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Evaluating HIV Knowledge and Attitudes in First-Year Medical Students: Pre- and Post-Targeted Education Module

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Abstract

Background: Many medical schools encourage participation in clinics where human immunodeficiency virus (HIV) testing should be performed in light of the Centers for Disease Control and Prevention's 2006 recommendations. It has been shown that preclinical medical students have knowledge gaps and/or stigmatizing attitudes that may compromise their care of patients living with HIV. This initiative sought to develop a training module to address these knowledge gaps and evaluate the efficacy of the module in remedying them.
Methods: A training module was developed from evidence-based sources. A test consisting of previously validated questions was administered to first-year medical students at Georgetown University as a pre-test and post-test with the training module viewed in between. A paired t-test was performed to determine if statistical significance existed between the pre- and post-training scores.
Results: A total of 158 medical students completed the training. A statistically significant difference was found between the overall pre- and post-training mean scores ($p < 0.0001$). Improvement of knowledge regarding viral suppression, transmission routes, and treatment were statistically significant from pre- to post-test. There were no statistically significant improvements, pre- and post-test, for questions assessing the knowledge of relative transmission and stigma.
Conclusions: The education module is an effective way of targeting preclinical medical students' knowledge deficits, suggesting that the module should be offered to preclinical students working in a clinic performing HIV testing.

Introduction

Medical education has shifted in recent years to emphasize early clinical exposure that provides practical learning opportunities to previously considered "preclinical" medical students. While this exposure provides significant benefit, it is possible that students' lack of knowledge regarding sexual health, particularly human immunodeficiency virus (HIV), can result in a negative interaction with the patient populations primarily served by these students. Studies assessing the knowledge of HIV and acquired immunodeficiency syndrome (AIDS) in preclinical medical students have shown knowledge deficits that may compromise their care of patients living with HIV.[1]

Mani et al. sought to elucidate the particular knowledge gaps and attitudes held by medical students in their preclinical years.[1] In a survey of two medical schools in a single urban center, the District of Columbia (DC), they found gaps in the specific areas of relative risk of transmission, clinical testing modalities, recommendations for highly active antiretroviral therapy (HAART) use in pregnant women, and indications for pre-exposure prophylaxis (PrEP) use. The investigators suggested that future research should focus on

targeted education modules and practical training in these areas. Based on the results of this previous study and the researchers' recommendations, the purpose of this current study was to develop and test the effectiveness of a targeted HIV education presentation to close gaps in knowledge and attitudes related to HIV epidemiology including testing methods, transmission risk, and prevention methods.

Stigmatizing attitudes held by medical students may also compromise care of their patients living with HIV. Cultural sensitivity courses are available online through the United States Centers for Disease Control and Prevention (CDC) and are funded with the goal of decreasing stigma in the health care setting.[2] The CDC has also developed a focused sexually transmitted infections health curriculum, packaged as online modules developed by the University of Washington and University of California, San Francisco.[3] Studies have shown that discriminatory attitudes towards individuals with HIV can result in indifference towards them, reluctance to perform life-sustaining measures such as mouth-to-mouth, or even complete refusal to care for individuals who are HIV positive.[4-6]

Further, there is significant data to suggest that stigma regarding HIV and resulting discrimination against individuals with HIV affect the emotional well-being and subsequently the mental health of people living with HIV. The stigma that they experience can become internalized and result in a negative self-image in which they fear being actively discriminated against or judged if their HIV status becomes public. This can lead to feelings of shame, fear of disclosure, isolation, and despair. These feelings and internalization of stigma can keep individuals from being tested and/or treated for HIV.[2] We thus felt it imperative that we assess the attitudes and stigma regarding HIV in medical students as they may be the first people to discuss their patient's HIV status.

Methods

Development of Training Assessment

The pre- and post-training assessment was developed by using six validated questions specific to HIV that were generated by Mani et al.[1] These questions were selected to target the areas of weakness in knowledge domains previously identified in their study, including epidemiology, virology, viral suppression, disease transmission, disease treatment and prognosis, HIV prevention, pregnancy and HIV, clinical testing modalities, and attitudes and sources of stigma in the experience of an HIV-positive patient. Nine additional questions were generated to assess the attitudes regarding HIV and the use of stigmatizing language. These questions were generated using publicly available information on the CDC's website in order to assess students' understanding of how an HIV diagnosis can influence the life of an individual living with HIV. The CDC's Stigma Language Guide was used to test students' knowledge of supportive versus stigmatizing language and gauge their understanding of the effect that specific words and phrases can have when speaking to an individual with HIV.[2]

Video Training Method

An HIV education module was developed to target the knowledge domains identified in the study by Mani et al. and included in the pre- and post-training test.[1] The module was a PowerPoint slide presentation with an electronic voice-over video that was fifteen minutes long with eleven slides. University of California, San Francisco's *HIV Today: What Everyone Needs to Know* training course (December 2014), the CDC website, and AIDS.gov were the primary sources utilized (Appendix 1).

