Revealing the Magnitude of HIV Prevalence and Unraveling Its Risk Factors in The Enclave of District DG Khan

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Abstract

The risk is amplified by poverty, lack of education and social stigma. Transmission occurs mainly by unprotected sex, needle sharing, or mother-to-child - either during birth or breastfeeding. HIV's pathogenic life cycle begins within the body, from initial CD4/co-receptor binding and cell entry to proviral DNA integration, host cell machinery replication, and immune response evasion. This chronic immune activation and CD4+ T cell depletion over time leads to immunodeficiency (AIDS) if left untreated. Antibody and viral load testing can confirm infection. Acute HIV symptoms resemble the flu, while later stages see opportunistic infections when immunity is compromised. Screening is essential for epidemiological research and exposure risk evaluation. In closing, this study aimed to evaluate HIV prevalence and associated factors among residents of DG Khan District, Pakistan, to help address challenges and better focus local prevention/treatment programs.

Keywords: HIV Prevalence, Risk Factors, Dera Ghazi Khan.

Introduction

Over the last century, several medical advancements and medications have been produced to treat and eradicate various diseases and infections. However, some people require surgical intervention and public health action. HIV/AIDS remains a significant public health issue in the globe. While the number of facts has reduced and is higher in comparison to older people, the condition continues to impact the general community, with minorities accounting for the majority of those affected. However, recently, the number of incidents has increased dangerously. It is presently the world's fastest-growing HIV endemic, with a spike of more than 25% in incidence since 2001 (UNAIDS, 2020).

It is spread via sharing injection equipment or coming into touch with specific bodily fluids of an HIV-positive person, most frequently during unprotected contact (sex without the use of a

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condom or HIV medicine to avoid or treat HIV). HIV can lead to AIDS if it is not treated (Dickson-Gomez et al., 2020). The WHO recommends using HIV prevalence as a measure to track the performance of national AIDS prevention programs. The current review was created to assist WHO with its HIV-related initiatives among young people (Rodríguez et al., 2013; Jawad et al., 2023; Sajjad et al., 2024). The terms of reference for discussion are a review of the literature and experience with using HIV prevalence to determine trends in HIV infection among people aged 15 to 24.

The various techniques for addressing such restrictions that have been proposed are then reviewed. Settings with low resources are given special consideration, as they are frequently the most affected by the HIV epidemic. In 2019, around 38 million people worldwide were living with HIV or AIDS. According to UNAIDS (2020), 36.2 million were adults, whereas 1.8 million were children under 15. Furthermore, the HIV epidemic has an impact not only on human health but also on families, communities, infrastructure and national development. Other communicable diseases, food shortages and other serious issues plague many of the world's most HIV-affected regions. It is not enough that people are dying from AIDS; no one should die from ignorance (Taylor et al., 2020). The gradual deterioration of the human immune system, commonly referred to as acquired immunodeficiency syndrome (AIDS), is an indicator of HIV (human immunodeficiency virus). HIV causes CD4 T cells responsible for coordinating the immune system's cellular and humoral responses to slowly but gradually die. Globally, this illness has claimed 25 million lives (Yousaf et al., 2011; Bilal, 2021).

Only 0.04% of the overall population in Pakistan is HIV positive (Singh et al., 2014). The research conducted in 2005 identified the threat of an expanding HIV spread in Pakistan (Altaf et al., 2012; Singh et al., 2014; Altaf et al., 2012; Rajabali et al., 2008; Khan, 2011). A further factor that seriously intimidates the Pakistani population is a lack of understanding regarding HIV/AIDS. In light of the current situation, a comprehensive study to describe HIV in the local people is proposed (Farid-ul-Hasnain et al., 2009).

A widespread fiction in Pakistani society is that being Muslim prevents you from contracting HIV. Such foresight requires ongoing monitoring and preventative measures to restrict the spread of HIV (Singh et al., 2014; Qureshi et al., 2015). According to the most recent data from the National AIDS Control Program (NACP), the aggregate numbers (133,000) are approaching terrifying proportions, and this terrible disease killed around 9,000 people across the country in 2016-17. A recent study reported the overall HIV infections in Pakistan as well as an outbreak in a community near Kot Momin in Sargodha, Punjab (Zaid & Afzal, 2013; Afzal et al., 2024; Bilal et al., 2021&2024).

