The Original

Health System Barriers to Effective HIV Screening and Management in Baluchistan's Public Facilities

[1]Prof, Dr. Raz Muhammad Kakar, [2]Dr. Asmatullah, [3]Dr. Zain Ullah Khan, [4]Dr. Mir Abdul Qadir, [5]Dr Zia ud Din, [6]Dr, Uzma Qudoos, [7]Sana Ullah Kakar

[1]HOD Department of Neurosurgery Bolan Medical Collage Hospital Principal Bolan Medical Collage
[2]Assistant prof Department of ENT Bolan Medical Collage Hospital Quetta Vice Principal Bolan Medical Collage Quetta
[3]Associate Prof Balochistan Institute of Psychiatry and Behavioural Sciences BIPBS Quetta
[4]Additional Director Post Graduate Medical Institute Quetta
[5]Divisional Director Health Quetta, Balochistan
[6]Bolan Medical Collage Hospital Quetta
[7]Balochistan Institute of Psychiatry and Behavioural Sciences BIPBS Quetta

Corresponding Author: Prof, Dr. Raz Muhammad Kakar, HOD Department of Neurosurgery Bolan Medical Collage Hospital Principal Bolan Medical Collage. razbazia67@gmail.com

ABSTRACT

Background

Human Immunodeficiency Virus (HIV) remains a pressing global health challenge, particularly in resource-limited settings. In Pakistan, HIV prevalence has risen sharply in recent years, with Balochistan facing unique barriers due to weak infrastructure, sociocultural stigma, and poor service accessibility. Despite ongoing efforts under the National AIDS Control Program, HIV screening and treatment adherence remain suboptimal in the province.

Objective

With a focus on availability, infrastructure, stigma, and care results, this study aimed to identify and examine systemic impediments influencing HIV screening and management in Balochistani public healthcare facilities.

Methods

150 participants, including patients and healthcare professionals, participated in a quantitative cross-sectional descriptive study in Quetta's public facilities. A standardized, pretested questionnaire encompassing workforce and infrastructure, sociodemographic data, service accessibility, and stigma-related issues was used to gather the data. To summarize the data, descriptive statistics were employed. To investigate relationships between education and

screening as well as between education and service satisfaction, chi-square and ANOVA tests were used.

Results

32.7% of participants were illiterate, while 62% of participants were female. Just 52.7% of respondents said their facilities offered HIV testing, and 50% said they had run out of ART or test kits. 54.7% of facilities had insufficient laboratory services, while 47.3% had insufficient counseling services. Stigma and a lack of awareness regarding HIV services were reported by half of the respondents. The descriptive results revealed inadequate ART adherence (mean = 1.51), low screening uptake (mean = 1.57), and low service satisfaction (mean = 1.46). There was no significant difference in satisfaction across education groups ($p = 0.076$), and there was no significant correlation between education and HIV screening ($p = 0.079$) according to chi-square analysis.

Conclusion

Systemic obstacles that hinder efficient HIV screening and management in Balochistan include a lack of supplies, poor infrastructure, a shortage of workers, stigma, and low awareness. All demographic groupings are impacted by these pervasive issues. System-wide changes are needed to address them, including bolstering supply chains, increasing counseling and infrastructure, lowering stigma, and incorporating HIV care into larger health platforms to improve long-term management and early diagnosis.

Keywords: HIV Screening, HIV Services, Barriers to Healthcare, Antiretroviral Therapy (ART), ART Adherence

INTRODUCTION

HIVs remain one of the most pressing global problems concerning social, medical, and economic impacts on humanity. HIV primarily attacks the CD4 helper T-cells leading to further immunosuppression and the increase of susceptibility to cancer and opportunistic infections (1). The primary modes of spread of the virus are unprotected sexual contact, infected blood transfusion, and sharing infected needles as well as mother-to-child infection during delivery or breastfeeding (2). HIV is a virus of the Retroviridae family and genus called Lentivirus that has distinguishing features that allow it to fuse with the host DNA and become almost impossible to eliminate (3). HIV has remained one of the largest global health problems with millions of infected individuals representing diverse population groups since its initial appearance in the early 1980s. Even though life expectancy and quality of life have improved greatly because of antiretroviral therapy (ART), the disease continues to spread particularly where healthcare infrastructure is poor, sociocultural beliefs and ignorance among people are high (4).