Administration of Training and Assessment

First-year medical students at Georgetown University were sent a personalized link to complete the study. The testing and training were performed during the fall semester of the 2017-2018 academic year by 195 Georgetown first-year medical students who attended the HOYA Clinic Orientation. HOYA Clinic is a student-driven free clinic, formerly located in the old DC General Hospital Building in Southeast DC, that is managed by medical students of the Georgetown University and caters to the health needs of DC's homeless and uninsured. Additional information can be found at: hoyaclinic.som.georgetown.edu/. The 15-question test contained knowledge questions related to HIV/AIDS. The same test, with test

items in a random and different order from the pre-test, was then re-administered to the students upon completion of the training. The participants had approximately 15 minutes between the pre-test and the post-test. At no point were the students told the correct answers to the pre-training test. No compensation was provided to participants of the study. The study was approved by the Georgetown University Institutional Review Board.

Statistical Analysis

Pre- and post-test scores from the medical students were calculated. We implemented a scoring rubric for the two question types: single answer and multiple answers. For the single-answer questions, a student respondent would receive one full point if the question was correctly answered. For multiple-answer questions, a student respondent would receive between a quarter of a point to a full point, depending on the number of correct answers selected. For example, if a multiple answer question has three correct answers, the student respondent will receive 1/3rd of a point for each correctly selected choice. If all three are correctly select, a full point is answered. A maximum of fifteen points total could be obtained. No points were awarded for completely incorrect or skipped questions. Details on the questions and corresponding knowledge and attitude domains are listed in Table 1. We calculated the average points awarded and the percentage change pre- and post-test for each question. The average points awarded per question in the pre-test was used as a referent value to determine deficiencies in HIV knowledge prior to the education module. To determine the impact of the education module on medical students' overall HIV knowledge and attitude, the differences in the mean total scores of the pre- and post-test were calculated and compared using a paired, two-sample t-test. The difference in response to each question was assessed using McNemar's test for single-answer questions and using a paired, two-sample t-test for multiple-answer questions. P-values were adjusted for multiple comparisons using the Bonferroni method. Means and their corresponding 95% confidence intervals (CI) were reported. Analyses were conducted using R and SAS version 9.4 (The R Foundation for Statistical Computing, Vienna, Austria; SAS Institute Inc, Cary, North Carolina, USA).

Results

From the 195 medical students, a total of 158 pre- and post-test records were included in the analyses after excluding 37 incomplete records. The questions and correct responses of the pre- and post-test are reported in Table 1. Cronbach's alpha in the sample was 0.65 and 0.62, pre- versus post-test. The mean pre-test score was 9.8 (standard deviation [SD]: 3.9), with an average point awarded per question of 0.65 (referent value; SD: 0.24). After the administration of the education module, the mean post-test score increased 29.1% to 12.6 (SD: 2.7), with an average point awarded per question of 0.84 (SD: 0.13). The education module significantly increased overall HIV knowledge and attitude, as assessed by the pre- and post-test, by 2.8 points (95% CI: 2.52 - 3.17; $p<0.0001$). The average point awarded and percentage change for each question pre- and post-test are reported in Figure 1. Statistically significant percentage increases were found in questions 2, 3, 4, 6, 8, 9, 10, 11, 12, and 15 (Table 1). While questions 8 and 15 showed significant increases in the average points awarded, they remained lower than the pre-test referent value of 0.65.

Discussion

The areas in which first-year medical students demonstrated a mean score above the reference line in the pre-training module included the virus' name, mechanism of action, high-risk behaviors for HIV infection, and importance of pregnant patients understanding their HIV status.

The HIV education module effectively targeted the knowledge deficits in the areas of viral load and suppression, routes of transmission, vertical transmission, and PrEP and post-exposure prophylaxis (PEP). The mean scores of the questions in these areas, as well as questions assessing the window period and stigmatizing language, showed significant percentage increases from pre-test to post-test (>30% change).