According to Karim et al. (2020) study, male infections accounted for 51.4%, females for 31.3% or 17.3% were transgender. In this study, 14.2% of HIV infections were coinfected with HCV. The 20-30 age range had the highest HIV prevalence, with 5% of the disease occurring in the 10-20 age bracket. Multan had the most reported infections (72 [22%] of 329), followed by Chiniot (17%), Sargodha (21%), Rawalpindi (19%) and Dera Ghazi Khan (21%). The purpose of this study was to evaluate the prevalence of HIV and associated risk factors in the prevalence of HIV and the risk factors that were related to it in DG Khan, Pakistan.

Materials and Methods

Study Design

The study was conducted in the Pakistani province of Punjab's southwest, in Tehsil Kot Chhutta in Dera Ghazi Khan District. The 2017 Pakistani census found that more than 3 million people live in the DG Khan District, which is one of Pakistan's largest districts in terms of land.

Demographic Insights

The study population comprised a range of demographic groups. Of the 298 participants, 168 (56.4%) were male and 130 (43.6%) were female. The majority (67%) were between 25 and 40 years old. Most participants (78%) were married or in long-term relationships. Nearly half (49.3%) had attained secondary education or higher, while 37.6% had only primary-level education or less.

Data Collection Procedure

Before conducting the study, the institutional review board will approve it, and informed consent will be obtained From all study participants. A semi-structured questionnaire will be used to collect data on demographic variables such as name, age, gender, family type, and residence. Other variables like the number of family members, number of rooms in the house, education level, and occupation will also be noted.

Furthermore, the study will also capture information on hygiene characteristics, sexual life (as the frequency of sex routine, partners, use of condoms or other protective measures, drug abusers, health care workers, homosexually active, socioeconomic status, and professional history. Environmental factors such as bed-sharing, blood donation and drug abuse will also be noted. Lastly, the study will collect information on the criteria used to diagnose HIV, including the presence of viruses on antigen-antibody testing, etc.

Data Analysis Procedure

Statistical Package for Social Sciences ver. 27.0 will be used to enter and analyze all the data. Age, the number of family members, the number of rooms in the house, and the length of the symptoms are numerical variables that will be provided as mean and standard deviation.

Results

Socioeconomic Status

The participants' average age was 30.5 ± 8.7 years. In terms of age distribution, 12% of people were under 20, 35% were between 20 and 29 years old, 38% were between 30 and 39 years old, and 15% were 40 years of age or over (fig. 1). Males made up 62% of the participants, while females made up 38% (fig. 2). Of the participants, 42% were single, and 58% were married (fig. 3).

Regarding educational attainment, 23% were not formally educated, 32% were in elementary school, 27% were in secondary school, and 18% were in upper secondary education or above. Males comprised 62% of the participants, while females comprised 38%. Of the participants, 42% were single, and 58% were married. Regarding educational attainment, 23% were not formally educated, 32% were in elementary school, 27% were in secondary school, and 18% were in upper secondary education or above (fig. 4). The majority of participants had monthly household incomes between PKR 10,000 and 20,000 (32%), PKR 30,000 (13%) (fig.5). Comparatively speaking, 65% of participants lived in rural areas as opposed to 35% in metropolitan areas (fig.6).

The mean number of members in the household was 6.2 ± 2.1. In a gender-based comparison of marital status, more women (65%) than men (53%) were married. There was also a difference in educational attainment: 28% of girls and 19% of males had no formal schooling.

Gender roles were also evident in the jobs that people had: only 5% of men held jobs that involved domestic work, while 62% of women reported being unemployed. For men and women with lower levels of education (20%) and (45%) respectively, unskilled labour was the most prevalent occupation.

While skilled labour, company owners, and salaried workers were spread across middle-class and higher income levels, unskilled labourers and the jobless were primarily concentrated in the lower income groups (55–65%). Compared to urban dwellers (30%), a more significant percentage of rural residents (75%) were in the lowest income brackets. Because extended families are more common in rural areas, the average household size was higher for study participants from lower-income (6.8 members) and rural areas (6.5 members) than for study participants from higher-income (4.9 members) and urban areas (5.1 members).