The World Health Organization (WHO) estimates that millions of new HIV infections are made annually, and that as of the end of the year 2022, more than 38 million people worldwide already live with the virus (5). Because of several institutional and behavioral risk factors, the rate of infection in some of the marginalized groups is disproportionate; these include intravenous drug users, sex workers, and men who have sex with men (MSM). Epidemiological trends indicate that there exist significant regional disparities in HIV prevalence, as the developed world such as

the US has implemented comprehensive prevention and treatment strategies, whereas resource limited regions of the Asian and African regions continue to grapple with the increasing cases of HIV infection (6). Approximately 1.2 million Americans are HIV-positive, and approximately 35000 cases are reported each year, which means that the disease is a significant threat to the national health despite the advances in medicine. African American and Hispanic communities and other underprivileged groups have a higher disease burden, and it is mostly transmitted through sex (7).

The HIV-diagnosed population in Pakistan is increasing at an alarming rate, and the number of cases is estimated to be 190,000 in 2023 (9). The epidemic in Pakistan remains disproportionate with a high number of injectable drug users (38.4) and transgender people (7.5) and sex workers (5.6) (10). HIV became an even greater issue in 2024. According to the latest national statistics over 9700 new cases of HIV were reported in the first nine months of the year with an average of about 1079 new cases of HIV being reported every month. These numbers should reach above 12950 at the end of the year, exceeding the 12731 cases of 2023 (11). This increase does not equally affect the provinces. Punjab leads the race with 5691 cases registered in the first half of the year and the third quarter of 2024, indicating that the epidemic is so concentrated there that it is among the most populated regions (12,13). By October 2024, Sindh had 2531 new HIV infections, among which 635 had been in Karachi.

New HIV infections were estimated at about 69.4 per cent in men, 20.5 per cent in women, 4.1 per cent in transgender and 6 per cent in children as per a recent 2024 report. This implies that there exist numerous sources of transmission and that maternal screening procedures are lacking. It also contradicts the world trend of a higher number of cases being reported in men and this highlights the idea that the disease is not discriminatory with regard to gender [13,14].

In order to reduce the transmission of the disease, the National AIDS Control Program (NACP) has been vigorously campaigning on screening, care, and prevention. Nevertheless, the socioeconomic factors, stigma, and lack of access to healthcare centers continue to impair effective illness management (15). Structural barriers that lead to non-adherence to ART include poverty, ignorance, and social taboos among others, which reduce the effectiveness of treatment and increase the rate of transmission (16).

Moreover, to avoid vertical transmission, mother-to-child transmission (MTCT) remains a critical issue that requires better prenatal screening and administration of ART using pregnancy (17). The spread of HIV is partly contributed using non-sterilized medical equipment in medical facilities and unscreened blood transfusion (18). Ignorance exacerbates the issue since illiterate individuals tend to believe more in the falsehoods about HIV and therefore, they tend to commit risky behavior, particularly in poorer regions such as Balochistan (19).

The purpose of the study was to give evidence-based advice on how to enhance HIV prevention, diagnosis, and treatment services in the province through the identification and analysis of the health system factors that hinder the effective screening of HIV and its management in Balochistani public healthcare facilities.

LITERATURE REVIEW

The HIV control programs in Pakistan have also recognized several interrelated challenges which affect HIV screening, linking care and adherence to treatment. As studies have revealed, stigma (both social and medical practitioners) is a significant challenge to any individual who is at risk of being untested (or left in treatment). As a qualitative study of HIV-positive people in Punjab revealed, a lack of concern about confidentiality violation, clinic employee's discrimination, and fear of social rejection were the strongest reasons against seeking care and screening services. These stigma-related fears were especially intense among the conservative or rural cultures, where HIV is often associated with immoral conduct. 20].

Healthcare provider attitudes have a role to play. A survey that was carried out on dental healthcare practitioners in Islamabad revealed that most of them were uncomfortable treating patients with HIV and that there were prevalent myths of the risk of infection of HIV in their hospitals. Lack of proper training and ambiguous processes contributed to the discriminatory practices, and subsequently a less confident patient and a future one became towards medical facilities. [21].

