Clinical research

European students are more likely to provide incorrect HIV testing indications as compared to other international students

Justyna D. Kowalska[1], Dorota Kozioł-Kaczorek[2], Andrzej Horban[1]

[1]Department for Adults Infectious Diseases, Medical University of Warsaw, Warsaw, Poland
[2]Faculty of Economic Sciences, Warsaw University of Life Sciences – SGGW, Warsaw, Poland

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Corresponding author:
Justyna D. Kowalska
Department for Adults Infectious Diseases
Medical University of Warsaw
37 Wolska St
01-201 Warsaw, Poland
Phone: +48 722 545 575
E-mail: jdkowalska@gmail.com

Abstract

Introduction: Expanding HIV testing is recognised as a major tool in halting the HIV epidemic. However, HIV testing is still advised inadequately by medical practitioners. Therefore we investigated medical students' knowledge on HIV and indications for HIV testing.
Material and methods: Fifth year students were pre-tested while entering the infectious diseases course. Questionnaires were anonymous and covered three areas: medical practice, transmission risk and indications for HIV testing. Logistic regression models were used to identify factors associated with incorrect responses to questions on HIV testing indications.
Results: In total 224 students were included; 64% were female. The majority of students were from Europe (64.3%), followed by Asia (24.5%), North Africa (6.3%) and North America (4.9%); 72.8% were from high-income countries. Only 91 (41%) students provided correct indications for HIV testing, i.e. including sexual contacts, STDs or pregnancy in addition to medical condition. Over half (54%) listed only medical conditions related to immunodeficiency as an indication for HIV testing. In the multivariate logistic regression model the odds of incorrect indications for HIV testing were higher for European students (odds ratio (OR) = 2.56, 95% CI: 1.19–5.50; $p < 0.016$) and those overestimating the homosexual risk of HIV infection (OR = 1.03, 95% CI: 1.00–1.06; $p = 0.026$). The odds were lower for students overestimating the risk of mother-to-child transmission (OR = 0.97, 95% CI: 0.96–0.98; $p < 0.001$).
Conclusions: Students tend to represent a condition-focused HIV testing approach, underscoring the importance of behaviour-related indications, as well as the asymptomatic character of HIV infection. This observation is especially relevant for students originating from Europe.

Key words: HIV testing, indications, transmission.

Introduction

Despite wide access to treatment and care, AIDS and deaths due to AIDS are still observed in Europe, which can be mainly linked to the high rate of patients presenting at a late stage of disease [1–3]. At the same time, up to 50% of HIV-positive persons living in the European region are unaware of their HIV status [4]. Therefore expanding HIV testing is rec-

ognised as a major tool in decreasing mortality, as well as halting the HIV epidemic, and is thus recommended by European health authorities [5, 6]. Despite this, HIV testing is still advised rarely and inadequately by medical practitioners [7, 8]. A good example is HIV testing in pregnancy. Prevention of vertical transmission remains an important indication for HIV testing. At the same time, in many European countries it is not offered routinely at the antenatal clinics, resulting in HIV infections still occurring among newborns in Europe [9–12]. Another striking example is incomplete HIV screening among patients presenting at medical care with an AIDS-defining condition. As reported by Mosimann *et al.*, only 11% of women diagnosed with invasive cervical cancer and 60% of those with lymphomas were tested for HIV at the oncological ward in a large tertiary centre in Switzerland [13].

Recently another testing approach was proposed, namely indicator conditions guided HIV screening. This concept merges three dissimilar condition groups together, i.e. those which are AIDS-defining, those associated with an undiagnosed HIV prevalence of > 0.1%, and finally conditions with the estimated prevalence of HIV lower than 0.1% where testing is offered to avoid immune suppression, which could have significant adverse implications for the individual's future clinical management [14, 15].

Although the guidelines for HIV testing are well established, they are not always adhered to, often for unclear reasons. A systematic review performed by Deblonde *et al.* revealed a lack of structured information on barriers to HIV testing considering attitudes and practices of health care providers [16]. In order to better understand and target these barriers, it is important to carry out structured assessments, preferably cross-European, investigating further the nature of these obstacles. Such an initiative, namely the Optimising testing and linkage to care for HIV across Europe (OptTEST) project, are on their way, yet data in this area are still sparse [17].

From this perspective it seems relevant to investigate medical students' knowledge on HIV risk and indications for testing in order to better understand whether the gap in the knowledge develops after or during the medical teaching process.

Therefore we investigated fifth year medical students' knowledge on indications for HIV testing at the English Division Faculty of the Medical University of Warsaw.

