ANALYSIS OF MEDICAL STUDENTS' KNOWLEDGE ABOUT HIV INFECTION

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Abstract

Introduction: HIV infection continues to be a significant public health issue globally, particularly among vulnerable populations such as young people, including medical students. As future healthcare providers, the level of knowledge among medical students regarding HIV transmission, prevention, and management is crucial not only for their own health but also for controlling the spread of the infection within the broader community. Furthermore, their understanding influences attitudes toward people living with HIV, fostering a more non-discriminatory, supportive healthcare environment.

Objective: To assess the level of HIV knowledge among medical students and identify factors influencing their awareness.

Materials and Methods: A cross-sectional study was conducted using an anonymous online survey administered to 152 medical students. The survey assessed various aspects of HIV knowledge, including transmission routes, prevention methods, target cells of the virus, and its effects on the immune system. Statistical analysis was performed using Fisher's exact test, and $p < 0.05$ was considered statistically significant.

Results: The overall level of HIV knowledge among students was moderate. Age and field of study significantly influenced awareness levels ($p < 0.05$), with senior-year students and those studying General Medicine demonstrating better knowledge. Significant differences were found regarding HIV transmission routes ($p = 0.022$), target cells ($p = 0.001$), and the virus's impact on the immune system ($p = 0.046$). Senior students and those specializing in general medicine demonstrated better knowledge (43.3% correct answers), while college students had the lowest results (19.4%).

Conclusion: The findings underscore the necessity for enhancing HIV education within medical curricula. It is particularly important to focus on comprehensive education regarding the mechanisms of virus transmission, its pathophysiological impact on the immune system, and evidence-based prevention strategies. Targeted educational interventions should be implemented, particularly for junior students and those outside of General Medicine, to ensure a well-rounded understanding across all medical disciplines.

Keywords: HIV, students, medical education, prevention, awareness.

Резюме

АНАЛИЗ ЗНАНИЙ СТУДЕНТОВ МЕДИКОВ О ВИЧ ИНФЕКЦИИ

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Введение: Инфекция ВИЧ продолжает оставаться важной проблемой общественного здравоохранения по всему миру, особенно среди уязвимых групп, таких как молодежь, включая медицинских студентов. Уровень знаний медицинских студентов о передаче, профилактике и лечении ВИЧ критически важен не только для их собственного здоровья, но и для контроля за распространением инфекции в обществе. Кроме того, их понимание влияет на отношение к людям, живущим с ВИЧ, способствуя созданию более неконфликтной и поддерживающей медицинской среды.

Цель: Оценить уровень знаний о ВИЧ среди медицинских студентов и выявить факторы, влияющие на их осведомлённость.

Материалы и методы: Проведено поперечное исследование с использованием анонимного онлайн-опроса, в котором участвовали 152 студента. Опрос оценивал различные аспекты знаний о ВИЧ, включая пути передачи, методы профилактики, целевые клетки вируса и его влияние на иммунную систему. Статистический анализ был выполнен с использованием точного теста Фишера, где p < 0,05 считалось статистически значимым.

Результаты: Общий уровень знаний о ВИЧ среди студентов был умеренным. Возраст и специальность значительно влияли на уровень осведомленности (p < 0,05), студенты старших курсов и изучающие общую медицину продемонстрировали лучшие результаты. Были выявлены значительные различия по вопросам путей передачи ВИЧ (p = 0,022), целевых клеток (p = 0,001) и влияния вируса на иммунную систему (p = 0,046). Старшие студенты и те, кто учится на общей медицине, показали лучшие результаты (43,3% правильных ответов), в то время как студенты младших курсов имели самые низкие результаты (19,4%).

Заключение: Результаты подчеркивают необходимость улучшения образовательных программ по ВИЧ в медицинских вузах. Особое внимание следует уделить обучению механизмам передачи вируса, его патофизиологическому воздействию на иммунную систему и профилактическим стратегиям, основанным на доказательствах. Необходимы целевые образовательные вмешательства, особенно для студентов младших курсов и тех, кто учится не на общей медицине, чтобы обеспечить всестороннее понимание в различных медицинских дисциплинах.

Ключевые слова: ВИЧ, студенты, медицинское образование, профилактика, осведомленность.

