


RESEARCH ARTICLE

Preparedness, attitudes, and risk perceptions of future pharmacists regarding HIV/AIDS: A cross-sectional study from Pakistan

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Abstract

Background: The World Health Organisation (WHO) aims to end the HIV epidemic by 2030, sparking ongoing debates about pharmacists' increased involvement in providing care to HIV-affected individuals. This study was conducted to assess the knowledge, attitudes, and risk perceptions related to HIV/AIDS among final-year pharmacy students to determine whether they are adequately trained to elevate HIV prevention and management to the next level. **Methods:** This descriptive cross-sectional study was conducted in 2023 among 309 pharmacy students at different private universities in Pakistan located in Islamabad and Rawalpindi using a structured questionnaire. Data analysis was done using SPSS v.23. **Results:** More than half of the sample had poor knowledge related to HIV. Only 26.2% of the students knew about diagnosing AIDS. Regarding attitudes, less than 20% of participants strongly agreed that a Pharm.D. student can counsel an HIV/AIDS patient, while 25% were hesitant to do volunteer work with HIV patients. Only around 50% of the participants agreed that HIV transmission could be prevented by using safety measures. **Conclusion:** This study found that future pharmacists are not prepared, as the majority had poor knowledge of HIV/AIDS, varying by sex and institution. Attitudes towards patient care differed, but risk perceptions were satisfactory. Involving community pharmacists can help prevent HIV transmission through proactive measures.

Introduction

Human immunodeficiency virus (HIV) targets and weakens the human immune system, leading to an advanced stage of illness called acquired immunodeficiency syndrome (AIDS). The deadly virus has claimed more than 40.4 million lives till now, and HIV-related deaths are expected to surge by a further 10% over the next five years (Hogan *et al.*, 2020). Hence, HIV and AIDS are considered a global threat (Pinto *et al.*, 2023). The HIV pandemic mainly affects young people between the ages of 15 and 24 years old, and such patients account for more than half of all new

infections globally (Blair *et al.*, 2021). According to the UNAIDS report of 2023, last year in the Asia and Pacific region, a quarter of the new cases were young adults between the ages of 15 and 24 (UNAIDS Global AIDS Update, 2023).

In Pakistan, the escalating HIV-related mortality and morbidity scenario is termed "a growing epidemic," and according to the national statistics, 8262 cases were reported during the first ten months of 2022 (Samarasekera, 2022). The lack of awareness about the disease, coupled with growing societal stigma among the Pakistani population, is the primary obstacle to the implementation of control strategies and policies

(Khan, 2023). Inadequacy in awareness among the healthcare workforce was also highlighted in a study when 909 cases were reported across a span of three months in Larkana, Sindh (Syed et al., 2022).

As the effectiveness of treatment is no longer the primary constraint in reducing HIV viral load, public health initiatives must shift towards enhancing patient engagement via preventive services in less stigmatised settings, such as community pharmacies, rather than conventional testing locations like sexual health clinics. Patients with HIV demonstrated a strong receptiveness to counselling and point-of-care screening services offered by pharmacists in a community pharmacy setting (Dai & Wang, 2019; Kherghepoush & McKeirnan, 2021). The literature indicates that pharmacists can play a vital role in HIV management and transmission control by creating awareness through disease education or administering proper therapeutic regimens (McCree et al., 2020; Ahmed et al., 2021). Adequate disease knowledge is not only beneficial for prophylaxis; it can also assist in the promotion of positive attitudes, reduction of stigmatisation, as well as behaviour modification from incorrect and unsafe practices to correct and safe practices, thereby curbing its spread (Dai & Wang, 2019). Hence, the advantages of pharmacist-led HIV care encompass a decrease in drug-related issues, improvements in clinical outcomes, economic benefits, increased awareness, and identification of practice process challenges, resulting in improved disease prevention in the community (Eldooma et al., 2023).

Pharmacy students are future pharmacy practitioners, and the literature search indicated that knowledge, attitudes, and risk perceptions related to HIV and AIDS have been evaluated among pharmacy students only in countries like Malaysia, Korea, Saudi Arabia, and India, showing that improved knowledge leads to better attitudes and risk perceptions related to HIV and AIDS (Huh et al., 2014; Maheshwari & Sunny, 2016; Said et al., 2018; Alzahrani et al., 2023). In Pakistan, HIV/AIDS awareness has only been assessed among medical students (Rehan et al., 2016). By investigating the knowledge, attitudes, and risk perceptions of final-year pharmacy students regarding HIV/AIDS management, this study aims to assess the existing gap in understanding and potentially contribute to the planning of targeted, cost-effective educational interventions that can prevent HIV transmission and improve the overall quality of care provided to HIV-affected individuals in Pakistan.

Methods

Study design and setting

This study is part of a larger project exploring Pharm.D. students' preparedness, attitudes, and risk perceptions of various diseases in Pakistan (Amer et al., 2024). The research was conducted over a four-month period (February 2023 to May 2023) among final-year pharmacy students from six private universities in Islamabad/Rawalpindi, employing convenient sampling with a cross-sectional design. The STROBE checklist was adopted for the purpose of results reporting.

Inclusion and exclusion criteria

The study included only students from the final year of the Pharm.D. (Doctor of Pharmacy) programme. The rationale is that students in their final year are anticipated to engage with the community as healthcare service providers after earning their degree. Therefore, their knowledge, attitudes, and risk perceptions regarding HIV/AIDS will significantly influence society. Questionnaires with incomplete information were excluded from the study.

Sample size calculation

The data acquired from the Pakistan Pharmacy Council (PPC) indicates that 1350 final-year pharmacy students are enrolled in fully recognised pharmacy institutes of the twin cities (PCP, 2024). The representative sample was calculated using Yamane's formula, considering 0.05 as the degree of error (Louangrath, 2017). Yamane's formula: $n = N / (1 + N(e)^2)$

$$n = 1350 / (1 + 1350(0.05)^2) = 309$$

Stages of the study

The study was divided into three stages. In the first phase, the study instrument was developed and face-validated. In the second stage, the questionnaire was piloted among the proposed study population, while in the third phase, data collection was initiated after obtaining ethical approval from the pharmacy institutes.