Material and methods

Participants and questionnaire

Medical students attending the penultimate year of the Second Faculty of Medicine and English Division Faculty at the Medical University of Warsaw were asked to fill in a pre-course questionnaire while entering the HIV classes. The questionnaire was anonymous, but afterwards students were given feedback along with a full explanation of correct answers.

Their knowledge on HIV was assessed in three different areas: morbidity, risk of HIV transmission and indications for HIV testing. In the morbidity section students were asked to describe the difference between HIV and AIDS, whether HIV infection can be asymptomatic, and what the most common HIV-related diseases or conditions are. Students' knowledge on the risk of HIV transmission was evaluated by asking which body fluids can be contagious, what the risk of mother-to-child transmission is, and what the risk of sexual transmission is with differentiation between homosexual and heterosexual risk. Students were asked to provide their risk estimation as a percentage. Finally students were asked to provide indications for HIV testing.

For study purposes all questionnaires were evaluated by the academic teacher, based on a pre-defined evaluation system provided by a specialist in HIV medicine. A maximum of two points per answer was possible and was defined as the correct answer, a score of one point was considered partially correct, and no points were considered an incorrect answer. Table I presents detailed information on the system of evaluation that was defined at the stage of study design.

For the final analyses participants were divided into two groups based on their response to question on indications for HIV testing. The correct answer was considered when pregnancy and sexual contacts or sexually transmitted disease (STD) were listed as indications for HIV testing in addition to at least one medical condition.

Statistical analysis

Parametric and non-parametric tests were used for group comparison as appropriate. Logistic regression models were used to identify factors associated with incorrect responses to questions on HIV testing indications. The variables that were tested included age, gender, region of origin, income of the origin country, medical specialty considered by the student to be practised in future, and the risk of HIV mother-to-child (MTC) and heterosexual and homosexual transmission (in percent). All analyses were performed using Statistical Analysis Software Version 9.3 (Statistical Analysis Software).

Ethical approval

This is a non-invasive, questionnaire-based study where the authors of the study received

Table I. Evaluation system and questions used in pre-course questionnaire

Question	Correct	Partially correct	Incorrect
What is the difference between HIV and AIDS?	Proper description according to CDC or WHO definition	–	–
Can HIV infection be asymptomatic?	A "yes" answer	A conditional "yes" answer e.g.: "yes, but only at the first stage of infection"	A "no" answer
Name three most common HIV-related diseases or conditions	All three conditions being CDC B or C diseases	Less than three conditions being CDC B or C diseases	No CDC B or C conditions listed
Which body fluids can be contagious?	The following four body fluids should be listed: blood, breast milk, vaginal secretion, sperm	If three out of four are provided or if one incorrect answer is listed (e.g. saliva)	If two or less are provided
What is the risk of mother-to-child (MTC) HIV transmission in %?	20–50	–	< 20 or > 50
What is the risk of HIV transmission per one unprotected sexual contact in %? (separately for heterosexual and homosexual contact)	Heterosexual < 1% Homosexual < 3%	Heterosexual 1–5% Homosexual 3–10%	> 5% > 10% No differentiation between MSM and heterosexual contacts
What are the indications for HIV testing?	Pregnancy or sexual contacts/STDs listed in addition to one more indication that is correct	Pregnancy and sexual contacts/STDs not listed, only strict medical indications included	No relevant indication listed

anonymized data. Therefore no ethical approval is required according to local law and ethical regulations.

Results

Baseline characteristics

In total 224 students were included in the pre-course test and filled in the questionnaire. The mean age of students was 24.1 (standard deviation, SD = 2.1) years and 64% were female. The majority of students, 144 (64.3%), were from the European region, followed by Asia (24.5%), North Africa (6.3%) and North America (4.9%). In general, 72.8% of students were from high-income countries.

Eighty-six (38.4%) students planned to practise in the area of internal medicine, 50 (22.3%) in surgical specialties, 53 (23.7%) in obstetrics or paediatrics, and 35 (25.6%) did not know which area of practice they will chose.

Questionnaire evaluation

The median total score was 14 (IQR: 12–15) points. Only 4 (1.8%) students obtained a maximum score of 18 points.

In general, questions related to medical practice were answered most accurately, with 88% of students understanding correctly the difference between HIV infection and AIDS and 89% of the students agreeing to HIV being an asymptomatic disease. Students were less accurate in providing HIV-related conditions, with 63% answering correctly and 28% partially correctly.