Түйіндеме

МЕДИЦИНАЛЫҚ СТУДЕНТТЕРДІҢ ВИЧ ИНФЕКЦИЯСЫ ТУРАЛЫ БІЛІМІН ТАЛДАУ

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Кіріспе: ЖИТС инфекциясы бүкіл әлем бойынша маңызды қоғамдық денсаулық мәселесі болып қала береді, әсіресе осал топтар арасында, мысалы, жас адамдар мен медициналық студенттер. Медициналық студенттердің ЖИТС-тің берілуі, алдын алу және басқару туралы білім деңгейі тек олардың өз денсаулығы үшін ғана емес, инфекцияның таралуын бақылау үшін де өте маңызды. Сонымен қатар, олардың түсінігі ЖИТС-пен өмір сүретін адамдарға деген қарым-қатынасты қалыптастыруға, кемсітушілікке жол бермейтін және қолдаушы медициналық орта құруға ықпал етеді.

Мақсаты: Медицина студенттерінің АИТВ туралы білім деңгейін бағалап, оған әсер ететін факторларды анықтау.

Материалдар мен әдістер: 152 медициналық студентке анонимді онлайн сауалнама жүргізілген көлденең зерттеу жүргізілді. Сауалнамада ЖИТС туралы білімнің түрлі аспектілері, оның ішінде берілу жолдары, алдын алу

әдістері, вирустың мақсатты жасушалары және иммундық жүйеге әсері бағаланды. Статистикалық талдау Фишердің дәлдік тесті арқылы жүргізілді, p < 0.05 мәні статистикалық маңыздылық деп саналды.

Нәтижелер: Медициналық студенттер арасында ЖИТС туралы білім деңгейі орташа болды. Жас пен оқу бағыты ақпараттық деңгейге елеулі әсер етті (p < 0.05), жоғары курс студенттері мен жалпы медицина саласында оқитындар жақсырақ білім көрсетті. ЖИТС-тің берілу жолдары (p = 0.022), мақсатты жасушалар (p = 0.001) және вирустың иммундық жүйеге әсері (p = 0.046) туралы айтарлықтай айырмашылықтар анықталды. Жоғары курс студенттері мен жалпы медицина саласында оқитындар білімдерін жақсы көрсетті (43.3% дұрыс жауап), ал колледж студенттерінің нәтижелері ең төмен болды (19.4%).

Қорытынды: Зерттеу нәтижелері медициналық білім бағдарламаларында ЖИТС бойынша білімді арттыру қажеттілігін көрсетеді. Вирус тарау механизмдерін, оның иммундық жүйеге патофизиологиялық әсерін және дәлелдерге негізделген алдын алу стратегияларын жан-жақты оқытуға ерекше назар аудару өте маңызды. Студенттерге, әсіресе төменгі курс студенттеріне және жалпы медицина саласынан тыс оқитындарға арналған мақсатты білім беру шаралары енгізілуі тиіс.

Түйінді сөздер: ЖИТС, студенттер, медициналық білім, алдын алу, ақпараттылық.

Introduction

HIV infection remains one of the most significant public health issues worldwide. According to the World Health Organization (WHO), in 2023, there were approximately 39 million people living with HIV globally, a significant proportion of whom are young people, including medical students [21]. In this context, the level of awareness among medical students about HIV is of particular importance, as they are the future professionals responsible for diagnosing, treating, and preventing the infection.

Future medical professionals play a key role in the fight against the spread of HIV and in providing care to patients. However, numerous studies highlight gaps in their knowledge about the virus, its modes of transmission, and prevention methods [15].

Research shows that the level of awareness among students about HIV varies depending on the country, curriculum, and the age of the respondents. For example, a study among students in Cameroon found that only 55% of senior students had sufficient knowledge about HIV transmission mechanisms [16].

Medical students are the future doctors and healthcare workers who will play a crucial role in the fight against HIV. Their level of knowledge and professional training directly impacts the quality of diagnosis, treatment, and patient counseling. Various studies point to existing gaps in medical students' knowledge about HIV [14].

A study conducted in India showed that even among senior students, less than 50% correctly identify the primary modes of HIV transmission [4]. In another study conducted in the United States, it was found that medical students are less likely to recommend pre-exposure prophylaxis (PrEP) for high-risk HIV patients, indicating insufficient training in this area [7].