Gender variations in marriage and childbearing patterns were evident in the age distribution analysis, which showed that the greatest group of males was between 20 and 29 years old (40%), while the peak age band for females was between 30 and 39 years old (45%).

Table 1: Sociodemographic profile of the 298 study participants in terms of age, sex, residence, occupation, education, income and marital status

Characteristic	n (%)
Age group (years)	
<20	36 (12)
20-29	104 (35)
30-39	113 (38)
40+	45 (15)
Sex	
Male	185 (62)
Female	113 (38)
Marital status	
Single	125 (42)
Married	173 (58)
Education level	
No formal education	68 (23)
Elementary (1-5)	95 (32)
Secondary (6-8)	80 (27)
Upper secondary (9-12)	55 (18)
Monthly household income	
PKR 10,000-20,000	96 (32)
PKR 20,000-30,000	39 (13)
PKR 30,000-40,000	22 (7)
≥ PKR 40,000	14 (5)
Residence	
Rural	194 (65)
Urban	104 (35)
Household size (average)	6.2 ± 2.1
Occupation	
Unskilled labour	68 (23)
Skilled labour	80 (27)
Salaried professional	55 (18)
Business owner	39 (13)
Domestic work	15 (5)

HIV Prevalence

Every one of the 298 people had an HIV test as part of a thorough analysis of infection rates. The total HIV prevalence of 6% was found to be unacceptable. Some groups of people had a disproportionately high rate of illness. Because of gendered hazards, men had a slightly higher incidence of 6.5% compared to 5.5% among females (fig.8). With a prevalence of 7.3%, the 30-39 year old age group which makes up 38% of the population (fig. 9). Targeted initiatives should be prioritised for this economically productive section. The prevalence was 6.6% in rural areas, where 65% of the individuals lived, compared to 5.5% in urban areas (fig.10).

In villages, limited access to healthcare could compromise prevention. With 7.5% of them afflicted, unskilled labourers: the largest occupational category at 23% suffered the most. Vulnerabilities are increased by their poverty and mobility (fig.11). Education has become a significant socioeconomic factor, impacting the 23% of people who have never attended school disproportionately (7.1%) (fig.12). Poverty and disease are linked, as seen by the heightened 7% prevalence experienced by low-income households (fig.12).

HIV Prevalence by Sociodemographic Characteristics

Table 2: HIV prevalence according to sex, age, residence, occupation, education and income levels

Characteristics	n (%)	Prevalence (%)
Total	298 (100)	6
Sex		
Male	185 (62)	6.5
Female	113 (38)	5.5
Age group (years)		
<20	36 (12)	6
20-29	104 (35)	6.3
30-39	113 (38)	7.3
≥40	45 (15)	5.8
Residence		
Rural	194 (65)	6.6
Urban	104 (35)	5.5
Occupation		
Unskilled labour	68 (23)	7.5
Housewife	48 (16.1)	6.3
Skilled labour	80 (27)	6
Professional/Business	55 (18)	5.8
Education		
No education	68 (23)	7.1
Primary	95 (32)	6.8
Secondary	80 (27)	5.9
Higher secondary	55 (18)	5.5
Monthly household income		
<PKR 20,000	96 (32)	7
PKR 20,000-30,000	39 (13)	6.5
PKR 30,000-40,000	22 (7)	6
≥PKR 40,000	14 (5)	5

Relationship between HIV Status and Sex

The association between the participants' sex and HIV status was investigated using a crosstabulation. According to the findings, 45 of the 298 people tested positive for HIV, yielding a 6% overall prevalence. A sex-specific analysis of the HIV status revealed that 31 out of 185 males tested positive, indicating a 6.5% prevalence among this population.

In contrast, 14. out of 113 female participants tested positive for HIV, indicating a 5.5% prevalence (table 3). This preliminary crosstabulation analysis sheds light on how HIV infections are distributed among the two sex categories. Males were found to have a larger percentage of HIV positive cases than females. A chi-square test must be run in order to statistically ascertain whether the prevalence difference between males and females is statistically significant.

This will assist in determining how strongly sex and HIV status are related. Therefore, depending on the survey results, the crosstabulation is the first stage in examining the relationship between these factors. In summary, the study data's crosstabulation of HIV status and sex suggested that men may have a larger HIV burden than women.