The risk of HIV transmission was described properly by a lower proportion of students, as compared to the medical knowledge area. Almost half of the students (46%) did not correctly list the contagious body fluids, and less than one third of them provided the correct risk estimation for HIV risk transmission for MTC and sexual contacts (29% and 24%, respectively). In general, students greatly overestimated the risk of both MTC and sexual transmission. Mother-to-child risk was estimated as above 50% by one fourth of the students, MSM (men who have sex with men) risk as above 10% by over half (54%) of the students, and heterosexual risk as above 5% by almost half (45%) of participants. The median risk for MTC was 35% (IQR: 22.5–50%). The median estimate for MSM risk was 10% (IQR: 1.7–50%) and for heterosexual risk 3% (IQR: 0.5–30%). Risk estimation was not provided for MTC by 15 (7%) students, for MSM contacts by 44 (20%) students, and for heterosexual contacts by 27 (13%) students.

The question about the indications for HIV testing was answered correctly by 91 (41%) students. 54% of students did not list pregnancy or sexual contacts/STD as an indication for HIV testing, but listed other medical conditions (partially correct answer). Finally, 5% of the students answered incorrectly. Only 12% of the students listed pregnan-

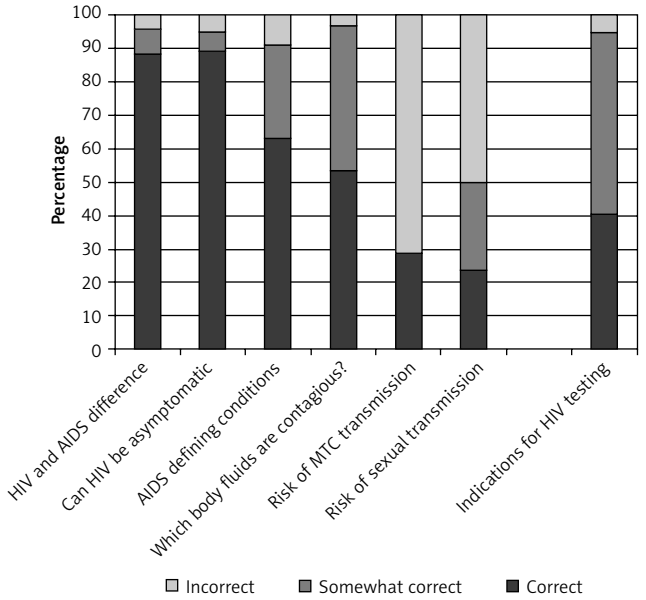

Figure 1. Crude percentage of incorrect, partially correct and correct responses to all questions

cy and 39% sexual contacts/STD as an indication for HIV testing (Figure 1).

Group comparison and logistic regression models

In total, 133 (59%) of the students provided incorrect indications for HIV testing. A comparison of baseline demographic characteristics and answers to the questionnaire for the group of students with correct and incorrect testing are provided in Table II.

In multivariate logistic regression models the odds of incorrect indications for HIV testing were higher for European students (OR = 2.56, 95% CI: 1.19–5.50; $p < 0.016$) as compared with the rest of the world and for students overestimating the risk of HIV acquisition through homosexual contacts (OR per 1% increase in risk estimation 1.03, 95% *:* 1.00–1.06; $p = 0.026$). The odds were lower for students providing higher risk of mother-to-child HIV transmission (OR per 1% increase in risk estimation – 0.97, 95% CI: 0.96–0.98; $p < 0.001$) (Table III).

International students included in our study tended to represent a condition-focused HIV testing approach, underscoring the importance of behaviour-related indications, as well as the asymptomatic character of HIV infection. This observation is especially relevant for students originating from Europe.

Discussion

Our study revealed that fifth year medical students entering the infectious diseases teaching module present fair knowledge on HIV disease, but poor knowledge on the risk of HIV transmission and indications for HIV testing. To our best knowledge this is the first study to investigate students' knowledge in these areas simultaneously. A large proportion of students overestimated the risk for HIV transmission, both for mother-to-child and sexual contacts. Almost one third of students estimated mother-to-child transmission risk as more than 50% and half of the students estimated the risk associated with homosexual intercourse as over 10%. At the same time, one in ten students listed pregnancy and one in three listed sexual contact or STD as an indication for HIV testing.

Overestimation of transmission risks may also result in a higher rate of fear after occupational exposures and lead to increased side-effects of post-exposure prophylaxis [18].

Students mainly focused on condition-based indications and usually listed diseases or infections directly linked to immunodeficiency as eligible for HIV testing, neglecting conditions or diseases which may share the same mode of transmission, i.e. hepatitis or STD [14]. This is a worrying result taking into account the increasing incidence of HIV among MSM and that behavioural factors need to be considered when offering HIV testing [19–21].

