

KNOWLEDGE AND AWARENESS REGARDING HIV AMONG HEALTHCARE WORKERS IN THE OPERATING ROOM AT AYUB TEACHING HOSPITAL, ABBOTTABAD

Anas Bacha Shaheen

Assistant Professor (Surgical), Rehman Medical Institute (RMI), Peshawar.

Email: Anas.shaheen@rmi.edu.pk

Ijaz Ahmad

Lecturer at Premier Institute of Health and Management Sciences

Email: ahmedijazkhan511@gmail.com

Furqan Shah

Lecturer Anesthesia Technology

Email: furqanfurqanshah5@gmail.com

Aasim Afaq

Cardiac Technician at Mardan Medical Complex, Mardan.

Email: aasimafaq124@gmail.com

Raifullah Khan

Trainee LRH, Peshawar

Email: rafikhanmp140@gmail.com

Ubaid Ullah (Corresponding author)

Assistant Professor (Surgical), Abasyn University, Peshawar

Email: ullahubaid558@gmail.com

Author Details

Keywords: HIV/AIDS, healthcare workers, knowledge, attitudes, practices, occupational safety, stigma, operating room, Pakistan, post-exposure prophylaxis

Received on 15 May 2026

Accepted on 14 June 2026

Published on 20 June 2026

Corresponding E-mails & Authors*:

Ubaid Ullah*

Email: ullahubaid558@gmail.com

Abstract

HIV/AIDS is an urgent public health issue on the international scale and healthcare workers find themselves at a very high risk of also because of occupational exposure. In Pakistan, especially in operating rooms, knowledge, attitudes and practices (KAP) gaps can lead to a compromised treatment and safety of the staff and their patients. This was to determine the KAP of HIV/AIDS among health workers at Ayub Teaching hospital at Abbottabad and

to determine factors that affect safe practices and stigma. The method was a cross-sectional one, and a sample of 150 operating room healthcare workers was taken, consisting of surgeons and anesthetists, nurses and OT technicians. A structured questionnaire that addressed demographic features, HIV

transmission and prevention knowledge, perception toward PLHIV, and professional behaviors were used in gathering data. Statistical analyses were performed to include descriptive statistics, chi-square tests, t-tests and logistic regression in order to determine correlations between characteristics of the participants and KAP result. Results showed that participants were moderately knowledgeable about the main routes of HIV transmission, with 90% proving significant with blood transfusion, 86.7% sexual transmission and 83.3% mother to child transmission. Misinformation continued on casual contact, bite of the mosquitoes, and recapping needles whereas only 78.7% state that they knowledge on post exposure prophylaxis. Attitudinally, the majority of the respondents stated in support of equal care of PLHIV, inclusion of affected children in schools, but 53.3% included fears of being exposed to the infection via occupation, and 40% said that key populations were the/her drivers of transmission. The practice behaviors were not entirely effective in that blood spill disinfection penetrated at a high rate (93.3%) though the use of gloves and handling needles were inconsistent (66.7% and 66.7% respectively). Regression analysis showed that safer practices depended on HIV training and the desire to help HIV-positive patients. To sum up, healthcare workers showed reasonable knowledge and positive attitudes, yet there are gaps in practice and ongoing stigma, which makes it necessary to implement specific training and stigma-reduction interventions to guarantee the occupational safety and the high level of care provided to PLHIV.

INTRODUCTION

HIV has remained a major global public health challenge since its identification in the early 1980s. In 2024, approximately 40.8 million people were living with HIV, with 1.3 million new infections and 630,000 HIV-related deaths reported worldwide (UNAIDS, 2024). Although Sub-Saharan Africa carries the greatest burden, increasing epidemics are also observed in South Asia, Latin America, and Eastern Europe (QUINN, 2021; WHO, 2022). Significant advances have been made in HIV prevention, diagnosis, and treatment; however, occupational exposure among healthcare workers (HCWs) continues to be a concern. International organizations emphasize occupational safety, stigma reduction, and training programs to minimize HIV-related risks in healthcare settings (WHO, 2021, 2023; QUINN, 2021, 2024). Stigma and misconceptions within healthcare systems negatively affect patient care and contribute to underreporting of occupational exposures (Wouters et al., 2022; Rana et al., 2023).

Healthcare workers are particularly vulnerable to HIV infection because of frequent exposure to blood, body fluids, and sharp instruments. Operating rooms are considered high-risk environments due to regular contact with sharps and biological materials (WHO, 2023). Needle-stick injuries remain one of the leading causes of occupational HIV exposure. Studies in Pakistan report high rates of such injuries among surgical staff, while awareness and utilization of post-exposure prophylaxis (PEP) remain inadequate (Kiddeer et al., 2024; Rana et al., 2023). Similar challenges have been reported internationally, including in the United States, Europe, Asia, and the Middle East (Mekonnen et al., 2024; Elghazaly et al., 2023; Alharbi et al., 2022; Saad et al., 2024). Despite the proven effectiveness of PEP, inadequate training and poor adherence to safety protocols continue to increase occupational risks (CDC, 2022; Adal et al., 2023).

Pakistan faces additional HIV-related challenges due to unsafe medical practices, weak infection-control systems, and recurring outbreaks. The 2019 Ratodero outbreak highlighted the consequences of unsafe injections and poor professional accountability (Bashir et al., 2024; Ullah et al., 2025). Studies have identified syringe reuse, poor sterilization practices, and inadequate compliance with universal precautions in healthcare facilities (Asghar et al., 2025). Training deficiencies are also common, with many nurses and operating theatre staff demonstrating limited awareness of HIV prevention and PEP protocols (Sukaina, 2021; Chatha et al., 2020). Furthermore, stigma toward people living with HIV remains prevalent among HCWs and contributes to underreporting of occupational exposures (Rana et al., 2023). These challenges were further aggravated during the COVID-19 pandemic when infection-control programs received less attention (WHO, 2021).

Globally, advances in antiretroviral therapy, early diagnosis, PEP, and pre-exposure prophylaxis (PrEP) have significantly reduced HIV-related morbidity and mortality (WHO, 2022; CDC, 2022; Mekonnen et al., 2024). Nevertheless, occupational exposure among HCWs remains a concern because of needle-stick injuries, inadequate infection-control measures, and inconsistent adherence to safety protocols (WHO, 2023). Research from both developed and developing countries demonstrates continuing gaps in knowledge, training, and institutional support (Shamil et al., 2021; Saad et al., 2024). Stigma remains a major barrier to quality care and occupational safety (UNAIDS, 2021, 2022; Rana et al., 2023; Iardino et al., 2025). Strengthening training programs, ensuring access to PEP, and promoting universal precautions are therefore essential to achieving global HIV targets (UNAIDS, 2024).

Pakistan has experienced several HIV outbreaks linked to unsafe healthcare practices. The Ratodero outbreak infected more than 800 children and 200 adults, exposing serious weaknesses in infection-control systems (Zaid et al., 2019). Hospital-based studies report low awareness of PEP protocols, frequent needle-stick injuries, and substantial underreporting among healthcare workers (Ali et al., 2013; Hussain et al., 2014; Akhtar et al., 2015). Recent studies continue to show inadequate training and poor utilization of PEP despite increasing awareness (Shakeel et al., 2022; Kiddeer et al., 2024). Pakistan also remains among the countries with the highest rates of unsafe injections, increasing both community and occupational HIV risks (WHO, 2022). Stigma and fear of treating HIV-positive patients further complicate prevention efforts (Rana et al., 2018; 2023).

Despite advances in HIV prevention and management, healthcare workers, particularly operating room personnel, remain at risk of occupational HIV exposure. Although universal precautions and PEP are internationally recommended, adherence remains inconsistent in low- and middle-income countries (WHO, 2022; CDC, 2022). In Pakistan, inadequate infection-control systems, limited PEP availability, underreporting of needle-stick injuries, and insufficient institutional support increase occupational risks (Kiddeer et al., 2024; Shakeel et al., 2022; Akhtar et al., 2015; Asghar et al., 2025). HIV-related stigma among healthcare workers further discourages safe practices and reporting of exposures (Rana et al., 2023; Wouters et al., 2022). Consequently, a significant gap exists between knowledge, attitudes, and safe practices among surgical healthcare workers.