Geographical and financial barriers to access are also quite common in literature. Lack of time to spend at work due to the necessity of taking leaves was ranked among the significant challenges reported in Punjab, as well as long distances to travel to HIV clinics and transportation costs. [20]. Prison statistics especially in Balochistan indicate that risk behaviors (sharing needles and extra marital sex) and HIV prevalence (1.6) among prisoners is high but also indicate that the prison system is limited in conducting routine screening and follow-up. (22). Such findings suggest that in environments where screening is possible, there are often a shortage of resources (labs, people and test kits) to provide credible HIV services.

Poor health awareness and literacy is another significant setback. In many studies, it is indicated that many individuals have misinformation about the methods of prevention and transmission and do not believe that they are in danger. As an example, HIV is thought by many significant groups and their acquaintances as a far-off or foreign group problem instead of a factor that might influence them. (23).

Unhealthy patterns in structural health system also reflect as recurring themes. The continuity of diagnosis and treatment is interfered with according to reports by supply chain problems which include antiretroviral and HIV test kit stockouts. As per the strategic assessment, provincial AIDS prevention program in Balochistan tends to omit the contracting with community organizations and non-governmental organizations in a variety of regions, limiting the coverage of services. (25). Poor budget implementation, poor governance and lack of balance in the distribution of facilities amplify inequalities in access. Some provinces have decreased capacity in terms of effective screening because of insufficient facility preparedness which includes lack of diagnostic laboratories, counseling rooms, and skilled employees. (24).

Finally, policy level assessments indicate gaps between policy and implementation. Reports have indicated that the 20202025 AIDS strategy in Balochistan has not been achieving its objectives. (25). Preventative programs are either not implemented or are underfunded and sometimes the allotments provided in the budget are not fully used in many districts. The barriers are poor

coordination between governmental tiers (district, provincial), inconsistent surveillance, and the absence of the inclusion of the HIV screening in other health services (i.e., maternity health, TB clinics).

RESEARCH OBJECTIVE

The main objective of this study was to explore the organizational barriers which hinder the effective screening and management of HIV among the Balochistani governmental healthcare institutions. The areas of interest in the study were the barriers to diagnosis and treatment in the workforce and infrastructure, the accessibility and availability of HIV testing services, and the effects of stigma, cultural beliefs, and community awareness on the utilization of care. Determining the service delivery gaps and making evidence-based proposals to improve HIV prevention, early detection and long-term management were also the goals. The outcome of the project was the support of a more inclusive and responsive provincial health system.

METHODOLOGY

The quantitative and cross-sectional descriptive study was conducted in Quetta, the capital city of Balochistan in Pakistan within the healthcare institutions of the population. Quetta was selected as the study site since it is the large metropolitan area in the province and has numerous HIV screening and control facilities, primary health centers, and referral hospitals. Because these facilities cater to both urban and peri-urban residents, it provides an appropriate background to study the obstacles within the health system.

The study population comprised of patients utilizing HIV-related services and medical practitioners in the field of screening and management of HIV. A purposive sample of 150 participants has been selected to ensure that patients and healthcare professionals have been represented within the sample. The inclusion criteria were adults (18 years and above) who are actively engaged in the delivery of HIV care or interested in accessing HIV testing and treatment services. The ones that did not provide their consent were not included.

A questionnaire of standardized, pretested questionnaire was used to collect data. The questionnaire was developed according to the aim of the research and the literature review and was divided into four major areas: (i) Sociodemographic characteristics; (ii) the accessibility and availability of HIV testing services; (iii) barriers to workforce and infrastructure; and (iv) stigma, awareness, and cultural influences.

The questionnaire was administered in face-to-face interviews by trained data collectors in healthcare facilities with informed consent and ethics granted. This was done through assurance of anonymity and confidentiality to the participants. The data were coded and analyzed with the help of SPSS 24.