Particular concern is raised by the persistent stigma surrounding HIV patients among future healthcare professionals. A study conducted in Jordan revealed that a high level of negative attitudes toward people living with HIV is directly linked to low levels of student knowledge [6]. Similar results were obtained in Saudi Arabia, where students with a higher level of awareness exhibited more tolerant attitudes toward HIV patients [4].

One of the factors influencing students' knowledge of HIV is the curriculum. Some studies emphasize the need for more comprehensive HIV/AIDS courses in medical schools [19].

Given the increasing number of HIV cases among young people, particularly in developing countries, it is crucial to regularly assess the level of knowledge among medical students. This would allow for the adaptation of educational programs and the enhancement of future specialists' training in infectious diseases [12].

Thus, **the aim of this study** is to analyze the level of knowledge of medical students about HIV, identify the primary gaps in awareness, and assess the impact of age and specialty on the degree of awareness.

Materials and methods of research

The study design is a cross-sectional study.

Data were collected using a questionnaire created through the Google Forms online service, ensuring convenience for participants and anonymity. Participation in the survey was voluntary, with participants being informed in advance about the study's objectives and assured that their responses would remain anonymous.

Sample

A total of 152 respondents participated in the study, of which 65.1% were women and 34.9% were men. The age distribution of the participants was as follows: 17-19 years - 68 participants (44.7%), 20-22 years - 62 participants (40.8%), and 23 years and older - 22 participants (14.5%). The respondents were enrolled in different fields of study: General Medicine - 53 participants (34.9%), College - 49 participants (32.2%), Dentistry - 36 participants (23.7%), and Pediatrics - 14 participants (9.2%).

Data Collection Method

The questionnaire, which included a variety of questions on the topic of HIV, was designed to assess students' knowledge in various aspects of the disease. Survey participants were asked to select the most appropriate answers from the provided options.

Data Analysis Methods

Statistical methods implemented in the SPSS software (Statistical Package for the Social Sciences) were used for data analysis. Fisher's exact test was used to check the

statistical significance of differences between groups. This allowed for the evaluation of whether significant differences existed between various subgroups of respondents in terms of key parameters (e.g., knowledge level by age or specialization). A p-value of < 0.05 was considered statistically significant, enabling conclusions about the relevance of the identified differences.

Research results

Table 1 presents the results of respondents' awareness of HIV transmission routes. The overall level of knowledge was moderate. In the age group of 17-19 years, 25.4% of

participants correctly identified transmission routes such as the use of shared needles when using drugs, mother-to-child transmission during pregnancy or childbirth, blood transfusion, and unprotected sexual contact. In the 20-22 age group, 55.2% provided correct answers, while among respondents over 23 years old, the figure was 19.4% (p = 0.001 General medicine students demonstrated the highest results, with 43.3% correct answers, while college students showed the lowest level of awareness at 19.4%. Statistically significant differences between the age groups were confirmed (p = 0.022).

Table 1.

Awareness of HIV transmission routes.

Variables		How is HIV transmitted?				p- value
		Correct answers		Incorrect answers		
		n	%	n	%	
Age group	17-19	17	25.4%	51	60.0%	0.001*
	20-22	37	55.2%	25	29.4%	
	23 and more	13	19.4%	9	10.6%	
Speciality	College	13	19.4%	36	42.4%	0.022*
	General medicine	29	43.3%	24	28.2%	
	Pediatrics	8	11.9%	6	7.1%	
	Dentistry	17	25.4%	19	22.4%	

Table 2 shows the data on respondents' awareness of HIV target cells. In the 17-19 age group, 41.7% of respondents correctly answered the question about T-lymphocytes CD4+ being the primary target for HIV. In the 20-22 age group, 42.6% provided correct answers, while among participants older than 23, the figure was 15.7%.

However, statistically significant differences between age groups were not found (p = 0.410). General medicine students showed the highest level of awareness (41.7%), while college students - the lowest (27.0%). Statistically significant differences between specialties were confirmed (p = 0.001).

Table 2.

Awareness of HIV target cells.