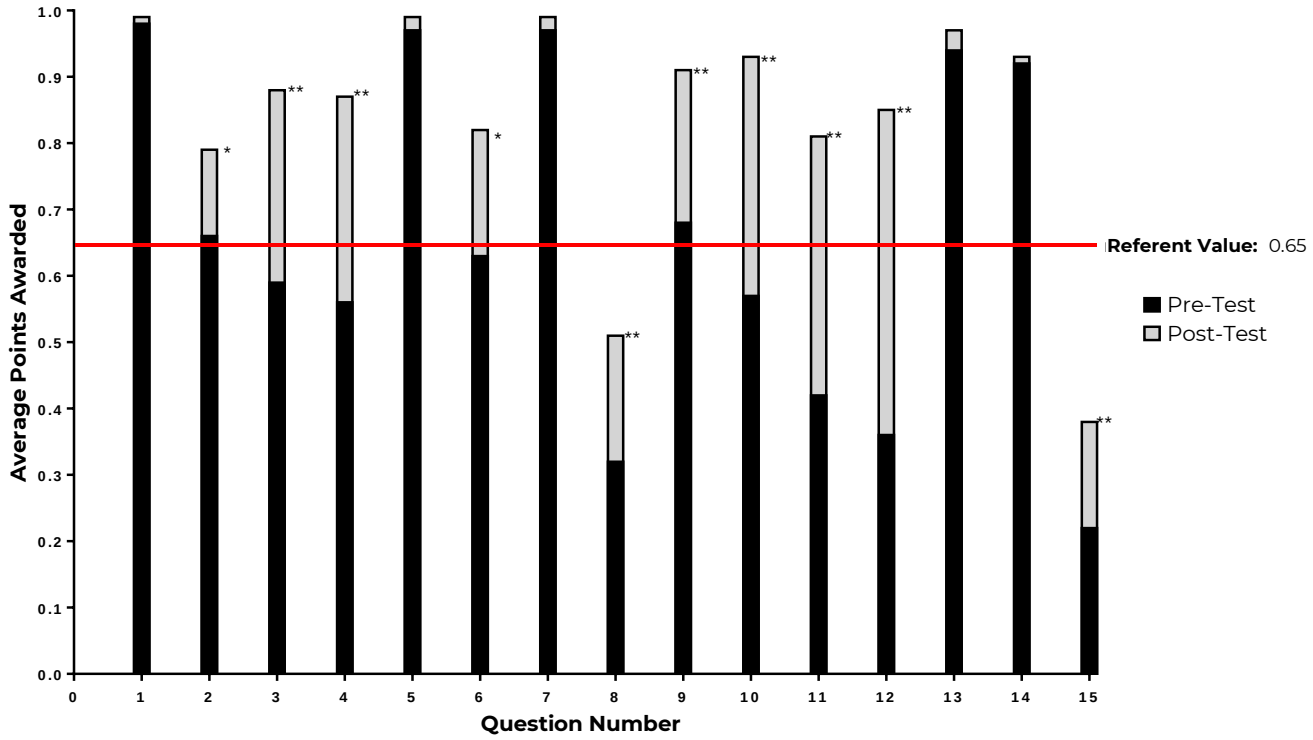
The mean score of the question regarding relative risk of transmission was below the reference line in the pre-test and remained below the refer-