The above discrepancies and misunderstandings in basic relations between the nature of disease transmission and medical approach in HIV testing underline that more effort needs to be put into practical teaching in this field. However, only a few studies have focused on testing interventions in this area. A study performed at a London medical school investigated the influence of a HIV targeted-testing teaching session in improving

Table II. Baseline characteristics of students with correct and incorrect answers

Characteristic	Correct testing indications, *N* = 91	Incorrect testing indications, *N* = 133	*P*-value
Age, mean (SD)	24.3 (2.3)	23.9 (1.9)	0.33
Female gender, *n* (%)	60 (65.9)	83 (62.4)	0.67
Region, *n* (%):			0.04
North America	8 (8.8)	3 (2.3)	
North Africa	5 (5.5)	9 (6.8)	
Asia	27 (29.7)	28 (21.0)	
Europe	51 (56.0)	93 (69.9)	
Income, *n* (%):			0.20
High	62 (68.1)	101 (75.9)	
Middle	29 (31.9)	32 (24.1)	
Specialty, *n* (%):			0.71
Surgical	20 (22.0)	30 (22.6)	
General medicine related	32 (35.2)	54 (40.6)	
Obstetrics and paediatrics	25 (27.5)	28 (21.0)	
Unknown	14 (15.4)	21 (15.8)	
Medical practice:			
What is the difference between HIV and AIDS? *n* (%):			0.13
Incorrect	4 (4.4)	5 (3.8)	
Partially correct	3 (3.3)	14 (10.5)	
Correct	84 (92.3)	114 (85.7)	
Name three most common HIV-related diseases or conditions, *n* (%):			0.76
Incorrect	8 (8.8)	12 (9.0)	
Partially correct	28 (30.8)	35 (26.3)	
Correct	55 (60.4)	86 (64.7)	
Can HIV infection be asymptomatic? *n* (%):			0.013
Incorrect	0 (0.0)	11 (8.3)	
Partially correct	4 (4.4)	9 (6.7)	
Correct	87 (95.6)	113 (85.0)	
Risk of HIV transmission:			
Which body fluids can be contagious? *n* (%):			0.97
Incorrect	3 (3.3)	4 (3.0)	
Partially correct	40 (44.0)	57 (42.9)	
Correct	48 (52.7)	72 (54.1)	
What is the risk of mother-to-child (MTC) HIV transmission in %? *n* (%):			0.52
Incorrect	61 (67.0)	98 (73.7)	
Correct	30 (33.0)	35 (26.3)	
What is the risk of HIV transmission per one unprotected sexual contact in %? (separately for heterosexual and MSM contact), *n* (%):			0.89
Incorrect	47 (51.6)	66 (49.6)	
Partially correct	22 (24.2)	36 (27.1)	
Correct	22 (24.2)	31 (23.3)	
Indications for testing:			
What are the indications for HIV testing? *n* (%):			
Incorrect	0 (0)	12 (9.0)	< 0.0001
Partially correct	0 (0)	121 (91.0)	
Correct	91 (100)	0 (0)	

Table II. Cont.

Characteristic	Correct testing indications, *N* = 91	Incorrect testing indications, *N* = 133	*P*-value
Qualitative information provided in the answer to the above question, *n* (%):			
Testing in pregnancy	26 (28.6)	1 (0.7)	< 0.0001
Testing in STDs	83 (91.2)	5 (3.8)	< 0.0001
Discordant response for mother-to-child transmission	16 (17.6)	46 (34.6)	0.006
Discordant response for STDs	2 (2.2)	43 (32.3)	< 0.0001
Qualitative information provided in the answer to questions on the transmission risk:			
Estimated risk of mother-to-child transmission, median (IQR)	30 (20–50)	35 (30–60)	0.003
Estimated risk of MSM transmission, median (IQR)	20 (3–60)	10 (1–40)	0.11
Estimated risk of heterosexual transmission, median (IQR)	5 (0.9–60)	2 (0.4–30)	0.24
Final score, mean (SD)	14.3 (1.8)	12.9 (2.3)	< 0.0001

knowledge and confidence in offering HIV tests [22]. Comparably to our study, this applied to fifth year medical students. After targeted-testing teaching over 90% of students felt more confident about when to test and how to discuss testing and more knowledgeable about this topic.

A randomised controlled trial from Malaysia investigated the impact of peer-adult-led intervention on improvement of knowledge, attitudes and behaviour of university students [23]. Although a substantial improvement in knowledge on HIV/AIDS was noted, the intervention did not greatly influence the attitudes and behaviours of the students.