Study instrument development and face validation

Data were collected using a structured questionnaire developed after the literature review. Similar studies related to HIV/AIDS, conducted in different parts of the world, served as reference literature for constructing the questionnaire (Maheshwari & Sunny, 2016; Rehan et al., 2016; Shah et al., 2020; Thingore et al., 2020; Sianturi et al., 2022; Alzahrani et al., 2023). The questionnaire was face-validated by two pharmacists and two public health specialists.

Pilot study

A pilot study was conducted among 30 final-year Pharm.D. students from different pharmacy institutes in Rawalpindi/Islamabad and the recommended changes were incorporated. Cronbach's alpha values of 0.75, 0.72, and 0.78 were attained for the three domains, respectively. These 30 students were not considered part of the sample size during the final analysis.

Data collection

Permission for data collection was obtained from all six pharmacy institutes. The authors coded the names of the pharmacy institutes with their first alphabet, i.e., A, H, M, S, L, and R. Students were invited to participate in the survey on the spot during their break time, and the questionnaire was collected after 20 minutes. Data collection was limited to private-sector institutes due to the research team's inability to obtain permission from public-sector pharmacy institutes within the designated time frame.

Data collection tool

The questionnaire consisted of four sections. The first part covered participants' demographic characteristics. The second section was related to the knowledge of HIV/AIDS; it consisted of 15 items that assessed the modes of transmission, prophylaxis, treatment, and unsafe practices, with three possible answers to the questions: yes, no, and don't know. The third part assessed attitudes with five items related to recognising drug abuse as a risk factor, teaching paediatric HIV patients in isolation, recognising AIDS patients by their appearance, the ability of a pharmacy student to counsel an AIDS patient, and volunteering with HIV patients. The fourth section consisted of five items and evaluated risk perceptions through the harm caused by HIV to the immune system, the prevention of HIV transmission, the availability of HIV vaccines, the screening period, and the isolation of AIDS patients.

Scoring

The total knowledge score was calculated for each student, with a maximum possible score of 15, assigning 1 point for each correct answer (Doan et al., 2022). Knowledge scores were categorised based on Bloom's knowledge criteria as follows: Good ($\geq 80\%$), Moderate (60%–79%), and Poor (<60%) (Alzahrani et al., 2022). The attitude and perception sections utilised a Likert scale featuring the options of strongly agree, agree, neutral, disagree, and strongly disagree to gather responses for both components, with values ranging from 5 to 1, respectively.

Statistical analysis

Data entry and analysis were carried out using SPSS version 23. Means and standard deviations were calculated for age, while frequencies were calculated for qualitative variables. Data were presented in tables. The chi-square test was applied to assess differences in knowledge, attitudes, and risk perceptions related to HIV/AIDS among students across sexes and institutions. A p -value < 0.05 was considered significant.

Results

Sociodemographic characteristics

The study included 309 final-year pharmacy students from six different universities in Rawalpindi and Islamabad.

A total of 400 students were approached, and 309 students agreed to participate in the study, yielding a participation rate of 77.3%. The majority of participants were female (61.2%). The mean age of the students was 23 ± 1 years. More than 70% were non-hostellers, and 262 students out lived in urban areas. Participation rates from A, H, M, S, L and R universities were 40%, 85%, 45%, 65%, 60%, and 47%, respectively. The maximum data were collected from the University L. Table I presents students' sociodemographic profiles.

Table I: Participants' sociodemographic profiles

Variables	N	(%)	Mean \pm SD	Range
Age (years)	-	-	23.0 \pm 1.0	20-26
Sex				
Male	120	(38.8)		
Female	189	61.2)		
Residence				
Non-hosteller	219	(70.9)		
Hosteller	90	(29.1)		
Location				
Rural	47	(15.2)		
Urban	262	(84.8)		
Institution				
A	43	(13.9)		
H	72	(23.3)		
M	42	(13.6)		
S	41	(13.3)		
L	75	(24.3)		
R	36	(11.7)		

Knowledge regarding HIV/AIDS

Knowledge score categorisation showed that 51.2% of pharmacy students had poor knowledge of HIV/AIDS,

with merely 7.4% demonstrating good knowledge. Only 26.2% of the students knew about diagnosing AIDS. The majority of students (94.2%) identified unprotected sexual contact, unscreened blood, occupational

exposures, and intravenous drug use as the main ways for HIV transmission while only 14.2% could identify the time it takes for HIV infection to progress to AIDS (Table II).