Table 1. Test Questions, Domains, and Correct Responses of Pre- and Post-test

Question Number	Question (Domain)	Correct Response(s)
1	What does HIV Stand for? (1)	Human immunodeficiency virus
2	Which of the following is true regarding Acquired Immunodeficiency Syndrome (AIDS)? (Multiple answer question)[#] (2)	AIDS is characterized by opportunistic infections such as *Pneumocystis carnii* pneumonia, esophageal candidiasis, and mycobacterium avium complex. In AIDS, the immune system of a person infected with HIV becomes severely compromised, measured by CD4 cell count.
3	Which is false regarding viral load and suppression? (3)	The higher the viral load, the higher the CD4+ T-cell count.
4	Which body fluids can transmit HIV? (5)	Blood, semen (including pre-cum), vaginal fluid, and breast milk
5	What specific part of the human body does HIV attack and what does this cause?[#] (5)	HIV infects the immune system, specifically the CD4 cells, weakening the immune system, making it progressively more difficult to fight infections.
6	Regarding treatment of HIV, which of the following are true? (Multiple answer question)[#] (6)	Anti-retroviral therapy successfully suppresses HIV progression and prolongs life. Anti-retroviral therapy does not cure HIV. Anti-retroviral therapy suppresses sexual transmission of HIV.
7	Which of the following can make a person at higher risk for HIV infection? (4)	Sexual activity in a region or community with high rates of untreated HIV infection.
8	Rank HIGHEST to LOWEST the following risks of HIV infection.[#] I. A child born to an HIV+ mother on anti-viral medication treatment regimen II. An African-American male engaging in unprotected sex with a male III. A healthcare worker injured via needle stick (8)	II > III > I
9	Which of the following is true regarding the "window period"?[#] (9)	The time between when a person gets HIV and when a test can accurately detect HIV infection
10	Which of the following best describes Pre-Exposure Prophylaxis (PrEP)?[#] (7)	Taking anti-HIV medication daily to reduce their risk of becoming HIV infected
11	Which of the following is not true about Post-Exposure Prophylaxis (PEP)? (7)	PEP can be taken up to 7 days after exposure to HIV to prevent HIV contraction
12	Which of the following is NOT a way that an HIV+ mother can transmit HIV to her baby? (5)	Through cesarean delivery
13	It's important for a pregnant woman to know her HIV status because: (8)	HIV treatments can minimize the likelihood she will transmit the virus to her baby
14	Which of the following are associated with HIV-related stigma/discrimination? (10)	Feeling isolated; Learning their HIV status; Disclosing their status to people including family members and sexual partner; Accessing medical care and treatment
15	Which phrase should you avoid using because of its stigmatizing language? (10)	"unprotected sex" rather than "condomless sex with/without PrEP"

Domains: *(1) State of HIV in DC; (2) Virology; (3) Viral suppression; (4) Epidemiology; (5) Transmission routes; (6) Treatment and prognosis; (7) Prevention; (8) Pregnancy (9) HIV Testing; (10) Attitudes and stigma*
[#]Item from Mani et al., 2018.

Figure 1. Distribution of Pre-test and Post-test Average Points Awarded per Question



Question Number	1	2*	3**	4**	5	6*	7	8**	9**	10**	11**	12**	13	14	15**
Percent Change	0.6	17.5	33.1	35.5	2.5	23.3	1.3	37.5	25.0	38.8	48.4	57.5	3.9	1.4	41.7

*Paired t-test for difference pre- and post-test; df=1; p<0.001; **McNemar Test for test difference pre- and post-test; df=1; p<0.001

ence line in the post-test despite significant improvement (>30%) from pre-test to post-test. This question asked the participants to rank from highest to lowest the risks of HIV infection, comparing a child born to an HIV-positive mother taking an antiviral medication treatment regimen, an African American male engaging in condomless sex with a male, and a health care worker injured via needle stick. The post-test mean of 51% indicates that a severe lack of understanding remains regarding the relative risks of HIV transmission via various routes. This is particularly concerning as hierarchal stratification of risk is an extremely clinically relevant, if not critical, task when conversing with a patient who may be concerned about a potential HIV exposure.[7] It is imperative that a re-evaluation of the HIV training module be performed to potentially improve education about relative risk of transmission of HIV. It is also possible that a targeted portion of the module may need to be developed to educate students about techniques to perform a critical assessment of a patient's HIV exposure.

The survey also indicated a mix of knowledge and/or understanding about potentially stigmatizing language. The question evaluating the effect that HIV can have on an individual's life had a high pre-test mean above the reference line that then increased further on the post-test although the increase was not statistically significant. This question asked students to identify factors associated with HIV-related stigma/discrimination including feeling isolated, learning their HIV status, disclosing their status to people including family members and sexual partners, and accessing medical care and treatment. Therefore, first-year medical students participating in this study seemed to have high baseline knowledge

of the ways stigma influences an HIV-positive person's experience both in the context of medical treatment as well as social factors.

The mean scores of the question assessing stigmatizing language in the post-test was still below the reference line, although there was significant (>30%) improvement from pre-test to post-test. The potential answers for question 15 (stigmatizing phrase to avoid) included: "person living with HIV" rather than the phrase "HIV patient" or "HIV-infected person"; "sex worker" rather than "prostitute"; "unprotected sex" rather than "condomless sex with/without PrEP"; and "chronic health condition" rather than "death sentence/fatal condition" when talking about HIV. In both the pre-test and post-test, more students answered that "person living with HIV" was a potentially more stigmatizing phrase than "HIV patient" or "HIV-infected person." This is despite the explicit inclusion in the training module of the directive to: "Use language like 'person living with HIV' rather than 'HIV patient' or 'HIV-infected person.'" The HIV training module also did not adequately address the correct answer, that is, "unprotected sex" rather than "condomless sex with/without PrEP," although the other possible multiple-choice answers were explicitly addressed as incorrect in the module. Thus, the information presented regarding these questions in the presentation should be reconsidered in order to improve the module. Specifically, a discussion of the difference between "unprotected sex" and "condomless sex with/without PrEP" should be included in order to ensure that medical students are taking a correct history that includes questions regarding barrier methods as well as prophylaxis and are thus able to perform a correct assessment of a patient's risk of transmission or infection. In the past, the term "unprotected sex" was a way of expressing sex without a condom. However, more precise terms are necessary today as there are numerous ways to engage in safe sex and prevent HIV transmission, including utilization of PrEP and PEP.[2]