Occupational HIV exposure remains a major concern for operating room personnel because of frequent contact with blood and sharp instruments. However, limited research in Pakistan has specifically focused on the knowledge, attitudes, and practices of surgical healthcare workers regarding HIV prevention and PEP (Asghar et al., 2025; Kiddeer et al., 2024). Evidence suggests that proper training and institutional support significantly improve preventive practices and reduce occupational risks (Kiddeer et al., 2024). Nevertheless, barriers such as inadequate training, poor access to PEP, and HIV-related stigma continue to hinder effective prevention efforts (Rana et al., 2023; Wouters et al., 2022). This study aims to provide context-specific evidence to support training programs, strengthen hospital policies, and improve occupational safety and patient care.

This study employed a descriptive cross-sectional survey design to assess the knowledge, awareness, attitudes, and practices of healthcare workers regarding HIV, occupational exposure, and post-exposure prophylaxis (PEP). A quantitative approach was adopted, allowing systematic data collection

through a structured questionnaire and statistical analysis of the findings. The design was considered appropriate because it provided a cost-effective method for evaluating the current status of knowledge and practices among healthcare workers at a single point in time.

The study was conducted at Ayub Teaching Hospital, Abbottabad, one of the largest tertiary care hospitals in Khyber Pakhtunkhwa, Pakistan. The hospital provides specialized surgical services in multiple disciplines, including general surgery, orthopedics, neurosurgery, ophthalmology, ENT, gynecology, and anesthesiology. The operating rooms of the hospital were selected as the study setting because healthcare workers in these areas are frequently exposed to blood, body fluids, and sharp instruments, placing them at increased risk of occupational HIV exposure.

The study population consisted of healthcare workers directly involved in operating room activities, including surgeons (consultants, residents, and postgraduate trainees), anesthetists, operating room nurses, and OT technicians. Only staff members with at least six months of working experience in the operating rooms and who provided informed consent were included. Healthcare workers not directly involved in operating room procedures, newly appointed staff with less than six months of experience, and those unwilling to participate were excluded from the study.

The sample size was calculated using Cochran's formula for proportion-based studies. Assuming a 95% confidence level ($Z = 1.96$), an expected proportion of 50% ($p = 0.5$), and a margin of error of 8% ($e = 0.08$), the required sample size was determined to be 150 participants. This sample size was considered sufficient to represent the target population and feasible within the available time and resources.

A stratified random sampling technique was used to ensure proportional representation of all professional categories. The study population was divided into strata consisting of surgeons, anesthetists, nurses, and OT technicians. Participants were then selected randomly from each stratum according to their proportion within the operating room workforce, thereby minimizing sampling bias and enhancing representativeness.

METHODOLOGY

Data were collected using a structured self-administered questionnaire developed after reviewing relevant literature and previous studies on HIV knowledge, attitudes, practices, and occupational safety. The questionnaire comprised four sections: demographic characteristics (age, gender, education,

designation, experience, and specialty), knowledge regarding HIV transmission and prevention, attitudes toward HIV-positive patients and occupational safety, and practices related to infection control measures, personal protective equipment (PPE), and post-exposure prophylaxis (PEP).

Prior to data collection, permission was obtained from the hospital administration. Eligible participants were approached in their respective departments, informed about the purpose of the study, and invited to participate voluntarily. Written informed consent was obtained from all respondents. Questionnaires were distributed and collected during the same visit to maximize the response rate. To maintain confidentiality and anonymity, participants' identities were not recorded, and coded numbers were used instead of names.

The collected data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the data. Inferential statistical tests were employed to assess associations between demographic or professional characteristics and HIV-related knowledge and awareness. These analyses included chi-square tests, independent t-tests, one-way ANOVA, and logistic regression. A p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Review Board of Times University, Multan, and administrative permission was secured from Ayub Teaching Hospital, Abbottabad. Participation was entirely voluntary, and informed consent was obtained from all respondents before enrollment. Confidentiality and anonymity were maintained throughout the study, and participants were informed of their right to withdraw at any stage without penalty. All collected information was used solely for academic and research purposes.

Results

Demographic characteristics of the Respondents

A total of 150 participants were included in the study. The demographic distribution is presented in Table 4.1. The study sample (n = 150) consisted predominantly of participants aged 30–39 years (34.7%), followed by those aged 40–49 years (26.7%) and 20–29 years (25.3%), with fewer respondents aged 50 years or older (13.3%). Males represented the majority (58.7%), while females accounted for 40% and only a small proportion identified as other (1.3%). Over half of the participants were married (53.3%), while 36% were

single, and smaller proportions were divorced (6.7%) or widowed (4%). In terms of professional designation, nurses formed the largest group (33.3%), followed by OT technicians (23.3%), surgeons (20%), anesthetists (13.3%), and others (10%). Nearly half of the respondents held a bachelor's degree (46.7%), with 26.7% holding a master's degree, 18.7% a diploma, and 8% reporting other qualifications. Most participants had between 6–10 years of operating room experience (36.7%), while 32% had 0–5 years, 20% had 11–15 years, and only 11.3% had more than 16 years. Encouragingly, a majority (61.3%) reported receiving training related to HIV/AIDS, though 38.7% had not. Work shifts were fairly distributed, with 36.7% working morning shifts, 30% on rotating shifts, 18.7% in evening shifts, and 14.7% during the night.

Table 1 Demographic Characteristics of the Respondent

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–29	38	25.3
	30–39	52	34.7
	40–49	40	26.7
	50+	20	13.3
Gender	Male	88	58.7
	Female	60	40.0
	Other	2	1.3
Marital Status	Single	54	36.0
	Married	80	53.3
	Divorced	10	6.7
	Widowed	6	4.0
Designation	Surgeon	30	20.0
	Anesthetist	20	13.3
	Nurse	50	33.3
	OT Technician	35	23.3
	Other	15	10.0
Highest Level of Education	Diploma	28	18.7
	Bachelor's Degree	70	46.7
	Master's Degree	40	26.7

Variable	Category	Frequency (n)	Percentage (%)
	Other	12	8.0
Years of Experience in OR	0–5 years	48	32.0
	6–10 years	55	36.7
	11–15 years	30	20.0
	16+ years	17	11.3
HIV/AIDS Training	Yes	92	61.3
	No	58	38.7
Work Shift	Morning	55	36.7
	Evening	28	18.7
	Night	22	14.7
	Rotating	45	30.0