One third of our students originated from North Africa and Asia, mostly from Arabic yet modern and non-conservative Islamic countries of this regions. Taking into account differences in the back-

Table III. Unadjusted and adjusted odds ratios for providing incorrect indications for HIV testing by medical students

Parameter	Univariate			Multivariate*		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Age per 1 year older	1.08	0.97–1.22	0.26	0.96	0.41–2.25	0.93
Gender	0.86	0.49–1.50	0.59	1.08	0.93–1.26	0.32
Region:						
Rest of the world	1.00	–	–	1.00	–	–
Europe	1.82	1.05–3.18	0.034	2.56	1.19–5.50	0.016
Specialty:						
Unknown	1.00	–	–	1.00	–	–
Internal medicine	0.89	0.40–1.99	0.77	0.83	0.22–3.18	0.79
Obstetrics	1.80	0.61–5.29	0.28	1.27	0.45–3.61	0.65
Paediatrics	1.08	0.40–2.89	0.87	0.96	0.37–2.49	0.94
Surgical	1.00	0.41–2.11	1.00	2.24	0.80–6.31	0.12
Risk of transmission in %:						
Mother-to-child per 1% increase	0.99	0.98–1.00	0.018	0.97	0.95–0.98	< 0.001
Homosexual per 1% increase	1.01	1.00–1.02	0.012	1.03	1.00–1.06	0.026
Heterosexual per 1% increase	1.01	1.00–1.01	0.20	0.98	0.96–1.01	0.31

**Multivariate model adjusted for all above.*

ground education and cultural diversity, we were expecting to see more accurate understanding of HIV testing among students originating from Europe and North America [24]. It was therefore interesting to note that according to our study this knowledge was comparable across all counties. Studies investigating students' knowledge in HIV/AIDS are heterogeneous, yet show an increasing interest in education on HIV in the Arabic countries. Two studies performed in 2007 and 2009 in the United Arab Emirates among high school students revealed their lack of knowledge in the field of HIV transmission and intolerant attitude towards people living with HIV [25, 26]. Final year pharmacy students of University Sains Malaysia correctly identified major routes of HIV transmission and the inability to completely cure HIV, yet recommended HIV testing for health care professionals and patients presenting before surgical procedures [27]. Another Malaysian study found that 60% of responding hospital pharmacists had negative attitudes towards HIV-infected persons, but participants over 40 years of age and with job experience over 20 years presented a better understanding of HIV/AIDS [24].

A more recent Vietnamese study identified gaps in knowledge of HIV-related basic sciences, prevention and care [28]. In comparison, a European study of all pre-clinical medical students in Israel showed that students' attitudes toward HIV testing and providing confidential medical information were contradictory to health protocols and guidelines. However, the most worrying fact was only modest improvement in this field as students progressed through pre-clinical years of their education [29]. Similar findings were also presented by Tesic *et al.* for Croatian medical students [30].

All of the above suggests that general knowledge on recommendations for HIV testing is poor among both medical and non-medical university students, and interventions to improve it may bring diverse results. This underlines the need for structured and standardized teaching interventions in this field.

As revealed by our study, and in concordance with other authors' work, it was before the course of infectious diseases when the students received their knowledge on HIV screening [29, 30]. Such an approach in teaching may translate into the observed underuse of HIV testing among non-infectious disease specialties, especially obstetrics and oncology [10, 13].

There are some limitations to our work worth noting. Firstly the questionnaire used in our study was not fully validated; therefore differences observed between the regions might reflect different understanding of the survey questions or willingness to answer them. However, students were living in Poland for at least 4 years, sharing the same settings and teaching environment. Moreover, an expert in the field confirmed that the questions effectively capture the topic under our investigation, as well as verifying the evaluation and scoring system. Finally, our study sample might not represent well the population of international students due to differences in student recruitment between universities.

Although regional differences in the HIV epidemic remain in Europe, a unified strategy in HIV testing is necessary to build a one-front approach towards halting the epidemic [31]. So far, many national and international testing guidelines have been published and many strategies have been discussed [5, 6, 32, 33]. However, there are no regulations or guidance on how to prepare future medical professionals for HIV testing, or how to teach HIV testing at the medical universities. It seems that medical students gain their knowledge on HIV transmission and attitudes towards people living with HIV/AIDS from the same source as the general population rather than through systematized education. This may result in incorrect understanding of HIV transmission and incorrect HIV testing. Along with other studies, our work indicates that more action is necessary for raising awareness of the need to include HIV testing teaching in medical schools' curricula. Cross-European evaluation of students' knowledge on HIV testing followed by studies evaluating different interventions is crucial for aligned teaching in this field.

Conflict of interest

The authors declare no conflict of interest.

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