It is important to note that the gap in understanding regarding stigmatizing language may have a large impact on patient care for people living with HIV. Student-run clinics may be the primary health care resource for many patients and the effect of stigmatizing language may result in lack of understanding of their disease, negative psychosocial outcomes, and a barrier to seeking care in the future.

Limitations

The limitations of this study include the specific population which was surveyed. The knowledge deficits identified in Mani et al. were specific to two medical schools in a single urban center, and this particular study looked at the results of a targeted education module in one medical school within the same geographical location.[1] Thus, these knowledge deficits may be regionally specific and/or limited to the population surveyed. Additionally, there was no long-term follow-up to assess knowledge retention regarding the content of the education module over a longer period of time. This is an area that could potentially be expanded upon in the future. However, the fundus of knowledge in this module is supported by courses offered during the pre-clinical years followed by clinical training.

Future applications of this study could be to perform a randomized control trial in which a group of students would complete the pre-test and post-test fifteen minutes apart without watching the education module and compare this cohort to the study population to assess for test-retest effects.

Conclusion

Overall, the HIV training module demonstrated improvement in HIV knowledge and attitudes among first-year medical students participating in this study. Additional information to improve knowledge about HIV transmission risk and stigmatizing language will be incorporated into future iterations of the training module. This type of intervention can be adopted for use in other student-run clinics offering HIV screening services in order to improve patient care.

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Disclosures

The authors have no conflicts of interest to disclose.

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Appendix 1. Knowledge Domains with Source and Slide Numbers from the Education Module

Knowledge Domain	Slides	Sources
State of HIV in DC	2-4	HAHSTA. Annual Epidemiology & Surveillance Report. DC Department of Health, 27 June 2017, https://doh.dc.gov/sites/default/files/dc/sites/doh/publication/attachments/HAHSTA%20Annual%20Report%202017%20-%20Final%20%282%29.pdf
Virology	5	http://www.hiv.gov and http://www.cdc.gov
Viral suppression	6	"Viral Load Test Definition." National Institutes of Health. US Department of Health and Human Services, https://aidsinfo.nih.gov/understanding-hiv-aids/glossary/743/viral-load-test
Epidemiology	7	http://www.hiv.gov and http://www.cdc.gov
Transmission routes	8	http://www.hiv.gov and http://www.cdc.gov
Treatment and prognosis	9	The Antiretroviral Therapy Cohort Collaboration. "Causes of Death in HIV-1-Infected Patients Treated with Antiretroviral Therapy, 1996-2006: Collaborative Analysis of 13 HIV Cohort Studies." OUP Academic. Oxford University Press, 15 May 2010, https://academic.oup.com/cid/article-lookup/doi/10.1086/652283
Prevention	10-12	http://www.hiv.gov and http://www.cdc.gov
Pregnancy and HIV	13	http://www.hiv.gov and http://www.cdc.gov
HIV testing	14-19	http://www.hiv.gov and http://www.cdc.gov "CD4 Count (or T-cell Test)." US Department of Veteran Affairs, https://www.hiv.va.gov/patient/diagnosis/labs-CD4-count.asp "Summary of Safety and Effectiveness." FDA. US Food and Drug Administration, 3 July 2012, https://www.fda.gov/downloads/BiologicsBloodVaccines/Blood-BloodProd-ucts%20/ApprovedProducts/PremarketApprov-alsPMAs/UCM312534.pdf
Attitudes and stigma	20-21	Lynn V, Watson C, Giwa-Onaiwu M, Ray V, Gallagher B, Wojciechowicz V. "HIV #LanguageMatters: Addressing Stigma by Using Preferred Language." Hiveonline, https://www.hiveonline.org/wp-content/uploads/2016/01/Anti-StigmaSign-Onletter-1.pdf Lynn V, Wojciechowicz V. "People First Language: Reducing Stigma in HIV Communication." POZ, 21 December 2015, https://www.poz.com/article/vickie-lynn-valerie-wojciechowicz-28210-9008