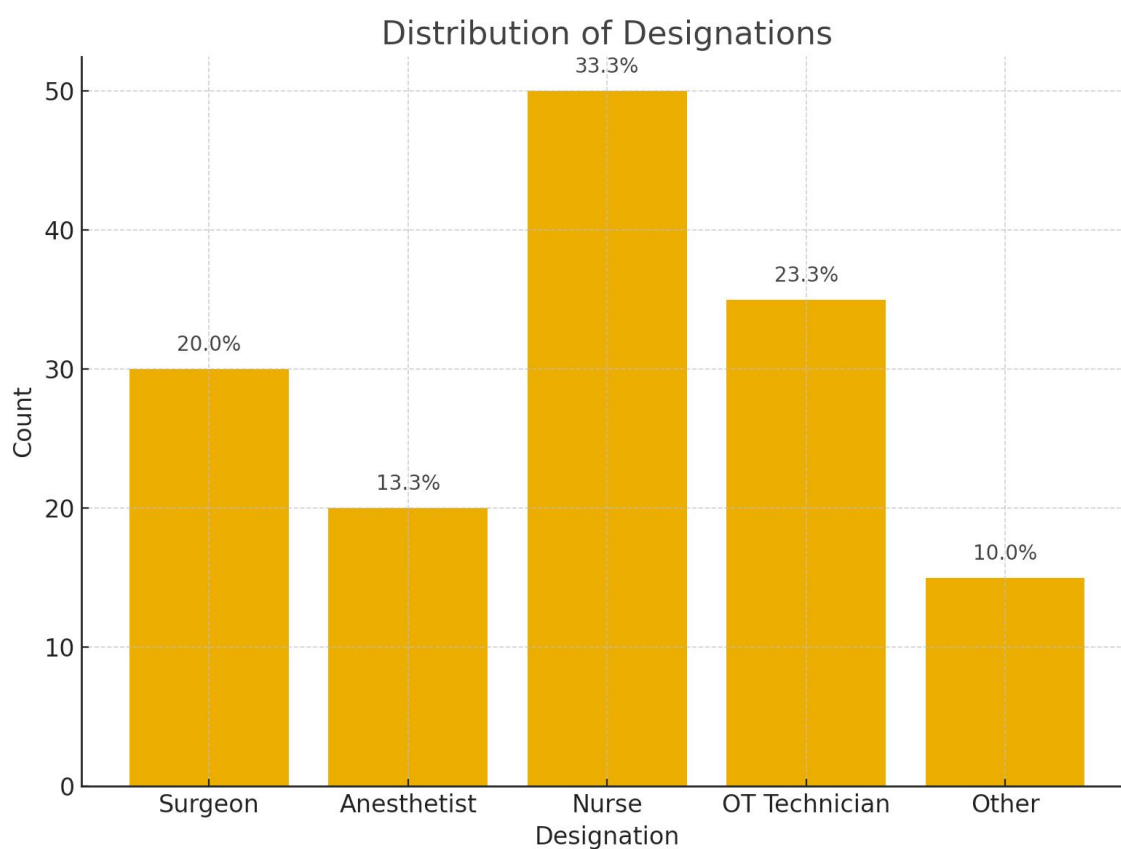


Figure 1: Distribution of Designations of Respondents

Knowledge regarding HIV/AIDS

The findings (Table 2) reveal that participants demonstrated generally good knowledge about HIV transmission and prevention, though some misconceptions persist. A majority correctly recognized that HIV can be killed with disinfectants in the environment (73.3%), and most understood that not all pregnant women with HIV will have babies born with AIDS (76.7%). Encouragingly, 80% were aware that an HIV-infected person can appear healthy, and nearly all participants knew that HIV can be transmitted through unscreened blood transfusion (90%), sexual intercourse with an infected partner (86.7%), and from mother to child via breast milk or placenta (83.3%). Preventive knowledge was also high, with 78.7% acknowledging that mutual monogamy with an uninfected partner reduces risk, and 83.3% recognizing consistent condom use as protective. However, some misconceptions remain: 20% believed HIV could spread to the families of healthcare workers caring for patients, 50% perceived occupational transmission risk as high, and notable proportions incorrectly thought HIV could be spread through hugging/handshaking (10%), sharing toilets (12%), mosquito bites (18.7%), or sharing food (14.7%). These gaps highlight areas for targeted educational interventions to dispel myths and reinforce accurate knowledge, especially regarding non-transmissible routes.

Table 2 Knowledge of HIV/AIDS among Respondent

Statement	Response	Frequency (n)	Percentage (%)
HIV virus can be killed with disinfectant in the environment	True	110	73.3
	False	25	16.7
	Do not know	15	10.0
All pregnant women with HIV will have babies born with AIDS	True	20	13.3
	False	115	76.7
	Do not know	15	10.0
HIV-infected person can look healthy	True	120	80.0
	False	20	13.3
	Do not know	10	6.7

Statement	Response	Frequency (n)	Percentage (%)
Possible to transmit HIV to family of HCW caring for PLHIV (though HCW not infected)	True	30	20.0
	False	95	63.3
	Do not know	25	16.7
Risk of occupational HIV infection among HCWs is high	True	75	50.0
	False	50	33.3
	Do not know	25	16.7
HIV can be transmitted by transfusion of unscreened blood/products	True	135	90.0
	False	5	3.3
	Do not know	10	6.7
HIV can be transmitted through sexual intercourse with HIV-infected person	True	130	86.7
	False	8	5.3
	Do not know	12	8.0
HIV can be transmitted through breast milk or placenta	True	125	83.3
	False	10	6.7
	Do not know	15	10.0
HIV can be transmitted through hugging/handshaking	True	15	10.0
	False	120	80.0
	Do not know	15	10.0
HIV can be transmitted through sharing toilets/bathrooms	True	18	12.0
	False	115	76.7
	Do not know	17	11.3
HIV can be transmitted through mosquito bites	True	28	18.7
	False	105	70.0
	Do not know	17	11.3
HIV can be transmitted through sharing	True	22	14.7

Statement	Response	Frequency (n)	Percentage (%)
utensils/food	False	110	73.3
	Do not know	18	12.0
Risk reduced by one uninfected faithful partner	True	118	78.7
	False	15	10.0
	Do not know	17	11.3
Risk reduced by condom use every time	True	125	83.3
	False	10	6.7
	Do not know	15	10.0

Attitude towards people living with HIV/AIDS

The attitudes of participants toward people living with HIV (PLHIV) were largely positive, though elements of stigma and fear remain. Encouragingly, an overwhelming majority believed that patients with HIV/AIDS deserve the same quality of care as others (93.3%), and most were willing to treat HIV-positive patients (90.0%). Similarly, strong support was shown for the rights of PLHIV, with 80% agreeing that women with HIV should be allowed to have children and 86.7% supporting the right of children with HIV to attend school with HIV-negative peers. Moreover, 92% opposed healthcare facilities refusing care to HIV-positive patients, and 78.7% reported no objection to purchasing food from an HIV-positive vendor.

Table 3 Attitude of the Respondent Towards People Living with HIV/AIDS

Statement	Response	Frequency (n)	Percentage (%)
Most people with HIV/AIDS only have themselves to blame	Yes	35	23.3
	No	115	76.7
Patients with HIV/AIDS have the right to the same quality of care as any other patient	Yes	140	93.3
	No	10	6.7
Most PLHIV do not care if they infect others	Yes	28	18.7
	No	122	81.3

Statement	Response	Frequency (n)	Percentage (%)
People get infected with HIV because they engage in irresponsible behaviours	Yes	55	36.7
	No	95	63.3
Women living with HIV should be allowed to have children if they wish	Yes	120	80.0
	No	30	20.0
Will you treat a patient who is HIV positive?	Yes	135	90.0
	No	15	10.0
If I know that my friend has HIV infection, I will end the relationship	Yes	25	16.7
	No	125	83.3
Would you mind buying food items from a food seller who has HIV?	Yes	32	21.3
	No	118	78.7
I am afraid of catching HIV through clinical practice while working	Yes	80	53.3
	No	70	46.7
Sex workers, youths & key populations are responsible for spreading HIV	Yes	60	40.0
	No	90	60.0
Health facilities should not refuse care because of HIV status	Yes	138	92.0
	No	12	8.0
Children with HIV should attend school with HIV-negative peers	Yes	130	86.7
	No	20	13.3

However, some misconceptions and stigmatizing attitudes persist: 23.3% felt that most people with HIV/AIDS are to blame for their condition, 18.7% believed PLHIV do not care if they infect others, and 36.7% associated HIV with irresponsible behavior. Additionally, 16.7% stated they would end a friendship if a friend were HIV-positive, and 21.3% expressed reluctance to buy food from someone with HIV. Fear of occupational exposure was also notable, with over half (53.3%) expressing fear of catching HIV during clinical practice. Furthermore, 40% attributed responsibility for spreading HIV to sex workers, youths, and other key populations, reflecting persistent stereotypes.