Table II: Knowledge of HIV/AIDS

No	Questions	Yes n%	No n%	Don't know n%	Correct answers %	Sex p-value* (%correct answers)	Institutions p-value* (%correct answers)
1	Unprotected sexual contact, un-screened blood, occupational exposures, and intravenous drug use are the main ways through which HIV is spread.	291 (94.2)	13 (4.2)	5 (1.6)	94.2%	0.32 (M=92.5, F=95.2)	0.33 (A=100, H=95.8, M=92.8, S=95.1, L=92, R=88.9)
2	Does the Body fluids of HIV infected person transmit HIV to another person	246 (76.6)	43 (13.9)	20 (6.5)	76.6%	0.01 (M=71.6, F=84.1)	0.03 (A=83.7, H=77.7, M=83.3, S=80.5, L=85.3, R=58.3)
3	Post-exposure prophylaxis of HIV starts in 72 hours	103 (33.3)	31 (10)	175 (56.6)	33.3%	0.88 (M=32.5, F=33.3)	0.00 (A=25.6, H=22.2, M=28.6, S=43.9, L=26.7, R=69.4)
4	Does chronic intestinal cryptosporidium in AIDS lasts more than one month	94 (30.4)	34 (11)	181 (58.6)	30.4%	0.98 (M=30.8, F=30.7)	0.01 (A=23.3, H=27.8, M=30.9, S=31.7, L=24, R=58.3)
5	People with severe immuno-compromised states like HIV are at increased risk of severe monkeypox or even death	238 (77)	31 (10)	40 (13)	77%	0.03 (M=70, F=81)	0.00 (A=81.4, H=79.2, M=76.2, S=87.8, L=82.7, R=41.7)
6	Is it possible that an HIV-positive mother gives birth to AIDS-infected children?	205 (66.3)	58 (18.8)	46 (14.9)	66.3%	0.01 (M=57.5, F=72)	0.01 (A=65.1, H=65.3, M=71.4, S=75.6, L=73.3, R=38.9)
7	Can HIV infection lead to AIDS in less than a year?	203 (65.7)	44 (14.2)	62 (20.1)	14.2%	0.13 (M=18.3, F=12.1)	0.10 (A=23.3, H=9.7, M=7.14, S=12.2, L=14.7, R=25)
8	To be diagnosed with HIV/AIDS, an infected person must have 200 cells/mm ³	81 (26.2)	24 (7.8)	204 (66)	26.2%	0.04 (M=20, F=30.2)	0.00 (A=20.9, H=13.9, M=14.3, S=41.5, L=32, R=41.7)
9	CD4+ cell count is used as a marker of how susceptible a person living with HIV is to opportunistic infections	193 (62.5)	36 (11.7)	80 (25.9)	62.5%	0.01 (M=52.5, F=68.8)	0.00 (A=67.4, H=65.3, M=40.5, S=70.7, L=73.3, R=44.4)
10	Can antiviral agents (Acyclovir, Ribavirin, and Amantadine) be used to treat HIV/AIDS?	204 (66)	58 (18.8)	47 (15.2)	66%	0.08 (M=60, F=69.8)	0.00 (A=60.5, H=58.3, M=73.8, S=82.9, L=76, R=38.9)
11	Is post-prophylaxis of HIV using antiretroviral recommended?	154 (49.8)	51 (16.5)	104 (33.7)	49.8%	0.96 (M=50, F=49.7)	0.37 (A=41.9, H=25, M=42.8, S=60.9, L=54.7, R=52.8)
12	Nonnucleosides/ Nucleosides Reverse Transcriptase and Protease inhibitors are the most widely available classes of HIV medications	166 (53.7)	25 (8.1)	118 (38.2)	53.7%	0.29 (M=50, F=56.1)	0.00 (A=81.4, H=38.9, M=30.9, S=68.3, L=58.7,

No	Questions	Yes n%	No n%	Don't know n%	Correct answers %	Sex <i>p</i> -value* (%correct answers)	Institutions <i>p</i> -value* (%correct answers)
							R=50
13	A person will not get HIV if he/she takes antibiotics	40 (12.9)	218 (70.6)	51 (16.5)	70.6%	0.35 (M=67.5, F=72.5)	0.00 (A=90.7, H=70.8, M=66.7, S=75.6, L=77.3, R=30.6)
14	Can HIV be cured if detected early?	138 (44.7)	124 (40.1)	47 (15.2)	40.1%	0.01 (M=30, F=46.6)	0.00 (A=18.6, H=36.1, M=59.5, S=41.5, L=50.7, R=27.8)
15	HIV infection progresses to AIDS without therapy after ten years	165 (53.4)	56 (18.1)	88 (28.5)	53.4%	0.15 (M=48.3, F=56.6)	0.01 (A=55.8, H=36.1, M=54.8, S=60.9, L=66.7, R=47.2)

*chi-square test

The assessment of knowledge by sex showed that female pharmacy students had better knowledge of HIV transmission through body fluids ($p = 0.01$), the risk for monkeypox or death in immunocompromised patients ($p = 0.03$), HIV vertical transmission ($p = 0.01$), diagnostic criteria ($p = 0.04$), and CD4+ cell count being a marker for opportunistic infections in HIV patients ($p = 0.01$). Female participants also recognised better than male students that early detection of HIV has no advantage in treating AIDS ($p = 0.01$). Students of both sexes responded correctly to questions regarding the source of HIV transmission ($p = 0.32$), the time required for HIV infection to progress to AIDS ($p = 0.10$), and HIV

prophylaxis ($p = 0.96$). Knowledge categorisation by sexes showed that over 60% of male students had poor knowledge, with only three out of 120 males demonstrating good knowledge of HIV/AIDS. In the case of female students, only 20 participants out of 189 had good knowledge, while 44.4% of female students had poor knowledge. Institutional analysis showed that no pharmacy student from University A had good knowledge about HIV/AIDS. Students from most other institutions also displayed poor knowledge, except for those from University S and University L, where 48% and 58.7% of students, respectively, had moderate knowledge (Table III).

Table III: Categorisation of knowledge scores across sexes and institutions

Variables	Knowledge categories			<i>p</i> -value*
	Good	Moderate	Poor	
Sex				
Male	3 (2.5)	43 (35.8)	74 (61.7)	0.00
Female	20 (10.6)	85 (45.0)	84 (44.4)	
Institutions				
A	0 (0.0)	22 (51.2)	21 (48.8)	0.00
H	4 (5.6)	23 (31.9)	45 (62.5)	
M	2 (4.8)	10 (23.8)	30 (71.4)	
S	9 (22.0)	20 (48.8)	12 (29.3)	
L	7 (9.3)	44 (58.7)	24 (32.0)	
R	1 (2.8)	9 (25.0)	26 (72.2)	
Total	23 (7.4)	128 (41.4)	158 (51.1)	

*chi-square test

Attitudes regarding HIV/AIDS

In the assessment of attitude, over 40% of students strongly agreed that drug abuse is a risk factor for HIV/AIDS. More than 25% strongly agreed that

paediatric HIV patients should be educated in separate schools, while around 15% agreed that an AIDS patient can be assessed by appearance. Fewer than 20% of participants agreed that pharmacy students could

counsel HIV/AIDS patients, and 25% remained neutral about volunteering to work with HIV patients. When attitudes were compared across sexes, no significant differences were observed in most attitude-related questions, except for the question regarding counselling HIV/AIDS patients, where male students were more confident in their ability to counsel such

HIV/AIDS patients ($p = 0.03$). Institutional comparisons revealed significant differences in attitudes among students from different universities on most beliefs related to HIV/AIDS. However, the question about educating paediatric patients in separate classes showed no significant variation ($p = 0.14$) (Table IV).