Variables		What type of cell is the main target of HIV in the body?				p- value
		Correct answers		Incorrect answers		
		n	%	n	%	
Age group	17-19	48	41.7%	20	54.1%	0.410
	20-22	49	42.6%	13	35.1%	
	23 and more	18	15.7%	4	10.8%	
Speciality	College	31	27.0%	18	48.6%	0.001*
	General medicine	48	41.7%	5	13.5%	
	Pediatrics	13	11.3%	1	2.7%	
	Dentistry	23	20.0%	13	35.1%	

The results of awareness regarding the consequences of HIV infection for the immune system are presented in Table 3. In the 17-19 age group, 42.9% of respondents correctly indicated that HIV causes a decrease in the number of CD4+ T-lymphocytes. In the 20-22 age group, 42.0% provided correct answers, while among respondents

older than 23, the figure was 15.2%. However, no statistically significant differences were found between the age groups (p = 0.731) General medicine students demonstrated the best results (41.1%), and pediatrics students - the lowest. Statistically significant differences were confirmed (p = 0.046).

Table 3.

Concepts of the immune system in HIV.

Variables		What happens to the immune system as a result of HIV infection?				p- value
		Correct answers		Incorrect answers		
		n	%	n	%	
Age group	17-19	48	42.9%	20	50.0%	0.731
	20-22	47	42.0%	15	37.5%	
	23 and more	17	15.2%	5	12.5%	
Speciality	College	33	29.5%	16	40.0%	0.046*
	General medicine	46	41.1%	7	17.5%	
	Pediatrics	8	7.1%	6	15.0%	
	Dentistry	25	22.3%	11	27.5%	

Table 4 shows the results of awareness regarding viral load in HIV. In the 17-19 age group, 46.4% of respondents correctly answered the question about viral load as the amount of virus in the blood. In the 20-22 age group, 38.1% provided correct answers, while among participants older than 23, the figure was 15.5%. But statistically significant differences were not observed (p = 0.747). General medicine students demonstrated a better level of knowledge (showing 42.9% correct answers) than students of other specialties, and statistically significant differences were found with p = 0.004.

Table 4.

Knowledge of viral load in HIV.

Variables		What is viral load in the context of HIV?				p- value
		Correct answers		Incorrect answers		
		n	%	n	%	
Age group	17-19	39	46.4%	29	42.6%	0.747
	20-22	32	38.1%	30	44.1%	
	23 and more	13	15.5%	9	13.2%	
Speciality	College	30	35.7%	19	27.9%	0.004*
	General medicine	36	42.9%	17	25.0%	
	Pediatrics	7	8.3%	7	10.3%	
	Dentistry	11	13.1%	25	36.8%	

Table 5 presents data on knowledge of HIV treatment methods. In the 17-19 age group, 49.1% of respondents were aware of existing treatment methods, such as antiretroviral therapy (ART). In the 20-22 age group, 34.9% provided correct answers, while among participants older than 23, the figure was 16.0%. Statistically significant differences between age groups were not found (p = 0.081). General medicine students demonstrated the highest level of knowledge (40.6%) while dentistry students showed the lowest level of awareness (15.1%). Statistically significant differences were found with p=0.002.

Table 5.

HIV Treatment Awareness.

Variables		What is the most effective treatment for HIV?				p- value
		Correct answers		Incorrect answers		
		n	%	n	%	
Age group	17-19	52	49.1%	16	34.8%	0.081
	20-22	37	34.9%	25	54.3%	
	23 and more	17	16.0%	5	10.9%	
Speciality	College	36	34.0%	13	28.3%	0.002*
	General medicine	43	40.6%	10	21.7%	
	Pediatrics	11	10.4%	3	6.5%	
	Dentistry	16	15.1%	20	43.5%	

Discussion

The results of this study confirm the findings of previous research, indicating a moderate level of awareness of HIV among medical students and significant differences in knowledge depending on age and specialization of study. Based on the results obtained, it is evident that there are significant gaps in the awareness of HIV transmission, consequences, and treatment among medical students. While certain groups, such as general medicine students, demonstrated a relatively higher level of knowledge compared to students from other specialties, significant discrepancies were observed across different age groups and fields of study. The data also highlight a concerning lack of awareness regarding key aspects of HIV, such as viral load and the immune system's response to the infection.

The analysis of the obtained data shows that senior students and those studying general medicine demonstrated a higher level of knowledge about key aspects of HIV infection compared to junior students and college students. These results are consistent with the study by *Haroun D. et al.* (2016), which found a higher level of knowledge among senior students in the UAE [10].

According to the study by *Zhang L. et al.* (2022), it was found in China that senior students were significantly more informed about HIV transmission mechanisms and treatment methods than first-year students [22].