Practice related to HIV/AIDS

The results indicate generally strong practices and awareness among participants regarding HIV prevention and infection control, though notable gaps remain. Almost all respondents reported encouraging HIV testing and counseling (92.0%) and a large majority would refer individuals for voluntary counseling and testing, even if unavailable in their workplace (83.3%). Similarly,

93.3% affirmed the correct practice of treating blood spills with disinfectants before cleaning, and 80% reported consistently practicing universal blood and body fluid precautions. Awareness of occupational risk was evident, with 73.3% recognizing the high risk of HIV infection after accidental needle stick injuries, and 78.7% reporting knowledge of post-exposure prophylaxis (PEP).

However, inconsistencies in protective practices emerged. While two-thirds (66.7%) agreed that gloves and gowns should be used for any contact with HIV/AIDS patients, a third did not recognize this requirement. Similarly, although most participants acknowledged the importance of double gloving during exposure-prone procedures (76.7%), nearly a quarter did not. More concerning, 28% incorrectly believed that used needles should be recapped after use—a practice known to increase needle stick injury risk—highlighting a critical misconception.

Table 4: Practices of the Respondents Regarding HIV/AIDS

Statement	Response	Frequency (n)	Percentage (%)
Encourage people to get tested and counseled for HIV/AIDS if needed	Yes	138	92.0
	No	12	8.0
Refer people for voluntary counseling/testing even if not available at workplace	Yes	125	83.3
	No	25	16.7
Always practice universal blood & body fluid precautions at workplace	Yes	120	80.0
	No	30	20.0
Gloves and gowns required for any contact with HIV/AIDS patients	Yes	100	66.7
	No	50	33.3
Double gloving only recommended during some exposure-prone procedures	Yes	115	76.7
	No	35	23.3
Treat blood spills with disinfectant before cleaning	Yes	140	93.3
	No	10	6.7
Risk of HIV infection is high after accidental needle stick injury	Yes	110	73.3
	No	40	26.7
All used needles should be recapped immediately after use on HIV patients	Yes	42	28.0
	No	108	72.0
Knowledge about PEP and its usage at workplace	Yes	118	78.7
	No	32	21.3

Gloves and Gowns Required for Contact with HIV/AIDS Patients

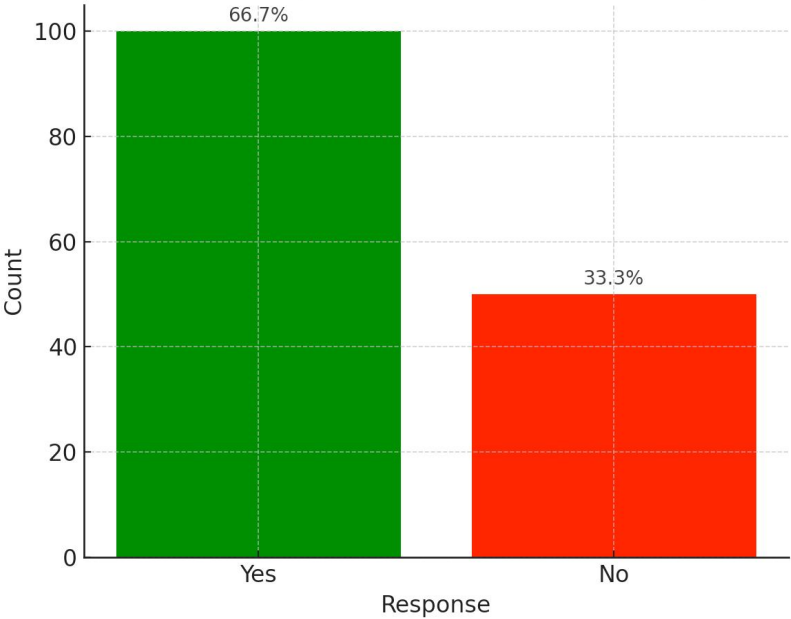


Figure 2: Gloves and Gown Required by Respondents for Contact with HIV/AIDS Patients

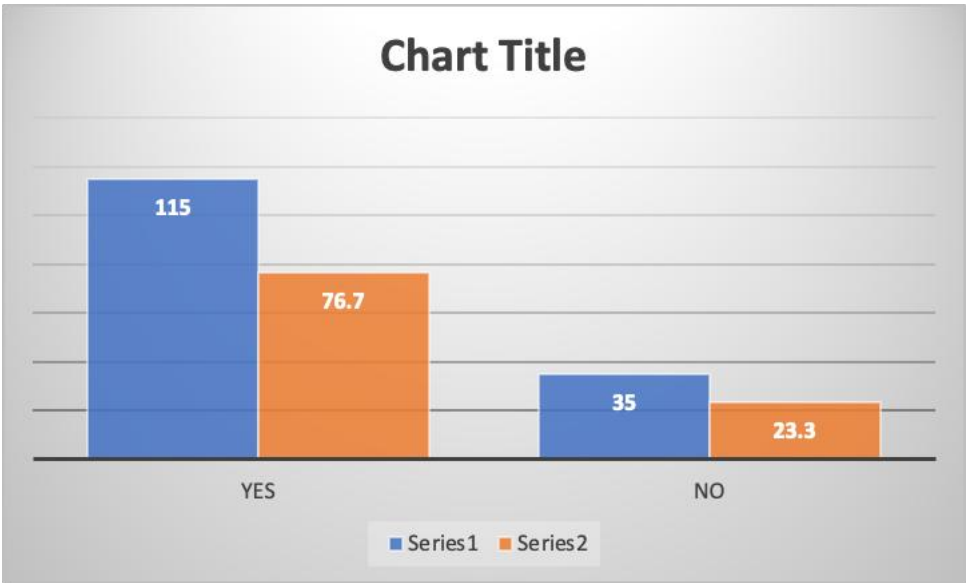


Figure 3: Response of Respondents regarding Healthcare Facilities

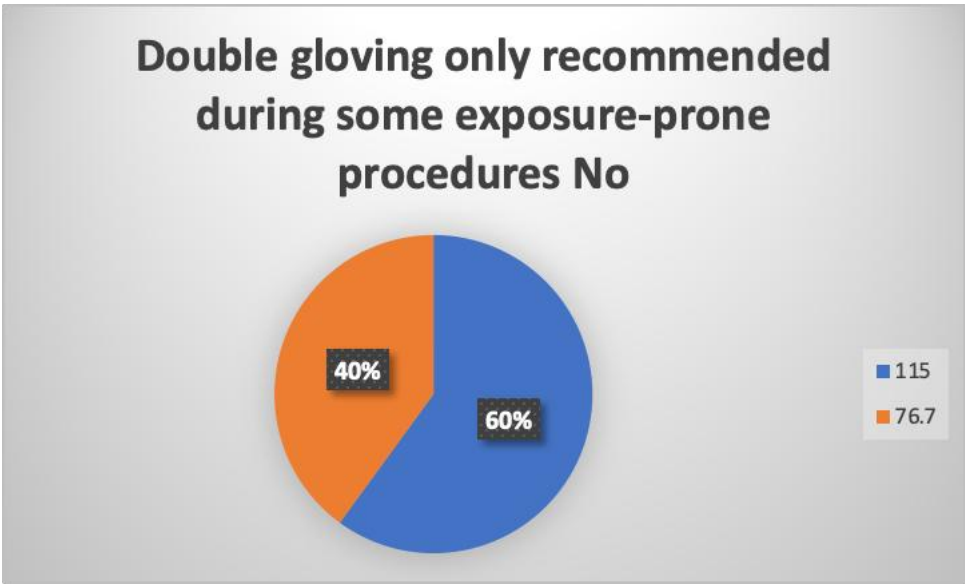


Figure 4: Response of Respondents regarding Double Gloves Recommendations

Cross-Tabulation Analysis

The cross-tabulation analysis highlights several significant associations between demographic and professional factors with HIV-related training, knowledge, and willingness to provide care. Gender was significantly associated with HIV/AIDS training ($p = 0.045$), with males more likely to have received training (68.2%) compared to females (53.3%), while none of the respondents identifying as “other” reported any training. Designation, however, showed no significant association with knowledge about HIV transmission through unscreened blood ($p = 0.299$), as nearly all categories—surgeons (96.7%), anesthetists (95.0%), nurses (86.0%), OT technicians (85.7%), and others (93.3%)—demonstrated high levels of correct knowledge. Years of experience were significantly linked to willingness to treat HIV-positive patients ($p = 0.049$), with higher willingness observed among those with 6–10 years (94.5%) and 11–15 years (96.7%) of experience, compared to slightly lower willingness among those with ≤ 5 years (83.3%) or ≥ 16 years (82.4%).