Table IV: Students' attitudes regarding HIV/AIDS

No	Questions	Strongly agree n %	Agree n %	Neutral n %	Disagree n %	Strongly disagree n %	Sex p -value*	Institute p -value*
1	Drug abuse increases the hazard of contracting HIV/AIDS	125 (40.5)	111 (35.9)	36 (11.7)	24 (7.8)	13 (4.2)	0.33	0.00
2	Children infected with HIV should be educated in separate schools	82 (26.5)	126 (40.8)	53 (17.2)	35 (11.3)	13 (4.2)	0.22	0.14
3	Can a person infected with AIDS be assessed by appearance?	48 (15.5)	105 (34.0)	69 (22.3)	58 (18.8)	29 (9.4)	0.16	0.00
4	Pharm D students are enabled enough to counsel HIV/AIDS patients	59 (19.1)	100 (32.4)	92 (29.8)	31 (10.0)	27 (8.7)	0.03	0.00
5	I am willing to do volunteer work with HIV/AIDS patients	66 (21.4)	104 (33.7)	77 (24.9)	39 (12.6)	23 (7.4)	0.70	0.00

*chi-square test

Risk perceptions of HIV/AIDS

Participants' risk perceptions were optimal, as the majority strongly agreed and agreed with HIV/AIDS-associated risks. Over 60% of students strongly agreed that HIV harms the immune system, more than 50% strongly agreed that HIV transmission can be prevented by using safety methods, less than 25% strongly agreed that vaccines' availability can mitigate HIV transmission in adults, more than half strongly agreed that people in

close contact should get tested for HIV periodically, and around 40% strongly agree that AIDS patients should always be isolated. Risk perceptions across sexes revealed no significant differences. Institutional analysis of risk perceptions showed significant differences among students of the six institutions in questions related to HIV harming the immune system ($p = 0.00$), reduced transmission of HIV by using safety methods, and vaccines' ability to stop HIV transmission in adults ($p = 0.01$) (Table V).

Table V: Students' risk perceptions of HIV/AIDS

No	Questions	Strongly agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly disagree n (%)	Sex p -value*	Institute p -value*
1	The immune system is harmed by HIV	197 (63.8)	83 (26.9)	24 (7.8)	3 (1.0)	2 (0.6)	0.92	0.00
2	The risk of HIV transmission is decreased by the use of safety methods.	172 (55.7)	117 (37.9)	16 (5.2)	2 (0.6)	2 (0.6)	0.19	0.01
3	The availability of a vaccine that can stop adults from getting HIV	71 (23.0)	83 (26.9)	87 (28.2)	44 (14.2)	24 (7.8)	0.33	0.00
4	All those who are working in HIV care should test for HIV periodically	158 (51.1)	107 (34.6)	35 (11.3)	5 (1.6)	4(1.3)	0.55	0.68
5	AIDS patient has to be isolated from healthy human beings for safety measurements.	117 (37.9)	100 (32.4)	59 (19.1)	17 (5.5)	16 (5.2)	0.38	0.62

*chi-square test

Discussion

This study revealed that 51.2% of pharmacy students had poor knowledge of HIV/AIDS, with 10.6% of female participants having good knowledge compared to 2.5% of their male counterparts. Attitudes towards HIV showed mixed responses, while risk perceptions were up to the mark. A study in Indonesia found that poor knowledge of HIV among pharmacists and pharmacy students contributed to reduced empathy and inadequate practices when dealing with HIV patients (Sianturi *et al.*, 2022). A study at a Saudi university reported poor knowledge among pharmacy students, with over 40% lacking proper education on providing care to HIV-positive people, highlighting the need for educational interventions (Alzahrani *et al.*, 2023).

In the present study, 94% of the respondents knew about HIV transmission modes, which may be due to increased interest among the population in the disease over the past decade. A similar study in India also reported that more than 88% of pharmacy students were able to identify the appropriate modes of transmission (Thingore *et al.*, 2020). Female students demonstrated better knowledge of the majority of topics, including risk identification, virus transmission, and diagnostic criteria ($p < 0.05$). In contrast, an Indian study reported no significant differences in knowledge across both sexes in most HIV and AIDS topics (Thingore *et al.*, 2020).

Among the modes of transmission, it is crucial for pharmacists to recognise that high-risk sexual practices are a leading cause of HIV transmission. In this study, 16% of the students were unaware of the correct modes of transmission, an alarming finding, particularly given reports that people living with AIDS have an increased inclination towards sexual activities. Community pharmacy-based counselling has been shown to reduce such high-risk behaviours in AIDS patients (Starks *et al.*, 2020; Hanum *et al.*, 2024). Post-exposure prophylaxis is a critical preventive strategy for AIDS. In this study, 56.6% of the students were unaware of the time frame for initiating effective prophylaxis, and only half knew that antiretroviral drugs are used for this purpose. Pharmacists play a pivotal role in ensuring adherence to post-exposure prophylaxis, highlighting the importance of equipping them with adequate knowledge of HIV prophylaxis strategies (Adams & Klepser, 2024).

HIV leads to severe immune deficiency, making conditions such as intestinal cryptosporidiosis and monkeypox, which have limited treatment options, particularly challenging to manage. In this study, 58.6% of the pharmacy students were unaware of the prolonged illness in AIDS patients with intestinal

cryptosporidium, and more than 13% did not know that this immune-suppressed state increases susceptibility to other fatal infections. Additionally, around 26% of participants did not know that CD4+ cell count serves as a marker of immune suppression. As AIDS is now being managed as a chronic infection worldwide, it is essential for healthcare providers to have the knowledge required to effectively manage infections associated with this condition (American Society of Health-System Pharmacists, 2015).