The data on the demographics and responses on the barriers were evaluated with the help of the descriptive statistics (frequencies, percentages, means, and standard deviations). In the case of categorical variables, frequency tables were generated. The relationships between dependent outcomes (i.e. high blood pressure) and independent factors (i.e. level of education, residence, and awareness of HIV services) were evaluated using chi-square tests and other inferential

statistics. There were also ANOVA and independent t-tests as necessary to be used to compare the means of the groups. The statistical significance was determined as a p-value of below 0.05. The research met the ethical standards of research involving human subjects. The institutional review board gave its consent, and all participants signed a written informed consent. The respondents were notified of the right to a free withdrawal of any time, and their anonymity and confidentiality were maintained.

RESULTS

Frequency tables

Table 1: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	57	38.0	38.0	38.0
	Female	93	62.0	62.0	100.0
	Total	150	100.0	100.0	

Table 2: Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Illiterate	49	32.7	32.7	32.7
	Primary	33	22.0	22.0	54.7
	Secondary	30	20.0	20.0	74.7
	Graduate	38	25.3	25.3	100.0
	Total	150	100.0	100.0	

Table 3: Residence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban	84	56.0	56.0	56.0
	Rural	66	44.0	44.0	100.0
	Total	150	100.0	100.0	

Table 4: HIV Testing Available

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	79	52.7	52.7	52.7
	No	71	47.3	47.3	100.0
	Total	150	100.0	100.0	

Table 5: Waiting Time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Short	54	36.0	36.0	36.0
	Moderate	50	33.3	33.3	69.3
	Long	46	30.7	30.7	100.0
	Total	150	100.0	100.0	

Table 6: Distance to Facility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Near	92	61.3	61.3	61.3
	Far	58	38.7	38.7	100.0
	Total	150	100.0	100.0	

Table 7: Stockouts

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	75	50.0	50.0	50.0
	No	75	50.0	50.0	100.0
	Total	150	100.0	100.0	

Table 8: Enough Trained Staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	74	49.3	49.3	49.3
	No	76	50.7	50.7	100.0

	Total	150	100.0	100.0	

Table 9: Lab Support Adequate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	68	45.3	45.3	45.3
	No	82	54.7	54.7	100.0
	Total	150	100.0	100.0	

Table 10: Counseling Available

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	79	52.7	52.7	52.7
	No	71	47.3	47.3	100.0
	Total	150	100.0	100.0	

Experienced Stigma

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	75	50.0	50.0	50.0
	No	75	50.0	50.0	100.0
	Total	150	100.0	100.0	

Table 11: Knowledge HIV Services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Adequate	75	50.0	50.0	50.0
	Inadequate	75	50.0	50.0	100.0
	Total	150	100.0	100.0	

Descriptive Statistics

Table 12: Age

	N	Minimum	Maximum	Mean	Std. Deviation
Age	150	1	4	2.46	1.109
Valid N (listwise)	150				

Table 13: Ever Screened HIV

	N	Minimum	Maximum	Mean	Std. Deviation
Ever_Screened_HIV	150	1	2	1.57	.496
Valid N (listwise)	150				

Table 14: ART Adherence

	N	Minimum	Maximum	Mean	Std. Deviation
ART_Adherence	150	1	2	1.51	.502
Valid N (listwise)	150				

Table 15: Satisfaction with services

	N	Minimum	Maximum	Mean	Std. Deviation
Satisfaction with Services	150	1	2	1.46	.500
Valid N (listwise)	150				

Table 16: Chi-Square Test (Education & Ever screened HIV)

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.795[a]	3	.079
Likelihood Ratio	6.828	3	.078
Linear-by-Linear Association	2.646	1	.104
N of Valid Cases	150		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.80.

Table 17: ANOVA

Satisfaction with Services

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.711	3	.570	2.342	.076
Within Groups	35.549	146	.243		
Total	37.260	149			

DISCUSSION OF RESULTS

This study focused on the problem of stigma, infrastructural gaps, demographic characteristics, and service outcomes as the key factors to explore the problem of systems barriers to effective HIV screening and management in Balochistani state health institutions. The findings have significant implications for the effect that health system constraints have on HIV control in the low resource setting.

Out of all 150 study participants, most of them (62 out of 150) were female, and only a minority (38 out of 150) were male participants, as indicated in Table 1. This implies that women have a greater likelihood of receiving HIV related services and this may be attributed to the fact that women are becoming more involved in reproductive health services to access the healthcare

system. However, the same gender gap also indicates the under-use of care by the male populations bearing in mind that the prevalence of HIV in Pakistani men is on the rise.