Table 5: Cross-Tabulations with Chi-Square Test Results (n = 150)

Cross Tabulation	Categories	Response	n (%)	p-value
1. Gender × HIV/AIDS Training	Male (n = 88)	Yes	60 (68.2%)	0.045*
		No	28 (31.8%)	
	Female (n = 60)	Yes	32 (53.3%)	

Cross Tabulation	Categories	Response	n (%)	p-value
	Other (n = 2)	No	28 (46.7%)	
		Yes	0 (0.0%)	
		No	2 (100.0%)	
2. Designation × Knowledge (Q14: HIV via unscreened blood)	Surgeon (n = 30)	True	29 (96.7%)	0.299
		False/DK	1 (3.3%)	
	Anesthetist (n = 20)	True	19 (95.0%)	
		False/DK	1 (5.0%)	
	Nurse (n = 50)	True	43 (86.0%)	
		False/DK	7 (14.0%)	
	OT Technician (n = 35)	True	30 (85.7%)	
		False/DK	5 (14.3%)	
	Other (n = 15)	True	14 (93.3%)	
		False/DK	1 (6.7%)	
3. Experience × Willingness to Treat HIV+ Patient	0–5 yrs (n = 48)	Yes	40 (83.3%)	0.049*
		No	8 (16.7%)	
	6–10 yrs (n = 55)	Yes	52 (94.5%)	
		No	3 (5.5%)	
	11–15 yrs (n = 30)	Yes	29 (96.7%)	
		No	1 (3.3%)	
	16+ yrs (n = 17)	Yes	14 (82.4%)	
		No	3 (17.6%)	

Independent Samples t-test

The comparative analysis revealed several significant associations between socio-demographic, professional, and attitudinal factors with HIV/AIDS knowledge and practices. Male participants, married individuals, older staff (≥ 35 years), and doctors consistently demonstrated higher mean scores compared to their counterparts, highlighting the role of experience and professional designation in shaping knowledge. Training, prior exposure to HIV patients, attendance at CME/workshops, and reliance on formal education as a knowledge source were strongly linked with better awareness and safer practices, underscoring the importance of structured educational interventions.

Table 6: Independent Samples t-test Results (n = 150)

Comparison	Category	Mean Score ($\pm$ SD)	t-value	df	p-value
Gender	Male	12.8 $\pm$ 3.1	2.34	146	0.021*
	Female	11.5 $\pm$ 3.4			
Marital Status	Single	11.9 $\pm$ 3.3	-2.10	148	0.037*
	Married	13.2 $\pm$ 3.0			
Age Group	<35 yrs	11.6 $\pm$ 3.5	-3.01	148	0.003
	$\geq$ 35 yrs	13.4 $\pm$ 2.8			
Designation	Doctors	14.2 $\pm$ 2.5	4.08	95.6 ⁺	<0.001*
	Nurses/Technicians	11.8 $\pm$ 3.3			
Experience	$\leq$ 10 yrs	12.1 $\pm$ 3.3	1.85	148	0.066
	>10 yrs	13.0 $\pm$ 3.0			
HIV/AIDS Training	Trained	13.9 $\pm$ 2.7	5.12	148	<0.001*
	Not Trained	11.2 $\pm$ 3.5			
Willingness to Treat HIV+ Patient	Yes	13.6 $\pm$ 2.6	4.98	148	<0.001*
	No	10.4 $\pm$ 3.7			
Stigma Belief ("HIV due to irresponsible behavior")	Agree	11.1 $\pm$ 3.2	-3.75	148	<0.001*
	Disagree	13.3 $\pm$ 3.0			
Fear of Catching HIV in Clinical Practice	Yes	11.8 $\pm$ 3.4	-2.89	148	0.005
	No	13.5 $\pm$ 2.7			

Furthermore, willingness to treat HIV-positive patients, absence of stigma, and lower fear of infection were associated with significantly higher knowledge and practice scores, indicating that attitudes and perceptions directly influence professional behavior. In contrast, variables such as years of experience and prior needle-stick injury showed weaker or non-significant differences, suggesting that practical exposure alone does not guarantee improved knowledge unless supported by formal training and positive attitudes. Overall, these findings emphasize that professional role, structured training, and attitudinal factors play a more decisive role than mere work experience in shaping HIV/AIDS-related knowledge and practices.

Logistic Regression Analysis

The regression analysis identified key predictors of higher HIV/AIDS knowledge and safer practices. Age ≥ 35 years (AOR = 1.92, $p = 0.034$) and professional designation as a doctor (AOR = 2.88, $p = 0.004$) significantly increased the likelihood of better knowledge, while marital status and overall work experience were not significant predictors. HIV/AIDS-specific training emerged as the strongest positive predictor (AOR = 3.20, $p < 0.001$), followed by willingness to treat HIV-positive patients (AOR = 2.75, $p = 0.005$), knowledge of PEP (AOR = 2.42, $p = 0.011$), and belief in condom effectiveness for HIV prevention (AOR = 1.95, $p = 0.047$). Conversely, holding stigmatizing beliefs reduced the odds of higher knowledge and safer practices by nearly half (AOR = 0.48, $p = 0.025$). Fear of contracting HIV in clinical practice was not statistically significant but showed a negative trend. Overall, these findings highlight that structured training, professional role, positive attitudes, and correct preventive beliefs are stronger determinants of HIV/AIDS-related knowledge and practices than demographic or experiential factors alone.

Table 7: Logistic Regression Results (n = 150)

Predictor Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Gender (Male vs Female)	1.35	0.75 – 2.44	0.312
Age ≥ 35 yrs (vs < 35 yrs)	1.92	1.05 – 3.50	0.034*
Marital Status (Married vs Single)	1.41	0.80 – 2.50	0.225
Designation (Doctor vs Nurse/Technician)	2.88	1.40 – 5.92	0.004
Experience > 10 yrs (vs ≤ 10 yrs)	1.55	0.86 – 2.79	0.142
HIV/AIDS Training (Yes vs No)	3.20	1.65 – 6.20	$< 0.001^*$
Willingness to Treat HIV+ Patient (Yes vs No)	2.75	1.35 – 5.58	0.005

Discussion

The research evaluated the awareness and attitudes of healthcare workers, as well as the practices of medical professionals regarding HIV/AIDS in the operating rooms of Ayub Teaching Hospital, Abbottabad. The demographic analysis revealed that the majority of respondents were men (58.7%), most of whom were within the age group of 30–39 years (34.7%). Nurses represented the most prominent professional category (33.3%), followed by other operating room personnel. In terms of educational qualification, a considerable proportion of the respondents (46.7%) held a bachelor's degree. These findings are consistent with similar studies conducted in Pakistan and

other developing countries, where operating room staff are typically younger and often lack formal, structured training in infection prevention and control practices (Sukaina, 2021; Aamir et al., 2023).

This pattern of a younger workforce may have both advantages and challenges. On one hand, younger healthcare professionals often demonstrate adaptability, enthusiasm, and a strong capacity for skill development when provided with proper institutional support and continuous education. On the other hand, the lack of regular professional training and refresher courses can pose serious threats to workplace safety and infection control. In the absence of systematic infection prevention programs, younger staff may be at greater risk of occupational exposure due to inexperience and insufficient awareness of standard safety procedures. Therefore, while the youthful composition of the workforce offers an opportunity for capacity building through long-term structural training, the current absence of consistent, evidence-based professional education programs increases the potential for unsafe practices and inadequate infection prevention measures within the operating room environment.