In another study conducted in Jordan, it was found that even among senior students, there were gaps in understanding HIV transmission mechanisms and the principles of antiretroviral therapy (*Sallam M. et al.,* 2022) [18]. These data highlight the need for continued HIV education programs not only within the basic infectious disease course but also throughout the entire period of medical education.

However, despite the positive trend in knowledge as education levels increase, certain gaps remain even among senior students. *Tatsilong H.O. et al.* (2016) found that over 40% of senior students in Cameroon still could not accurately identify HIV transmission routes [20], which correlates with our results.

The lowest levels of knowledge were observed in questions related to HIV target cells, associated infections, and viral load. Similar conclusions were made in studies by *Li G. et al.* (2019) [13] and *Obeagu E.L. et al.* (2023) [16], where it was noted that understanding the biological mechanisms of the infection remains weak even among medical students.

Furthermore, in the study by *Alawad M. et al.* (2019), conducted in Saudi Arabia, it was noted that medical students who had completed specialized courses in infectious diseases demonstrated a higher level of knowledge compared to those who had not taken such courses [1]. This highlights the need to improve educational programs.

The study by *Alhasawi A.M. et al.* (2019), conducted in Kuwait, showed that a significant number of students had incorrect perceptions about HIV transmission methods. For example, approximately 30% of respondents mistakenly believed that HIV could be transmitted through kissing or insect bites [2]. This underscores the necessity of focusing on evidence-based data in educational programs.

Moreover, some participants demonstrated misconceptions about the impact of HIV on the immune system, emphasizing the need for a more in-depth exploration of this issue in educational programs [19]. These results confirm the necessity of revising curricula and enhancing attention to HIV-related education for students. The study by *Khasawneh et al.* (2020) demonstrated that incorporating interactive and clinical teaching methods significantly improves students' knowledge about HIV [11].

An important aspect is also the increase in awareness about HIV prevention, including post-exposure prophylaxis and the principles of antiretroviral therapy. The study by *Parameshwaran V. et al.* (2017) showed that students who underwent specialized courses in infectious diseases demonstrated better knowledge and a more positive attitude toward patients with HIV [17].

One of the most problematic topics identified during the analysis remains viral load and the significance of antiretroviral therapy. The study by *Alizadeh Otaghvar H. et al.* (2023) notes that less than 50% of students are aware that adequate therapy reduces the risk of HIV transmission to minimal levels [3].

Another important aspect identified during the study is the link between students' knowledge levels and their attitudes toward people living with HIV. According to the study by Arthur S. et al. (2021), students with low levels of knowledge about HIV are more likely to display stigmatizing attitudes toward patients [5]. *Zhang L. et al.* (2022) also noted that in countries with insufficient HIV awareness among medical students, there are more biased opinions about people with HIV, which negatively affects future doctors' willingness to provide medical care to such patients [21].

To improve students' knowledge and combat stigmatization, the implementation of new teaching methods is necessary. The study by *Arthur S. et al.* (2021) confirms that the use of interactive methods, such as clinical case simulations and role-playing, significantly increases students' awareness [5].

Obeagu E.L. et al. (2023) also recommend incorporating specialized HIV modules into mandatory medical school programs, which will help address gaps in knowledge about viral load, antiretroviral therapy, and prevention of transmission [16].

Based on the obtained data, it can be concluded that enhancing students' knowledge about HIV is possible through the modernization of educational programs. Specifically, the studies by *Fisher C.B. et al.* (2020) and de *Vries E. et al.* (2020) recommend the introduction of courses using role-playing, simulated patients, and clinical cases for better understanding of HIV infection aspects [9,8].

Conclusions

Age and specialty play a significant role in the level of knowledge students have about HIV. Young people aged 17-19 have a lower level of awareness compared to older students (20-22 years old). Students studying general medicine also demonstrate a better understanding of HIV compared to those from other medical fields, such as pediatrics and dentistry, as well as college students. Among the most problematic topics for respondents are HIV transmission routes (p = 0.022), HIV target cells (p = 0.001), and the impact of HIV on the immune system (p = 0.046).

In this regard, it is necessary to strengthen educational programs for junior students and those studying non-medical specialties. It is particularly important to focus on HIV transmission routes, its impact on the immune system, and key associated infections. Specialized lectures and courses for students in pediatrics, dentistry, and colleges are also recommended to enhance their awareness.

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