual transmission pathways and biomedical information among students [16],[24]. The erroneous belief that sterilized needles are safe to share (40.1 % inaccurate) aligns with the studies conducted in Nigeria and South Africa, which underscored the necessity for practical instruction on injection safety, even within educated demographics [1,25]. These findings emphasize that educational initiatives must not only enhance public understanding but also address enduring myths and beliefs through evidence-based information. Although most participants comprehended behavioural prevention measures, their understanding of biomedical treatments, such as pre-exposure prophylaxis (PrEP), was restricted, with only 65.8 % answering correctly. Similar trends were observed in other university populations: Haffejee et al. [8] in South Africa and Maseko et al. [21] in Malawi both indicated inadequate awareness and low intentions to utilize PrEP among young adults. These gaps mirror a broader regional challenge in transitioning from behavioral to biomedical HIV literacy. Enhancing education and awareness regarding PrEP and safe needle procedures may consequently bolster preventative preparedness among sexually active youth.

The study further gives several novel insights relevant to the broader HIV research community in Malawi and Sub-Saharan Africa. The present study demonstrates that while university students possess a high level of overall HIV knowledge, significant deficiencies are evident in their understanding of biomedical HIV prevention, especially concerning PrEP and misconceptions surrounding the safety of sterilised needle sharing, and non-sexual transmission of HIV through saliva. These gaps have not been documented at the tertiary level in Malawi before this study. The study reveals significant variations in student knowledge based on programme and year of study, underscoring structural disparities in access to HIV information within universities, an area that has received limited attention in previous research. The present study offers updated evidence in the post-2020 HIV-prevention context, indicating that while traditional behavioural knowledge is well established, comprehension of contemporary prevention science remains insufficient. The distinction between established and emerging knowledge domains provides insights into the necessary evolution of HIV education programs. The study utilizes data from six universities in Malawi, offering nationally relevant insights into HIV knowledge that were previously inaccessible due to the restricted geographical focus of earlier research. These findings provide insights into young adults' readiness to engage with current HIV prevention strategies and identify specific deficiencies that necessitate targeted policy and educational interventions. It demonstrates that universities continue to serve as strategic spaces for HIV prevention initiatives.

Conclusion

This study builds on prior research by generating the very first national, multi-university analysis incorporating biomedical HIV prevention literacy, such as PrEP, among university students in Malawi. It has been demonstrated that the level of knowledge among full-time university students in Malawi is relatively high. Yet, it also reveals that gaps in knowledge according to myths, beliefs, biomedical HIV prevention, gender, program, and year of study persist. These findings recommend the establishment of a structured, standardised, and integrated HIV education curriculum across all university programs to address the identified gaps. Increasing HIV knowledge at universities will help Malawi advance its national prevention goals and global commitments towards SDG 3.3 targets of ending the epidemics of AIDS by 2030 and the AU Agenda 2063 Aspiration 1, goal 3 of healthy, well-nourished with long life spans citizens. The results further underscore the need for continued research on how enhanced knowledge influences actual risk behaviours among young adults.

CRediT authorship contribution statement

Wezzie M Tenthani: Conceptualization, Formal analysis, Investigation, Methodology, Project Administration, Resources, Visualisation, Writing – original draft, Writing – review & editing. **Fanuel Kapute**: Supervision, Validation, Writing – review & editing. **Ulemu Msiska**: Supervision, Validation, Writing – review & editing. **Shaibu Benard**: Data curation, Software, Writing – review & editing.

Ethical statement

Since the study involved human subjects, prior to commencing, ethical approval was sought from MZUNIREC (Ref No: MZUNIREC/DOR/23/87). Clearance from all selected universities was also obtained before data collection. At the onset of the study, participants were briefed on the study's purpose, and then written consent was obtained from the respondents before administering the questionnaires. Participation in the study was strictly voluntary, and respondents were free to withdraw at any time. The information collected from the respondents was treated as private and confidential, and no respondent's name was recorded.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data analysed during the current study are available from the corresponding author upon reasonable request.

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