Concerning knowledge, the participants were quite aware of the major routes of primary HIV transmission. Many of them identified correctly with a large percentage the essential forms of transmission blood transfusion (90%), sexual intercourse (86.7%), and mother-to-child situation (83.3%). Nevertheless, long-term illusion was displayed. As an example, 28% thought a used needle could be recapped safely and people still had misconceptions about transmission via mosquito bites, by hugging, or even by sharing food. These results are consistent with previous studies carried out in Pakistan and other South Asian settings, indicating healthcare providers to have shown moderate levels of understanding regarding the transmission of HIV infection but still practiced minor myths about incidental contact (Harsha et al., 2020; Elghazaly et al., 2023). Though one may assume that a basic level of knowledge is sufficient, the fact that these myths still exist speaks to how insufficient knowledge is in spurring safe practices. The same worries were also expressed in the international literature and it suggests a sense of urgency to continue educating people on the issue to counter the misperceptions and reinforce the primary prevention interventions.

There were positive attitudinal findings. Almost all the respondents (92%) favored the equal treatment of HIV-positive patients, and 86.7% supported the inclusion of children living with HIV in schools. These responses reflect a generally positive and compassionate attitude toward individuals affected by HIV/AIDS. Such attitudes align well with global health commitments and ethical principles that advocate for non-discrimination, equality, and the

provision of equal care to all individuals regardless of their health status (Quinn, 2021). This suggests that the majority of healthcare workers recognize the importance of treating HIV-positive patients with fairness and dignity, which is an encouraging sign for improving the overall quality of patient care.

However, several problematic attitudes were also discernible among the respondents. More than half (53.3%) admitted being afraid of contracting HIV during clinical practice, and 40% attributed infectivity primarily to key populations. These perceptions reveal that, despite a generally positive attitude toward patient rights, fear and stigma continue to influence the professional behavior of healthcare workers. These findings are not far from those reported in previous studies from Pakistan, where fear of infection and stigmatizing beliefs have been shown to remain deeply rooted among healthcare workers regardless of their exposure to awareness programs (Saad et al., 2024; Nagai et al., 2023).

There is substantial evidence suggesting that such professional stigma not only affects healthcare workers' confidence but also negatively impacts preventive practices, ultimately reducing the level of trust and communication between patients and healthcare providers (Sallam et al., 2022). These results indicate that both workplace safety concerns and entrenched discriminatory beliefs must be addressed through structured stigma-reduction programs and continuous professional training. Such programs, when implemented systematically, can play a vital role in promoting positive attitudes, reducing fear-driven behaviors, and improving the quality of HIV-related care in hospital environments.

On the practices, the findings made a perplexing showing. Positively, large percentages indicated the clearing-up of blood spills (93.3%), the encouragement of HIV testing and counseling (92%), and the maintenance of universal precautions (80%). These findings reflect that most of the participants were conscious of infection prevention practices and followed standard safety protocols to some extent in their daily routines. Such adherence to basic preventive steps demonstrates that healthcare workers in the operating room possess an understanding of the importance of universal precautions in minimizing occupational risks. However, weaknesses in occupational safety were also seen, highlighting inconsistency between knowledge and actual practice. The study showed that about one in three respondents used gloves and gowns at an inconsistent rate, twenty-eight reported that they recapped needles, and more than twenty percent of respondents stated that they did not know about post-exposure prophylaxis (PEP). These findings suggest that although awareness exists, the actual

implementation of safety measures remains inadequate and varies among individuals.

The results align with those found in Lahore and Karachi, where managers revealed that although healthcare professionals have fair knowledge regarding HIV prevention measures, practices such as the proper use of PEP and safe disposal of sharps are still poorly observed (Shakeel et al., 2022; Kiddeer et al., 2024). This similarity indicates that the problem is not isolated but rather a widespread challenge across healthcare facilities. Also, though updated recommendations on the topic of occupational safety and handling HIV exposure are still accessible, factors like inappropriate resources, insufficient training, and organizational issues further reduce the efficiency of implementation efforts, making adherence to these guidelines inconsistent (Mekonnen et al., 2024). Overall, these observations point toward a gap between policy and practice, where the availability of safety protocols does not necessarily ensure their full application within the clinical environment.

Important associations were also indicated by the regression analysis. The relationship between HIV/AIDS training and better knowledge and safer practice was strong and willingness to treat HIV-positive and more positive attitudes was interconnected with willingness to treat HIV-positive patients. In contrast, beliefs linking stigma had a lot of connection with discriminatory behavior. This can be compared to recent research, which has also shown that training interventions are effective to enhance awareness and decrease negative attitude towards hand hygiene among healthcare workers in Pakistan (Chatha et al., 2020). Similarly, it has been reported around the world that knowledge-based interventions cannot exist in isolation and need to be coupled with the use of stigma-reduction methods and institutional support (Quinn, 2021; Iardino et al., 2025).

In general, these results indicate that healthcare service providers in the operation room exhibit an average level of HIV-related awareness and mostly positive attitudes, but still, ingrained misperceptions and stigma, as well as the lack of universal precautionary use, hinder the implementation of safe practices. Restrictions of this paper are that it was cross-sectional, self-reported, and confined to one tertiary care institution and this may limit the generalization. Regardless of these shortcomings, the conclusions are important in answering the questions related to occupational safety and stigma-related issues in Pakistani hospitals. Solving these problems will involve interventions in areas such as refresher course arrangements, specific stigma-reduction programs, better access to PEP, and adequate access to infection prevention materials.

CONCLUSION

The present study evaluated the knowledge, attitudes, and the practices of health workers in the operating rooms of Ayub teaching hospital in relation to HIV/ AIDS. The results show a moderate level of knowledge in health professionals about HIV transmission and positive attitudes and biased followership towards the recommended preventive measures of PLHIV. Major routes of the transmission, including the following, were identified properly by most respondents: blood transfusions, sexual, and mother-to-child. Nevertheless, the still persistent false beliefs were related to non-violent ways of transmission such as the bite of a mosquito, sharing of facilities, and communication per se. Also, a significant percentage of respondents noted that they recapped needles, which shows flaws in the practices of safe practices.

Attitudinal measurement showed that there were mainly positive perceptions. Most of them were in favor of treating HIV-positive patients equally and supported the inclusion of HIV children in schools. These positive attitudes did not, however, mean that more than half of the respondents had feared being infected with HIV during clinical practice, and key proportions pointed the blame at being transmitted to other people belonging to the key populations. These results suggest that the issue of stigma and apprehension still exists among healthcare personnel and it might affect the manner in which the workers provide care and their behavior at workplaces.

Practice behaviors were unstable. Although the majority of the respondents indicated taking universal precautions and disinfecting blood spills, promoting HIV testing and counseling, lack of coherence in wearing gloves and gowns, managing needles, and understanding of post-exposure prophylaxis were noted. The regression analyses also found that some of the associated factors covered previous HIV/AIDS training and desire to treat HIV-positive patients were with concerns safer practices and more favorable attitudes, whereas beliefs associated with stigma were on the relationship with discriminator ship behavior.

On the whole, the study proves that though healthcare workers have fairly decent knowledge and positive attitudes, they do not always translate to safe practices, and stigma is a point of interest. The results indicate the essentiality of closing the gap between the knowledge, attitudes and practice to guarantee occupational safety and care of high quality. One of the reasons that it is necessary to address such gaps in the operating room setting is to enhance infection control practices, reduce occupational risks, and offer ethical care to the PLHIV.

Recommendations

It has been showed through the findings of the study that multiple recommendations can be offered to enhance HIV-related knowledge, attitudes, and practices in operating room health care professionals. To begin with, periodic and targeted training should be introduced to strengthen the appropriate knowledge of HIV transmission and safe workplace behavior, such as safe sharps, and universal precautions.