It is concerning that, even in their final year, only 26.2% of pharmacy students were knowledgeable about diagnosing AIDS. This knowledge varied across sexes and institutions, with female students being more aware of diagnostic criteria. As patient care is entering the era of a "patient-centred medical home model," it is crucial for pharmacists to possess adequate knowledge of diagnostics and evolving AIDS management practices as members of multidisciplinary teams (American Society of Health-System Pharmacists, 2015). In lower-middle-income countries, the incidence of AIDS has been reported to be higher among females than males (Cohn *et al.*, 2020). In a country with cultural barriers, such as Pakistan, as reported in this study, female pharmacists having a better knowledge of HIV is an asset, as female patients want to be attended by female healthcare workers (Habib *et al.*, 2021).

Only 20% of pharmacy students in this study agreed that they could counsel an HIV/AIDS, a reluctance that may partly stem from fear and societal stigmatisation. Similarly, a study in Southeast Asia reported that fewer than 25% of pharmacy students were willing to counsel patients due to the associated stigma (Sianturi *et al.*, 2022). The findings of the present study also revealed hesitation among students to consider volunteering with HIV patients, which may likewise be influenced by societal stigma. In contrast, a Saudi study reported that half of the pharmacy students were willing to take care of HIV patients (Alzahrani *et al.*, 2023).

The majority of students in this study strongly agreed that drug abuse is a risk factor for HIV/AIDS, which may be attributed to government-led educational campaigns through media. No significant differences in attitudes were observed between male and female students. Similar findings were reported in a study conducted at the University of Mumbai, where over 90% of pharmacy students identified needle reuse for drug administration as a risk factor for HIV. This study also noted no significant gender differences in attitudes towards HIV/AIDS patients (Thingore *et al.*, 2020). A large-scale Pakistani study across various educational institutions found that around 60% of students

recognised drug abuse as a contributor to HIV transmission (Shah *et al.*, 2020).

The present study found that over 40% of students held the misconception that paediatric HIV patients should be educated in separate schools, further exacerbating challenges for this already deprived population. Given their close contact with the community, pharmacists have a duty to foster a positive attitude among the general public towards AIDS patients. Addressing such misconceptions and discrimination within the healthcare workforce is essential, and efforts should focus on promoting the inclusion of HIV-affected children in common schools (Munteanu *et al.*, 2023).

More than 50% of students in this study strongly agreed that people in close contact with HIV-positive patients should undergo periodic testing for HIV. This finding was congruent with a Korean study where pharmacy students emphasised the importance of testing for people caring for HIV-positive patients (Huh *et al.*, 2014). Additionally, the present study found that around 40% of students strongly agree that AIDS patients should be isolated, echoing the findings of a Malaysian study where students also supported the need for quarantine (Elkalmi *et al.*, 2015). In Sudan, a significant portion of healthcare professionals (66.7%) had an ambiguous understanding of their risk for HIV infection, with merely 5.4% recognising a high level of risk. This perceived risk was inversely related to knowledge about HIV transmission, suggesting that those with a better understanding of transmission were less likely to feel at risk (Bushara & Adetunji, 2021).

Another finding was that less than a quarter of the participants in this study agreed that a vaccine against HIV exists to prevent its transmission among adults. In contrast, around 90% of medical students in a Saudi university held this belief (Alawad *et al.*, 2019). According to the National Institutes of Health (NIH), an HIV vaccine, once developed, will be administered to people who do not have HIV to protect them from HIV infection if exposed to the virus (AIDSinfo, 2019).

Educational institutions have the potential to become focal points for outbreaks, primarily due to the presence of young, sexually active individuals engaged in close social interactions. Also, some students believe that drug abuse does not increase their susceptibility to HIV (Alawad *et al.*, 2019; Shah *et al.*, 2020).

This study depicts variations in students' attitudes and risk perceptions related to AIDS/HIV, alongside poor knowledge of the disease. These variations can be attributed to several factors. Risk perceptions are often shaped by the belief that Pakistanis are not vulnerable to diseases transmitted through non-normative sexual practices, owing to adherence to religious principles. However, this perception overlooks other modes of

transmission (Kamran Khan, 2022). The mixed attitudes among students are due to the stigma associated with HIV/AIDS, which is often viewed as divine punishment for sinful sexual practices (Alomair *et al.*, 2023). This stigma extends beyond healthcare workers to the general public, who are often reluctant to care for individuals infected with HIV. In many cases, people living with AIDS are unjustly seen as adulterers or prostitutes in the eyes of society (Shahzadi *et al.*, 2023). The resulting fear and shame contribute to negative attitudes even among healthcare workers (Ullah & Arab, 2021). Given these misconceptions, there is an urgent need for targeted educational interventions to implement effective HIV control strategies in societies like Pakistan.

Final-year pharmacy students are considered future healthcare providers (Syed *et al.*, 2023). The literature shows that clinical pharmacists with good knowledge of HIV pharmacotherapy are invaluable resources and crucial members of HIV multidisciplinary care teams, given the ever-intricate range of HIV treatment options (Achi & Ogbonna, 2021). Studies have demonstrated that HIV-positive patients managed by clinical pharmacists exhibit considerable improvements in their CD4+ counts and viral loads, alongside a reduction in medication-related side effects. Moreover, pharmaceutical care provided to HIV/AIDS patients has been shown to reduce the economic burden on healthcare systems (Ahmed *et al.*, 2021).