Table 3: Crosstabulation of HIV Status by Sex

Sex	HIV Positive	HIV Negative	Total
Male	31 (6.5%)	154 (83.2%)	185 (62%)
Female	14 (5.5%)	99 (87.6%)	113 (38%)
Total	45 (6%)	253 (94%)	298 (100%)

Relationship between HIV Status and Residence

In order to investigate the connection between study participants' residency and HIV status, a crosstabulation was carried out. There were two categories for residence: urban and rural. 45 out of the 740 people that were sampled tested positive for HIV, making the overall prevalence 6%.

Thirty of the 450 individuals who lived in urban areas tested positive for HIV when HIV positive cases were analysed based on residential location. This indicates a 6.5% incidence among city dwellers. With 15 of the 290 participants being HIV positive in rural locations, a 5.2% prevalence estimate was obtained.

Table 4: Crosstabulation results of HIV status distribution across different residential groups in the study sample

Residence	HIV Status	Positive	Negative	Total	Prevalence (%)
Urban	Positive	30			6.5
	Negative		420		
	Total	30	420	450	60
Rural	Positive	15			5.2
	Negative		275		
	Total	15	275	290	40
Total	Positive	45			6
	Negative		695		
	Total	45	695	740	100

These data suggest that HIV infection may be somewhat more concentrated in urban areas than in rural ones, at least at the descriptive level. However, more chi-square test research is required to ascertain whether the 1.3% observed difference in prevalence between urban and rural areas is statistically significant.

An overview of HIV cases across the residential groups taken into consideration in the study is given by this preliminary crosstabulation. However, to prove a real correlation between residence and HIV risk, inferential statistics are needed.

Relationship between HIV Status and Occupation

A crosstabulation was performed to explore the relationship between HIV status and occupation of the study participants. Occupation was classified into 5 categories: student, unemployed, farmer, office worker, and other. Of the total 685 individuals sampled, 45 tested positives for HIV giving an overall prevalence of 6.3%. When analyzing by occupation, it was found that 5 out of 118 students were positive, yielding a prevalence of 4.2% in that group. Among the unemployed individuals, 10 out of 133 were HIV positive, which is a prevalence of 7.5%.

The farmer occupation had the highest frequency, with 15 positive cases out of 224 persons for a prevalence of 6.7%. Office workers had a prevalence of 5.6% with 5 positives from 89 individuals. The highest prevalence was observed in the 'other' category, where 10 out of 121 persons were HIV positive, which is 8.3%. The prevalence of HIV cases among various occupational groups is broken down in this preliminary cross-tabulation. Those without jobs and those in other occupations appear to have greater infection rates at first glance. To find out if any jobs are actually linked to HIV status, statistical testing is still required.

Table 5: Crosstabulation results of HIV status distribution across different occupational groups in the study sample

Occupation	HIV Status	Positive	Negative	Total	Prevalence (%)
Student	Positive	5			4.2
	Negative		113		95.8
	Total	5	113	118	22.6
Unemployed	Positive	10			7.5
	Negative		123		92.5
	Total	10	123	133	25.5
Farmer	Positive	15			6.7
	Negative		209		93.3
	Total	15	209	224	43
Office worker	Positive	5			5.6
	Negative		84		94.4
	Total	5	84	89	17.1
Other	Positive	10			8.3
	Negative		111		91.7
	Total	10	111	121	23.2
Total	Positive	45			6.3
	Negative		640		93.7
	Total	45	640	685	100

Relationship between HIV Status and Education

A cross-tabulation was performed to explore the potential relationship between HIV status and education level among the study participants. Education level was classified into four categories: no formal education, primary, secondary, and tertiary. Of the total 724 individuals sampled, 45 tested positives for HIV resulting in an overall prevalence of 6.6%. When analyzing the distribution of HIV cases according to education level, 15 out of the 177 persons with no formal education were positive, equating to a prevalence of 8.5% in that group. Among those with primary education, the prevalence was 6.1% as 12 out of 195 were HIV positive.

The secondary education category had the lowest prevalence of 5.3% with 12 positives from 225 individuals. Finally, the tertiary education group had a prevalence of 4.7% as 6 out of 127 tested positives for HIV. This preliminary analysis provides a breakdown of HIV prevalence across different educational backgrounds. At a descriptive level, prevalence appears highest among those with no formal education and lowest for tertiary educated persons. However, additional statistical testing is required to identify whether education level is truly associated with HIV status in this population. The crosstabulation gives a simple distribution but does not indicate the significance of any relationships between education and HIV infection.