Second, stigma-reduction programs are to be implemented in order to cover fear and discriminative mindset. Workshops, reading about ethical care, and discussing ethical care can serve to dispel misconceptions, and assist the staff to be more comfortable when treating HIV-positive patients.

Third, healthcare facilities can maintain a steady supply of personal protective equipment and PPE measures as well as promote clear delivery mechanisms to establish compliance to safety protocols. This entails auditing of the use of gloves and gowns, safe disposal of shreds, and follow up after exposure.

Fourth, regular feedback and evaluation systems must be developed in order to detect knowledge, attitude, and practice gaps. This will facilitate specific measures in which shortcomings are realised.

Lastly, the important step is to combine practice based education with attitude growth towards harmonizing knowledge against its behaviors. Through skill-based training coupled with awareness and systematic reinforcement, healthcare personnel can be trained to practice more safely and less stigma, and it will eventually lead to better protection of both personnel and patients.

Future Directions

1. Future studies should include multiple healthcare institutions from different regions to enhance the external validity of the results.
2. Research should involve a wider range of healthcare professionals, including nurses, doctors, technicians, and support staff from various hospital departments.
3. Qualitative approaches such as interviews or focus group discussions are recommended to explore the underlying reasons behind knowledge gaps and attitudes toward HIV.
4. Longitudinal or interventional studies could be conducted to assess the impact of educational and training programs on improving HIV awareness and prevention practices.

5. Future research may also focus on evaluating institutional infection control policies and their effectiveness in minimizing occupational exposure to HIV among healthcare workers.

Limitations of the Study

1. The study was carried out in only one hospital, so the results may not represent other hospitals or healthcare settings.
2. The sample included only operating room staff and did not cover other healthcare workers in different departments.
3. The data were collected through a self-filled questionnaire, which may have caused incorrect or biased answers from some participants.
4. The study did not include interviews or group discussions, which could have helped to better understand the reasons behind workers' knowledge or attitudes.
5. Due to limited time and resources, only a small number of participants could be included, and the study could not be expanded to more hospitals.

REFERENCES

1. Aamir, A., Mehmood, A., Faizan, M., Farooq, M. U., & Namuddin Diwan, M. (2022). *KAP of Tuberculosis Among Healthcare Workers*. 1–11.
2. Abaszadeh, F. (2021). Knowledge, Attitude, And Performance of Operating Room Personnel about Occupational Exposure to Blood-Borne Infections. In *Article in Journal Of Advanced Pharmacy Education And Research*. <https://www.researchgate.net/publication/349297498>
3. Adal, O., Abebe, A., & Ayele, T. (2023). Knowledge, attitude, and practice of human immune-deficiency virus (HIV) post-exposure prophylaxis among healthcare workers of governmental hospitals in Addis Ababa, Ethiopia. *Infection Prevention in Practice*, 5(2), 100270. <https://doi.org/10.1016/j.infpip.2023.100270>
4. Alharbi, H. H. O., Al-Dubai, S. A. R., & Rami M. H. Almutairi, M. H. A. (2022). Stigmatization and discrimination against people living with HIV / AIDS : Knowledge , attitudes , and practices of healthcare. *Journal of Family and Community Medicine*, 29(3), 230–237. <https://doi.org/10.4103/jfcm.jfcm>
5. Alhumaid, S., Al Mutair, A., Al Alawi, Z., Alsuliman, M., Ahmed, G. Y., Rabaan, A. A., Al-Tawfiq, J. A., & Al-Omari, A. (2021). Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: a systematic review. *Antimicrobial Resistance and Infection Control*, 10(1), 1–32. <https://doi.org/10.1186/s13756-021-00957-0>

6. AlJohani, A., Karuppiyah, K., Al Mutairi, A., & Al Mutair, A. (2021). Narrative review of infection control knowledge and attitude among healthcare workers. *Journal of Epidemiology and Global Health*, 11(1), 20–25. <https://doi.org/10.2991/JEGH.K.201101.001>
7. Ara, A., Investigation, T., Sa, A. K., Doi, B., Med, C. A., Author, C., Hilmi, A., Mah, U., Sitesi, S. A., Daire, B., Hilmi, A., Medicine, I., Training, A., & Education, M. (n.d.). *The Investigation of Knowledge About and Attitude Toward HIV Among Healthcare Professionals in a Tertiary Hospital Üçüncü Basamak Bir Hastanede Sağlık Çalışanlarının HIV Konusunda Bilgi ve Davranış Biçimlerinin Araştırılması*. 291–296. <https://doi.org/10.4328/JCAM.1057>
8. Asaad, A. M., El-Sokkary, R. H., Saeed, M. A., Saeed, S., Asaad, Y. A., & Khater, W. S. (2025). Knowledge, attitude and practices (KAP) among healthcare professionals regarding HIV-related stigma. *Microbes and Infectious Diseases*, 6(1), 123–134. <https://doi.org/10.21608/mid.2024.321531.2224>
9. Asghar, S., Atif, M., & Masood, I. (2025). An intersectional analysis of infection prevention and control practices in Pakistan: A nationwide survey based on the Infection Prevention and Control Assessment Framework. *American Journal of Infection Control*, 53(8), 887–894. <https://doi.org/10.1016/j.ajic.2025.04.006>
10. Bashir, B., Zareen, H., Hussain Shah, S., Shah, S., & Author, C. (2024). An Investigation of Waste Management Practices in Pakistan: A Case of Ayub Teaching Hospital Abbottabad. *Int. j. Adv. Multidisc. Res. Stud*, 4(4), 485–499. www.multiresearchjournal.com
11. Chatha, Z. F., Rashid, U., Olsen, S., Din, F. ud, Khan, A., Nawaz, K., Gan, S. H., & Khan, G. M. (2020). Pharmacist-led counselling intervention to improve antiretroviral drug adherence in Pakistan: a randomized controlled trial. *BMC Infectious Diseases*, 20(1), 1–10. <https://doi.org/10.1186/s12879-020-05571-w>
12. Dick, H., & Mulholland, J. (2015). This is a preview . Log in through your library . Abstract Preview. *Review of Educational Research*, 85(2), 1–3.
13. Elghazaly, A., AlSaeed, N., Islam, S., Alsharif, I., Alharbi, L., Al Ashagr, T., Alshanifi, A., Alrashoudi, R., Alsharidi, A., Alhokail, A., Dirar, Q., Shibl, A., Al-Kattan, K., Abothneen, N., & Al-Mozaini, M. (2023). Assessing the knowledge and attitude towards HIV/AIDS among the general population and health care professionals in MENA region. *PLoS ONE*, 18(7 July), 1–13. <https://doi.org/10.1371/journal.pone.0288838>
14. Ghosh, N., Dey, A., Majumdar, S., & Halder, D. (2020). Knowledge and awareness among nurses in tertiary care hospitals of Kolkata regarding HIV positive patient care: a cross-sectional study. *International Journal Of Community Medicine And Public Health*, 7(6), 2357.