The percentage of illiterates stood at 32.7, primary stood at 22, secondary at 20 and graduates at 25.3, meaning that education status was extensive (Table 2). This distribution shows the potential role of literacy on HIV knowledge, uptake in testing, and adherence to treatment and indicates the educational disparities in Balochistan more broadly.

The distribution of the residents of the participants showed that 44% of them were rural and 56% were urban (Table 3). The rural percentage indicates that health participation activities have not been deterred by distance and lack of proper infrastructure even in the case where access was relatively higher among urban residents.

Services became available and unavailable at different times. Only a fraction (52.7) reported the presence of HIV testing in their establishments (Table 4) meaning that there was a wide gap with nearly half of them having no direct access to screening services? The other problem was wait times; Table 5 indicated that 36% of those interviewed had short wait times, 33.3% had intermediate wait times and 30.7% had long wait times. Long queues can put off returning people and reduce the total number of people who are screened.

Geographic accessibility was one of the problems: 38.7% of the participants reported that the nearest institution was far (Table 6). This barrier is particularly significant in such a province as Balochistan which has problematic topography and poor road networks. Moreover, half of the respondents said that they have had ART or test kit stockouts (Table 7) and this is a symptom of structural dysfunction in supply chain management.

Large inter-facility discrepancy is reflected by almost equal proportions of participants that reported adequate and inadequate staffing (49.3% vs. 50.7%) (Table 8). 54.7% of participants reported that laboratory support was insufficient (Table 9) and this implies that diagnostic bottlenecks existed. Similarly, 47.3% of hospitals did not offer counseling (Table 10) and this limited the opportunity to educate patients and offer emotional support.

Since nearly fifty percent of the respondents (50) reported having faced discrimination in hospital facilities, stigma has continued to be a significant deterrent. This finding confirms previous studies that established stigma as an obstacle to service utilization.

Knowledge gaps were evident because half of the surveyed respondents indicated that they were aware of HIV services too little (Table 11). This is in line with previous studies that show that false information and lack of awareness inhibit testing and compliance.

Descriptive statistics were found to reveal that HIV care outcomes were challenging. Table 13 indicates that the average score of people who had ever been screened on HIV was 1.57 (SD =0.496) which implies that a considerable proportion had not been screened. The average adherence to ART was 1.51 (SD = 0.502) (Table 14), which means that a significant number of participants have not taken their therapy. The service satisfaction mean score was also low (1.46 SD = 0.500) (Table 15), which means that the general feeling towards the available care is not satisfactory.

The chi-square test was used to determine the relationship between education and HIV screening (Table 16). The correlation was not significant although there were differences observed (2 = 6.795, 3 =df, 0.079). This shows that there was no evident influence of the level of education on whether the participants in this sample were screened or not. However, the p-value is close to 0.05, which suggests that there can be a tendency whereby the increased screening uptake can be linked to higher education, as it is consistent with the broad evidence that literacy correlates with health-seeking behaviors.

ANOVA test was used to differentiate the satisfaction levels with the services of the various groups of people of different educational levels (Table 17). The outcome indicated that there was no statistically significant difference between the two (F = 2.342, p = 0.076). This is an indication that the dissatisfaction with the HIV services is not confined to a particular category of education. The absence of meaningful disparities highlights that all people, irrespective of their level of education, are impacted by the lack of essential supplies, insufficient workforce, and stigma (systemic barriers).

The findings suggest that there are severe gaps in the HIV response system in Balochistan. Service gaps like stockout of test kits, shortage of personnel and poor lab support directly contribute to early diagnosis and effective management. It is further constrained by geographic barriers, particularly to rural communities. Moreover, stigma and fake news remain widespread and demoralize individuals to seek timely treatment. As opposed to the fact that they are only restricted to certain subgroups in regard to demographics, the fact that the inferential tests did not find any significant differences shows that these are systemic and widespread barriers.