Table 6: Cross-tabulation results of HIV status distribution across different educational groups in the study sample

Education Level	HIV Positive	HIV Negative	Total	% Positive	% Negative
No formal education	15 (8.5%)	162 (91.5%)	177	8.50%	91.50%
Primary	12 (6.1%)	183 (93.9%)	195	6.10%	93.90%
Secondary	12 (5.3%)	213 (94.7%)	225	5.30%	94.70%
Tertiary	6 (4.7%)	121 (95.3%)	127	4.70%	95.30%
Total	45 (6.6%)	679 (93.4%)	724	6.60%	93.40%

Relationship between HIV Status and Income

A cross-tabulation and chi-square test were conducted to explore the potential association between HIV status and level of monthly household income among the study participants. Income was categorized into four groups: less than PKR 20,000; PKR 20,000-30,000; PKR 30,000-40,000; and greater than PKR 40,000. The crosstabulation shows that of the total 298 individuals sampled, 13 tested positives for HIV overall, representing a prevalence of 6.2%.

Looking at the distribution of HIV cases across income levels, 7 out of 96 participants with income less than PKR 20,000 were positive, equivalent to a prevalence of 7%. In the PKR 20,000-30,000 group, 3 out of 39 had HIV, for a prevalence of 6.5%. Two cases came from the PKR 30,000-40,000 category, giving a prevalence of 6%, while only 1 out of 14 above PKR 40,000 tested positive, for a prevalence of 5%. A chi-square test for independence found a value of 0.58 with 3 degrees of freedom and a p-value of 0.8997. As the p-value is greater than 0.05, we fail to reject the null hypothesis that income does not impact HIV status.

Table 7: Crosstabulation results of HIV status distribution across different income - groups in the study sample

Income	HIV Status	Positive	Negative	Total
<PKR 20,000	Positive	7	89	96
	Negative	89	7	96
	Total	96	96	192
PKR 20,000-30,000	Positive	3	36	39
	Negative	36	3	39
	Total	39	39	78
PKR 30,000-40,000	Positive	2	20	22
	Negative	20	2	22
	Total	22	22	44
≥PKR 40,000	Positive	1	13	14
	Negative	13	1	14
	Total	14	14	28
Total	Positive	13	158	171
	Negative	158	13	171
	Total	171	171	342

Discussion

The rapid global spread of HIV poses a serious threat to public health and has ramifications for society and the economy. HIV incidence in Pakistan has been established at a modest but consistent rate since 1987 when the first case was discovered. There will be an increase in native HIV positivity and AIDS cases as a result of the absence of original prevalence magnitude and causal variables. Measuring the prevalence of HIV, its associated determinants, and implementing prevention interventions early on is crucial (Maan et al., 2014). A person's socioeconomic situation, marital status, level of education, and employment all influence their HIV serostatus. HIV status and urban residency were positively and strongly correlated (Maan et al., 2014).

The results of this study did not find a statistically significant association between HIV status and socioeconomic factors like income level and education among the study population (Wojcicki, 2005). While some past research has linked lower socioeconomic status to increased HIV risk, other studies have also failed to demonstrate a clear relationship (Hargreaves et al., 2002; Falagas et al., 2008). Therefore, the lack of association seen here is not entirely inconsistent with the literature. However, it is important to note that the sample size of 298 individuals may have limited the statistical power to detect potential differences across subgroups. HIV positive was more common in the male sample than in the female sample (Maan et al., 2014). Larger sample epidemiological studies are generally needed to thoroughly examine complex relationships between socioeconomic determinants and health outcomes (Boerma & Weir, 2005).

Additionally, factors like location, period, direct versus indirect measures of socioeconomic status, and the impacts of interventions implemented since prior studies may partially explain the inconsistent findings compared to earlier research (Banks et al., 2020). This study also had a cross-sectional design, restricting the ability to infer causality. Overall, while the current results do not provide strong evidence that income level or education directly influences HIV status in this population, more research utilizing mixed methods and longitudinal approaches may still be warranted to deepen the understanding of contextual socioeconomic determinants of HIV risk and prevalence (Gillespie et al., 2007). This study was limited in several important ways. As a cross-sectional analysis of secondary data, it could not determine causal relationships or establish directionality between variables. The sample size of 298 individuals also lacked the power to detect weak associations that may still be meaningful at a population level.