Achieving the global goal of ending the HIV epidemic requires reducing both the incidence of new cases and HIV-related mortality (Assefa & Gilks, 2020). Pharmacists, as accessible healthcare providers within communities, are well-positioned to contribute to this effort. Their role includes counselling patients on preventive measures to reduce transmission risk, such as adopting safer sexual practices, using pre- or post-exposure prophylaxis, and promoting harm reduction strategies among intravenous drug users (International Pharmaceutical Federation, 2022). Given the need to address HIV/AIDS, policymakers should focus on enhancing pharmacists' roles in managing such diseases in Pakistan. They should also promote educational interventions for pharmacists and pharmacy students. At the undergraduate level, introducing an HIV-specific educational module into the national curriculum could address gaps in HIV-related content, as such a programme demonstrated its effectiveness in improving pharmacy students' awareness in South Africa (Crutchley *et al.*, 2023). For community pharmacists, continuing professional development (CPD) activities and certifications focusing on HIV management should be implemented. These programmes can help eliminate misconceptions, improve counselling skills, and build confidence in

managing HIV/AIDS (Karabatsos et al., 2024). Finally, promoting collaboration between patients, healthcare professionals, HIV-focused pharmacies, and support groups is essential.

Strengths and limitations

This study highlighted knowledge, attitudes, and risk perceptions related to HIV/AIDS among pharmacy students, making the first such investigation in Pakistan. This research involved multiple academic institutions rather than a single center and included a pilot study to validate the study instrument. However, the use of a non-random sampling technique limits the generalisability of the findings.

Conclusion

This study revealed that future pharmacists were largely unprepared, with most students demonstrating poor knowledge about HIV/AIDS. Significant differences in knowledge were found across sexes and institutions. Students had mixed attitudes towards caring for HIV/AIDS patients, while their risk perceptions regarding HIV/AIDS were deemed satisfactory.

Educational interventions should be designed to enhance awareness of HIV/AIDS, focusing on transmission, prevention strategies, and the importance of early detection. Partnerships with local HIV/AIDS organisations should be fostered to provide students with opportunities for community engagement by volunteering with support groups to gain deeper insights into the lived experiences of those affected by HIV/AIDS.

Ethics approval and informed consent

Ethical clearance for this study was granted by the Ethical Committee of Abasyn University (Islamabad Campus), vide letter no. AUIC/PD/02/23/EA01. The universities where the research was conducted also granted ethical clearance for data collection. Students provided written informed consent to participate. They were informed about their right to drop out of the study at any time. The ethics outlined in the Declaration of Helsinki, as revised in 2013, were followed during the course of the study, and respondent data were treated confidentially and anonymously.

Conflict of interest

The authors declare no conflict of interest.

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References

- Achi, C., & Ogbonna, O. B. (2021). Physician–Pharmacist collaboration in healthcare services in Nigeria from 1980–2020: a narrative review. *Journal of Current Biomedical Research*, *1*(3), 80–92. <https://journals.unizik.edu.ng/jcbr/article/view/849>
- Adams, A. J., & Klepser, M. E. (2024). Pharmacist prescribing models for HIV pre-exposure and post-exposure prophylaxis. *Annals of Pharmacotherapy*, *58*(4), 434–440. SAGE Publications. <https://doi.org/10.1177/10600280231187171>
- Ahmed, A., Dujaili, J. A., Hashmi, F. K., Awaisu, A., Chaiyakunapruk, N., & Hasan, S. S. (2021). The economic impact of pharmacist care for people living with HIV/AIDS: A systematic review. *Exploratory Research in Clinical and Social Pharmacy*, *3*, 100066. <https://doi.org/10.1016/j.rcsop.2021.100066>
- AIDSinfo. (2019). *What is a preventive HIV vaccine?* Understanding HIV. <https://hivinfo.nih.gov/understanding-hiv/fact-sheets/what-preventive-hiv-vaccine>
- Alawad M, Alturki A, Aldoghayyim A, Alrobaee A, & Alsoghair M. (2019). Knowledge, attitudes, and beliefs about HIV/AIDS and people living with HIV among medical students at Qassim University in Saudi Arabia. *International Journal of Health Sciences*, *13*(5), 22–30. <http://www.ncbi.nlm.nih.gov/pmc/articles/pmc6728128/>
- Alomair, N., Alageel, S., Davies, N., & Bailey, J. V. (2023). Muslim women’s knowledge, views, and attitudes towards sexually transmitted infections in Saudi Arabia: A qualitative study. *PLOS ONE*, *18*(6), e0286822. <https://doi.org/10.1371/JOURNAL.PONE.0286822>
- Alzahrani, F., Almohammadi, A., Alhejaili, M., Almkhli, S., Alou, E., Alhudhayban, A., & Khan, A. (2023). An evaluation of pharmacy students’ knowledge, attitudes and risk perceptions about HIV/AIDS. *Research Square*, 1–10. <https://doi.org/10.21203/rs.3.rs-3007080/v1>
- Alzahrani, M. M., Alghamdi, A. A., Alghamdi, S. A., & Alotaibi, R. K. (2022). Knowledge and attitude of dentists towards obstructive sleep apnea. *International Dental Journal*, *72*(3), 315–321. <https://doi.org/10.1016/J.IDENTJ.2021.05.004>
- Amer, M., Akhlaq, M., Ahmed, S., Idrees, N., Niazi, I., Muhammad, M. M., Ashraf, F., & Ahmed, A. (2024). A cross-sectional study to assess knowledge, attitudes, and risk perceptions of doctor of pharmacy students regarding

asthma. *Pharmacy Education*, **24**(1), 458–467.
<https://doi.org/10.46542/pe.2024.241.458467>

Assefa, Y., & Gilks, C. F. (2020). Ending the epidemic of HIV/AIDS by 2030: Will there be an endgame to HIV, or an endemic HIV requiring an integrated health systems response in many countries? *International Journal of Infectious Diseases*, **100**, 273–277.
<https://doi.org/10.1016/j.ijid.2020.09.011>

Blair, K. J., Segura, E. R., Garner, A., Lai, J., Ritterbusch, A., Leon-Giraldo, S., Guilamo-Ramos, V., Lake, J. E., Clark, J., & Holloway, I. W. (2021). PrEP awareness, use, intention to use, and information source among geosocial networking application users in Mexico in 2018–2019. *AIDS and Behavior*, **25**(9), 2743–2754.
<https://doi.org/10.1007/s10461-021-03184-1>