CONCLUSION

This paper has found several structural barriers that do not allow effective HIV screening and care in state health centers in Balochistan. Based on the results, the major areas of service deficiencies include frequent shortages of ART and HIV test kits, ineffective laboratory support,

absence of qualified personnel, and the absence of counseling. Wait time and inaccessibility based on geography are also limiting access to care, particularly among the rural populations. Stigma and lack of awareness about the HIV service are reinforcers of social and cultural hurdles, which remain to be substantial barriers to screening and adherence.

The inferential research showed that the dissatisfaction of service was similar among all types of education and that education level did not significantly correlate with the uptake of HIV screening. This implies that barriers are not specific to specific demographic subgroups. The interventions should be focused on improving supply chain reliability, expanding laboratory and counseling services, addressing staffing challenges and implementing stigma-reduction programs in balochistan to control HIV. As a way of encouraging early screening and adherence to ART in the long-term, HIV services need to be included in more extensive health platforms and targeted education campaigns. The system of monitoring and governance of provincial health system needs to be strengthened to effect long-term changes.

QUESTIONNIARE

Section A: Socio-demographic Information

1. Age
    - 18-25
    - 26-35
    - 36-45
    - 46 & Above
2. Gender
    - Male
    - Female
3. Education
    - Illiterate
    - Primary
    - Secondary
    - Graduate

4. Residence
    - Urban
    - Rural
5. Occupation
    - Employed
    - Unemployed
    - Student
    - Other

Section B: Availability and Accessibility of HIV Services

6. Is HIV testing available in your healthcare facility?
    - Yes
    - No
7. Waiting time for screening
    - Short
    - Moderate
    - Long
8. Distance to nearest facility
    - Near
    - Far
9. Have you ever faced stockouts of HIV test kits or ART?
    - Yes
    - No

Section C: Infrastructure and Workforce

10. Do you feel there are enough trained healthcare staff for HIV services?
    - Yes
    - No
11. Is laboratory and diagnostic support adequate?

- Yes
- No

12. Are counseling services available in your facility?

- Yes
- No

Section D: Stigma, Awareness, and Community Factors

13. Have you ever experienced stigma or discrimination in a healthcare setting?

- Yes
- No

14. Knowledge about HIV services

- Adequate
- Inadequate

15. Do cultural or social beliefs prevent people from getting tested?

- Yes
- No

Section E: Outcome Measures

16. I have been screened for HIV.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

17. ART adherence status

    - Never adhere
    - Rarely adhere
    - Sometimes adhere
    - Often adhere
    - Always adhere

18. Satisfaction with services

- Very Dissatisfied
- Dissatisfied
- Neutral
- Satisfied
- Very Satisfied

REFERENCES

1. Swinkels, H., Vaillant, A. J., Nguyen, A., & Gulick, P. (2024). HIV and AIDS. StatPearls.
2. Coffin, J., Blomberg, J., Fan, H., Gifford, R., Hatziioannou, T., Lindemann, D., ... & ICTV Report Consortium. (2021). ICTV virus taxonomy profile: Retroviridae 2021. Journal of General Virology, 102(12), 001712.
3. Sharma, S., Bhavani, R., & Singh, K. (2024). Unrevealing the challenge of perinatal transmission and risk factors of Hepatitis C virus infection in India: a review. Discover Medicine, 1(1), 18.
4. Goodwin, K. (2021). The World Health Organization and the Emergence of HIV/AIDS. The Mirror-Undergraduate History Journal, 41(1), 86-94.
5. World Health Organization. (2022). Global health sector strategies on, respectively, HIV, viral hepatitis and sexually transmitted infections for the period 2022-2030. World Health Organization.
6. Damgacioglu, H., Sonawane, K., Dorali, P., & Deshmukh, A. A. (2024, December). Estimating and Projecting the Economic Impact of Antiretroviral Therapy on the US Economy Through an Updated HIV Microsimulation Model. In 2024 Winter Simulation Conference (WSC) (pp. 1047-1058). IEEE.
7. Heath, K., Levi, J., & Hill, A. (2021). The Joint United Nations Programme on HIV/AIDS 95–95–95 targets: worldwide clinical and cost benefits of generic manufacture. Aids, 35(Supplement 2), S197-S203.
8. 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).