<https://doi.org/10.18203/2394-6040.ijcmph20202499>

15. Girma, A., Yenesew, T., & Biyadgie, A. (2017). Knowledge , attitude , practice and associated factors towards post exposure prophylaxis to HIV infection among health care professionals in Debre Markos town public health institutions ,. *Clinical Practice*, 14(6), 11. <https://10.0.16.76/clinical-practice.1000385>
16. Hani, Z., Yadzir, M., Ramly, M., & Suleiman, A. (2021). HIV-Related Knowledge, Attitude and Practice among Healthcare Workers (HCW) in Governmental Healthcare Facilities in Malaysia. *Primary Health Care: Open Access*, 11(3), 1–6. <https://www.iomcworld.org/open-access/hivrelated-knowledge-attitude-and-practice-among-healthcare-workers-hcw-in-governmental-healthcare-facilities-in-malaysia-66607.html%0Ahttps://www.iomcworld.org/abstract/hivrelated-knowledge-attitude-and-practice-amon>
17. Haq, A., & Ilyas, M. (2024). Article no.AJORIB.1535 Original Research Article Haq et al. In *Asian Journal of Research in Biosciences* (Vol. 6, Issue 1). <https://prh.globalpresshub.com/review-history/1535>
18. Harsha, L., Vishnu Priya, V., & Gayathri, R. (2020). Knowledge and awareness on HIV/AIDS among college students in a university hospital setting. *International Journal of Dentistry and Oral Science*, 7(12), 978–982. <https://doi.org/10.19070/2377-8075-20000234>
19. Iardino, R., Brogonzoli, L., Sala, E., Cascio, M., & Monforte, A. d' A. (2025). HIV and hospitals between knowledge and stigma. *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, 37(4), 654–668. <https://doi.org/10.1080/09540121.2025.2453123>
20. Khan, S., Saidu, H., Swat, S., Shah, B. A., Medical, K., & Anwar, M. (2025). *Review Journal of Neurological & Review Journal of Neurological &* 3(1), 266–276.
21. Ljubas, D., Škornjak, H., & Božičević, I. (2024). Knowledge, attitudes and beliefs regarding HIV among medical students in Zagreb, Croatia. *BMC Medical Education*, 24(1). <https://doi.org/10.1186/s12909-024-05994-y>
22. Mansur UD Din, G. singh. (2015). Assessment of knowledge, attitude and practice towards post exposure prophylaxis for HIV among health care professionals in Lahore. *Occupational Medicine & Health Affairs*, 03(04). <https://doi.org/10.4172/2329-6879.1000208>
23. Mansy, W., Syed, W., & Babelghaith, S. (2025). *Assessment of the knowledge , attitudes , and risk perceptions of pharmacy students regarding HIV / AIDS. January*, 1–7. <https://doi.org/10.3389/fpubh.2024.1499898>
24. Mekonnen, G., Liknaw, T., Anley, A., & Afenigus, A. D. (2024). Knowledge, attitudes, and associated factors towards HIV pre-exposure prophylaxis among health care providers. *Scientific Reports*, 14(1), 1–14.

<https://doi.org/10.1038/s41598-024-56371-0>

25. Mendez-lopez, A., Burns, F., Sullivan, A., Deogan, C., Darling, K. E. A., Simoes, D., Garner, A., Amo, J., Pasanen, S., Vaughan, E., Verluyten, J., & Bhagani, S. (2025). *cross-sectional study in Europe and Central Asia Background*. 1–8.
26. Mosende, A. G., Lacambra, C. B., & De Los Santos, J. A. (2023). Knowledge, Attitudes, and Behaviors toward HIV/AIDS among Health Care Workers' in Urban Cities in Leyte Philippines. *Malaysian Journal of Nursing*, 14(3), 185–193. <https://doi.org/10.31674/mjn.2023.v14i03.022>
27. Nagai, S., Kitahara, T., Kito, K., & Hitosugi, M. (2023). HIV/AIDS knowledge level, awareness of public health centers and related factors: a cross-sectional study among Brazilians in Japan. *BMC Public Health*, 23(1), 1–10. <https://doi.org/10.1186/s12889-023-17308-w>
28. Qadir, H. K. (2025). Nurses' knowledge and attitudes regarding HIV/AIDS in Erbil City: a cross-sectional study. *Journal of Infection in Developing Countries*, 19(2), 298–305. <https://doi.org/10.3855/jidc.19104>
29. Qianqian, Y., Chunhui, L., Xun, H., Anhua, W., Yuhua, C., Yaowang, W., & Pengcheng, Z. (2022). Knowledge of occupational exposure to HIV among healthcare workers in college campus clinics and tertiary hospitals. *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, 34(3), 388–391. <https://doi.org/10.1080/09540121.2021.1981815>
30. Quinn, T. C. (2021). Forty years of AIDS: A retrospective and the way forward. *Journal of Clinical Investigation*, 131(18). <https://doi.org/10.1172/JCI154196>
31. Rana, B. K., Sarfraz, M., Reza, T. E., & Emmanuel, F. (2023). A Cross-Sectional Study to Assess HIV/AIDS-Related Stigma and Its Drivers Among Dental Healthcare Providers in Islamabad, Pakistan. *Cureus*, 15(10). <https://doi.org/10.7759/cureus.46769>
32. Saad, R. K., Khader, Y., Aqel, A. J., Satyanarayana, S., Wilson, N., & Abaza, H. (2024). HIV- related knowledge, attitude, practices, and stigma among healthcare providers caring for HIV in Jordan: Identification of several organizational challenges. *Heliyon*, 10(2), e24423. <https://doi.org/10.1016/j.heliyon.2024.e24423>
33. Sain, S., Ramasamy, N., Verma, I., Tripathy, J., Narang, U., Kumbhalkar, S., Dube, A. H., & Nagpure, K. B. (2025). Knowledge, Attitudes, and Practices of Nurses Regarding Needle Stick Injuries, HIV, and Hepatitis B Prevention in a Tertiary Care Center in Nagpur, India: A Cross-Sectional Study. *Cureus*, 17(7). <https://doi.org/10.7759/cureus.87160>
34. Sallam, M., Alabbadi, A. M., Abdel-Razeq, S., Battah, K., Malkawi, L., Al-Abbadi, M. A., & Mahafzah, A. (2022). HIV Knowledge and Stigmatizing

- Attitude towards People Living with HIV/AIDS among Medical Students in Jordan. *International Journal of Environmental Research and Public Health*, 19(2), 1–15. <https://doi.org/10.3390/ijerph19020745>
35. Shah, S., Elgalib, A., Al-Wahaibi, A., Al-Fori, M., Raju, P., Al-Skaiti, M., Al-Mashani, H. N., Duthade, K., Omaar, I., Muqetullah, M., Mitra, N., Shah, P., Amin, M., Morkos, E., Vaidya, V., Al-Habsi, Z., Al-Abaidani, I., & Al-Abri, S. S. (2020). Knowledge, attitudes and practices related to HIV stigma and discrimination among healthcare workers in Oman. *Sultan Qaboos University Medical Journal*, 20(1), e29–e36. <https://doi.org/10.18295/squmj.2020.20.01.005>
 36. Shahar, E., Maor, C., & Moshe-Eilon, Y. (2020). Medical personnel knowledge and stigmatic attitude toward HIV patients in a high-income country. *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, 32(8), 1023–1029. <https://doi.org/10.1080/09540121.2020.1734172>
 37. Shakeel, S., Iffat, W., Naseem, S., Nesar, S., Rehman, H., Yaqoob, M., Rehman, A. U., Barrak, I., Jamshed, S., & Gajdács, M. (2022). Healthcare Professionals' Practice of HIV Post-Exposure Prophylaxis in Clinical Settings in Karachi, Pakistan. *Healthcare (Switzerland)*, 10(2). <https://doi.org/10.3390/healthcare10020277>
 38. Shamil, M., Legese, N., & Tadiwos, Y. (2021). Assessment of knowledge, attitude, practice and associated factors towards post-exposure prophylaxis for hiv/aids among health professionals in health centers found in harari region, eastern ethiopia. *HIV/AIDS - Research and Palliative Care*, 13, 41–51. <https://doi.org/10.2147/HIV.S278150>
 39. Shongwe, M., Baulita, N., Spellman, E., Menin, J., & Dhairyawan, R. (n.d.). *Measuring health care HIV knowledge within our NHS Trust*.
 40. Wouters, E., Van Rensburg, A. J., Engelbrecht, M., Buffel, V., Campbell, L., Sommerland, N., Rau, A., Kigozi, G., Van Olmen, J., & Masquillier, C. (2022). How the HIV/TB co-epidemic-HIV stigma-TB stigma' syndemic impacts on the use of occupational health services for TB in South African hospitals: A structural equation modelling analysis of the baseline data from the HaTSaH Study (cluster RCT). *BMJ Open*, 12(4). <https://doi.org/10.1136/bmjopen-2020-045477>