Bushara, M., & Adetunji, H. (2021). Prevalence of fear of perceived risks of acquiring HIV infections among health care providers towards people living with HIV and AIDS in River Nile State. *Journal of Umm Al-Qura University for Medical Sciences*, **7**(1), 10–13.
<https://doi.org/10.54940/ms24263562>

Cohn, J., Ake, J., Moorhouse, M., & Godfrey, C. (2020). Sex differences in the treatment of HIV. *Current HIV/AIDS Reports*, **17**(4), 373–384. <https://doi.org/10.1007/S11904-020-00499-X>

Crutchley, R. D., Newsome, C., Chen, L. W., Li, D., Sarangam, P., Min, A., Bowers, D., Coetzee, R., & McKeirnan, K. C. (2023). Design, implementation, and assessment approaches within an advanced Human Immunodeficiency Virus (HIV) elective course. *Journal of Pharmacy Practice*, **36**(5), 1284–1293.
<https://doi.org/10.1177/08971900221108723>

Dai, X., & Wang, H. (2019). Change in knowledge and attitude about HIV/AIDS in sub-Saharan Africa, 1990–2017: An analysis of national survey data. *The Lancet Global Health*, **7**, S4. [https://doi.org/10.1016/S2214-109X\(19\)30089-0](https://doi.org/10.1016/S2214-109X(19)30089-0)

Doan, D. A., Ho, H. H., Tran, L. D., Nguyen, P. L., Le, A. T. L., & Dinh, D. X. (2022). Knowledge, attitudes, and practices of university students regarding COVID-19: A cross-sectional study in Vietnam. *BMC Public Health*, **22**(1), 1–10.
<https://doi.org/10.1186/S12889-022-14442-9/TABLES/5>

Eldooma, I., Maatoug, M., & Yousif, M. (2023). Outcomes of pharmacist-led pharmaceutical care interventions within community pharmacies: Narrative review. *Integrated Pharmacy Research and Practice*, **12**, 113–126.
<https://doi.org/10.2147/ijrp.s408340>

Elkalmi, R. M., Al-Shami, A. K., Alkoudmani, R. M., Al-Syed, T., Qutaiba, O., Al-Lela, B., & Patel, I. (2015). Knowledge, attitudes and risk perceptions towards Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome (HIV/AIDS) among health sciences students in a public university, Malaysia. *Journal of Pharmacy Practice and Community Medicine*, **1**(1), 24–29.
<https://www.doi.org/10.5530/jppcm.2015.1.6>

Habib, S. S., Jamal, W. Z., Zaidi, S. M. A., Siddiqui, J. U. R., Khan, H. M., Creswell, J., Batra, S., & Versfeld, A. (2021). Barriers to access of healthcare services for rural women—Applying gender lens on TB in a rural District of Sindh,

Pakistan. *International Journal of Environmental Research and Public Health*, **18**(19), 10102.
<https://doi.org/10.3390/IJERPH181910102>

Hanum, N., Cambiano, V., Loncar, D., Mandalia, S., Sharp, A., Lwanga, J., Tiraboschi, J., Phillips, A. N., Lampe, F. C., Beck, E. J., & Fox, J. (2024). Behaviour changes following HIV diagnosis among men who have sex with men in the era of treatment as prevention: data from a prospective study. *AIDS Care*, **36**(6), 711–731.
<https://doi.org/10.1080/13548506.2023.2230884>

Hogan, A. B., Jewell, B. L., Sherrard-Smith, E., Vesga, J. F., Watson, O. J., Whittaker, C., Hamlet, A., Smith, J. A., Winskill, P., Verity, R., Baguelin, M., Lees, J. A., Whittles, L. K., Ainslie, K. E. C., Bhatt, S., Boonyasiri, A., Brazeau, N. F., Cattarino, L., Cooper, L. V., Coupland, H., ... Hallett, T. B. (2020). Potential impact of the COVID-19 pandemic on HIV, tuberculosis, and malaria in low-income and middle-income countries: a modelling study. *The Lancet Global Health*, **8**(9), e1132–e1141. [https://doi.org/10.1016/S2214-109X\(20\)30288-6](https://doi.org/10.1016/S2214-109X(20)30288-6)

Huh, W., Yang, Y.-M., Jeong, E., Lee, J., Kyung Je, N., Lee, J.-J., Sung Cil, L., & Joo Choi, E. (2014). Assessment of HIV/AIDS knowledge, attitudes, and risk perceptions among Korean pharmacy students. *Yakhak Hoeji*, **58**(5), 349–356.
<https://koreascience.kr/article/JAKO201435051109989.page>

International Pharmaceutical Federation. (2022). *HIV prevention, screening and management A handbook for pharmacists*. <https://www.fip.org/file/5342>

Kamran Khan, K. (2022). Assessing perception and knowledge regarding HIV and AIDS among high school, college and university students of South Punjab, Pakistan. *International Journal of Research Publications*, **99**(1), 209.
<https://doi.org/10.47119/ijrp100991420223104>

Karabatsos, V., Mantas, S., & Lord, L. (2024). Introduction and impact of a Human Immunodeficiency Virus education package on the knowledge and confidence of pharmacists. *Journal of Pharmacy Practice*, **37**(4), 814–821.
<https://doi.org/10.1177/08971900231182779>

Khan, A. M. (2023). The surge of HIV in Pakistan: An epidemic or a progressive transmission in denial? An editorial. *Annals of Medicine and Surgery*, **85**(2), 76–77.
<https://doi.org/10.1097/MS9.000000000000172>

Kherghehpoush, S., & McKeirnan, K. C. (2021). Pharmacist-led HIV and hepatitis C point-of-care testing and risk mitigation counseling in individuals experiencing homelessness. *Exploratory Research in Clinical and Social Pharmacy*, **1**(1), e100007.
<https://doi.org/10.1016/j.rcsop.2021.100007>

Louangrath, P. I. (2017). Minimum sample size method based on Survey Scales. *International Journal of Research & Methodology in Social Science*, **3**(3), 45.
<https://doi.org/10.5281/zenodo.1322593>