9. Rashid, A., Kang, L., Yi, F., Chu, Q., Shah, S. A., Mahmood, S. F., ... & Shao, Y. (2024). Human Immunodeficiency Virus Type-1 Genetic Diversity and Drugs Resistance Mutations among People Living with HIV in Karachi, Pakistan. Viruses, 16(6), 962.
10. Mark, M. (2024). The international problem of HIV/AIDS in the modern world: a comprehensive review of political, economic, and social impacts. Res Output J Public Health Med, 42, 47-52.
11. Irfan H, Irfan H. HIV Surge in Pakistan: A Challenge for the Nation. Asia Pac J Public Health. 2023;35:295-296. [RCA] [PubMed] [DOI] [Full Text] [Cited by in RCA: 2] [Reference Citation Analysis (0)]
12. Ali H, Zakar R, Junaid K, Khan A, Fischer F. Frequency and reasons for delayed treatment initiation after HIV diagnosis: cross-sectional study in Lahore, Pakistan. BMC Public Health. 2021;21:1000. [RCA] [PubMed] [DOI] [Full Text] [Full Text (PDF)] [Cited by in Crossref: 6] [Cited by in RCA: 13] [Article Influence: 3.3] [Reference Citation Analysis (0)]
13. Bhatti MW. Alarming rise of HIV in Pakistan: 1,079 new cases every month. The News International. 28 Dec 2024. Available from: https://www.thenews.com.pk/print/1266262-amid-mounting-public-concern-alarming-rise-of-hiv-in-pakistan-1-079-new-cases-every-monthd.
14. Haider S. KP reports over 1,000 new HIV cases in 2024. The News International. 15 Dec 2024. Available from: https://www.thenews.com.pk/print/1261772-kp-reports-over-1-000-new-hiv-cases-in-2024.
15. Omondi, E. O., Mbogo, R. W., & Luboobi, L. S. (2022). A mathematical model of HIV transmission between commercial sex workers and injection drug users. Research in Mathematics, 9(1), 2082044.
16. Ahmed, A., Dujaili, J. A., Jabeen, M., Umair, M. M., Chuah, L. H., Hashmi, F. K., & Chaiyakunapruk, N. (2022). Barriers and enablers for adherence to antiretroviral therapy among people living with HIV/AIDS in the era of COVID-19: a qualitative study from Pakistan. Frontiers in pharmacology, 12, 807446.

17. Solikhah, F. K. (2023). HIV and prevention of mother-to-child transmission awareness, perceptions, and attitudes of pregnant women in Malang: qualitative research. HIV & AIDS Review. International Journal of HIV-Related Problems, 22(4), 343-348.
18. Jacob, E. A. O. O. E., Kolawole, F., & Titilayo, O. E. (2022). Attitudes and behaviors of healthcare professionals toward HIV positive patients in a tertiary hospital. Biomedical Research and Clinical Reviews, 6(3).
19. Bashir, S., & Zarar, R. (2023). The role of nongovernmental organizations (NGOs) in prevention and treatment of HIV/AIDS in District Kech. Int J Spec Educ, 38(1).
20. Shamshad T, Bhutta MH, Kamran A, Javed H. Barriers in Seeking HIV Care Services: An Investigation of People Infected with HIV in Punjab-Pakistan. Pakistan Journal of Society, Education and Language (PJSEL). 2023;9(2):263–273. jehanf.com
21. A Cross-Sectional Study to Assess HIV/AIDS-Related Stigma and Its Drivers Among Dental Healthcare Providers in Islamabad, Pakistan. 2022;601 providers. PubMed
22. Prevalence and associated risk factors of HIV in prisons in Balochistan, Pakistan: a cross-sectional study. PLoS / PMC. 2018. PubMed+1
23. Understanding barriers to HIV pre-exposure prophylaxis initiation among men who have sex with men in Sindh, Pakistan." International Journal of STD & AIDS. 2024. PubMed+1
24. Barriers and Enablers for Adherence to Antiretroviral Therapy Among People Living With HIV/AIDS in the Era of COVID-19: A Qualitative Study From Pakistan. 2022. PubMed
25. The challenge of HIV spread" – analysis of the Balochistan AIDS Control Programme's budget execution issues, district-level coverage gaps and implementation shortfalls. The News, Pakistan.