Maheshwari, P., & Sunny, M. (2016). A prospective study on the knowledge, attitude and perception on HIV/AIDS among the nursing and other healthcare professionals. *Research Journal of Pharmacy and Technology*, **9**(9), 1403–1406.
<https://doi.org/10.5958/0974-360X.2016.00271.7>

- McCree, D. H., Byrd, K. K., Johnston, M., Gaines, M., & Weidle, P. J. (2020). Roles for pharmacists in the "Ending the HIV epidemic: A plan for America" Initiative. *Public Health Reports*, **135**(5), 547–554. <https://doi.org/10.1177/0033354920941184>
- Munteanu, B.-E., Chendrean, S. T., & Sandu, M. L. (2023). Integration of children with HIV in mainstream education. Between perception and attitude. *The Black Sea Journal of Psychology*, **14**(3), 241–254. <https://doi.org/10.47577/bspsychology.bsjop.v14i3.259>
- PCP. (2024). *Pharmacy Council of Pakistan*. <https://pcpisb.gov.pk/>
- American Society of Health-System Pharmacists. (2015). *Guidelines on pharmacist involvement in HIV care background and purpose*. <https://www.ashp.org/-/media/assets/policy-guidelines/docs/guidelines/pharmacist-involvement-hiv-care.ashx>
- Pinto, J., Waine, I., Peristiowati, Y., Belo, O. da S., & Perreira, A. G. (2023). The risk factors causes incidence of HIV/AIDS for peoples living with HIV/AIDS (PLWHA): A systematic review. *American Journal of Arts and Human Science*, **2**(3), 29–35. <https://doi.org/10.54536/ajahs.v2i3.1893>
- Rehan, M., Waheed, U., Sarwar, M., Arshad, M., Shafique Satti, H., Abbas Zaheer, H., Bank, B., & Zulfiqar Ali, S. (2016). Knowledge, attitude, practices and awareness regarding HIV/AIDS among university students of Islamabad and Rawalpindi, Pakistan. *Annals of PIMS*, **12**(2), 86–89. https://www.apims.net/apims_old/Volumes/Vol12-2/KnowledgeAttitudePractices%20and%20Awareness%20regarding%20HIVAIDS%20among%20University%20Students.pdf
- Said, N., Ab Hamid, M. R., Tarmizi, L. A., & Azizan, N. A. (2018). HIV knowledge, attitude and perception among university students. *Environment-Behaviour Proceedings Journal*, **3**(7), 153–160. <https://doi.org/10.21834/e-bpj.v3i7.1273>
- Samarasekera, U. (2022). Pakistan's growing HIV epidemic. *Lancet*, **400**(10368), 2031. [https://doi.org/10.1016/S0140-6736\(22\)02530-2](https://doi.org/10.1016/S0140-6736(22)02530-2)
- Shah, R., Sabir, I., & Khan, S. A. (2020). Student's risk perception and attitude towards drug abuse in educational institutions of Pakistan. *Global Sociological Review*, **5**(4), 19–29. [https://doi.org/10.31703/gsr.2020\(v-iv\).03](https://doi.org/10.31703/gsr.2020(v-iv).03)
- Shahzadi, T. U., Nadim, I., Siddiq, M., Habibullah, A., & Rahim, M. (2023). Changing social relations of HIV infected people with families and communities in Punjab. Pakistan. *International Journal of Health Sciences*, **7**(S1), 641. <https://doi.org/10.53730/ijhs.v7nS1.14246>
- Sianturi, E. I., Latifah, E., Pane, M., Perwitasari, D. A., Satibi, Kristina, S. A., Hastuti, E. B., Pavlovich, J., & Taxis, K. (2022). Knowledge, empathy, and willingness to counsel patients with HIV among Indonesian pharmacists: A national survey of stigma. *AIDS Care*, **34**(1), 21–28. <https://doi.org/10.1080/09540121.2021.1883506>
- Starks, P. T., Kelsey, M. M. G., Rosania, D., & Getz, W. M. (2020). Does HIV infection increase male sexual behavior? *Evolution, Medicine, and Public Health*, **2020**(1), 174–180. <https://doi.org/10.1093/EMPH/EOAA030>
- Syed, M. A., Khan, A., Chaudhry, A., Baig, M. A., Memon, N. M., Kumar, S., Bhurt, S. A., Qadri, M., Vighio, A., Baig, Z. I., Rabold, E. M., Ali, H., Blanton, C., Asghar, R. J., Ikram, A., Rahim, M., Solangi, M., Mahipala, P., & Fontaine, R. E. (2022). An epidemic of pediatric HIV from reuse of infusion equipment in Pakistan. *Journal of Acquired Immune Deficiency Syndromes*, **89**(2), 121–128. <https://doi.org/10.1097/QAI.0000000000002845>
- Syed, W., Qadhi, O. A., Barasheed, A., AlZahrani, E., & Basil A. Al-Rawi, M. (2023). Evaluation of knowledge of risk factors and warning signs of stroke—An observational study among future health care professionals. *Frontiers in Public Health*, **11**, 1131110. <https://doi.org/10.3389/FPUBH.2023.1131110>
- Thingore, C., Joshi, R., Kshirsagar, V., & Limaye, D. (2020). A study to assess the knowledge and attitude towards HIV of pharmacy students from Mumbai University. *International Journal of Community Medicine and Public Health*, **7**(10), 3867. <https://doi.org/10.18203/2394-6040.ijcmph20204013>
- Ullah, S., & Arab, N. (2021). Stigma and diseases: Analyzing the impact of stigmatization on treatment and prevention of HIV/AIDS in District Dir Lower, Khyber Pakhtunkhwa. *PalArch's Journal of Archaeology of Egypt / Egyptology*, **18**(4), 412–420. <https://archives.palarch.nl/index.php/jae/article/view/5987>
- UNAIDS Global AIDS Update. (2023). *The path that ends AIDS*. UNAIDS. <https://thepath.unaids.org/>