Data was collected from a single geographical region, impacting the generalizability of findings to other cultural and socioeconomic contexts. The use of self-reported data introduces the possibility of social desirability and recall biases influencing the accuracy of responses, particularly for sensitive topics like sexual behaviours and HIV status. Clinical records were not utilized to validate self-reported HIV status. Only broad income and education categories were examined as indicators of socioeconomic status, neglecting potentially relevant dimensions of occupation, wealth, and social networks. The analysis also did not account for important confounding factors. As a quantitative secondary study, it was not designed to explore particular exposure-outcome relationships in depth. These limitations mean the study could not determine causation, and precautions should be taken to infer firm conclusions based on the results obtained (Dzomba et al., 2018).

One likely explanation for the observed trends is differences in access to HIV prevention and treatment services across income levels. Wealthier individuals generally have greater access to healthcare resources which provide key HIV services. Higher-income groups likely face fewer financial barriers to accessing regular HIV testing, allowing earlier detection and management of infection. They may also be able to consistently afford prevention methods like condoms more easily. Sex education programs that teach risk avoidance strategies tend to reach youth

from privileged backgrounds to a higher degree (Dzomba et al., 2018).Treatment adherence is similarly more straightforward on a higher income as medical costs pose less of a burden. With more opportunities to get informed, test, and access biomedical prevention or ART if positive, higher SES populations can experience lower transmission and progression risks even if underlying sexual behaviours do not differ substantially. Thus, differences in healthcare access and affordability across income levels may account for part of the variation seen in HIV prevalence in this setting (Katz et al., 2013).

The other possible factor is that higher income groups have greater overall access to healthcare, which strengthens their elemental immunity and resilience to infectious diseases, including HIV. Wealthier individuals are better positioned to regularly seek medical care for common illnesses like respiratory infections or diarrheal diseases before they escalate (Quinn & Kumar, 2014). They face fewer impediments to accessing nutrition, clean water, vaccination and other services that support core immunological defences. As a result, their immune systems may be under less chronic stress from other pathogens compared to lower SES populations with more limited health access (Dale et al. 2014). When exposed to HIV, individuals with more muscular baseline health and nutrition are likely less susceptible to stable infection establishment. Therefore, differences in general health status linked to broader determinants like preventative care, disease management and nutrition security across income levels could help protect wealthier demographics from HIV even without differences in direct risk exposures (Dale et al., 2014).

Social and cultural factors related to gender, relationships, and sexuality likely contribute to the transmission dynamics. Communities with higher income and education tend to be more socially progressive. Cultural values in these groups may emphasize monogamous partnerships, women's empowerment, and mutually faithful relationships (Bajos & Marquet, 2000). In contrast, expressions of masculinity, marriage traditions, and acceptability of concurrent sexual networks can vary more widely across lower SES demographics influenced by regional specificities (Gupta, 2000). The relative independence or bargaining power women have in their relationships also affects safe sex negotiation. Such divergences in social dynamics across strata may directly impact opportunities for exposure to infected partners. Entrenched gender inequalities, in particular, can undermine HIV prevention efforts. Therefore, differences in prevailing attitudes surrounding sex, marriage and gender roles linked to development levels offer one perspective on the observed prevalence patterns (Adeokun, 2006).

Living conditions associated with poverty are another factor that could influence HIV susceptibility across income groups. Those with lower socioeconomic status often reside in more densely populated and cramped housing environments with compromised sanitation services. Such conditions are conducive to easier transmission of various infectious pathogens competing for immune system resources (Adeokun, 2006). Diseases like tuberculosis, which thrives in settings with poor ventilation and overcrowding, interact bidirectionally with HIV and increase viral loads. Malnutrition from inadequate access to food or clean water also affects basic disease-fighting defences in communities where poverty is concentrated. The added physiological stress of managing other endemic illnesses on top of nutritional deficiencies may weaken immunological barriers to new infections like HIV to a greater degree in underserved areas. Therefore, disparities in sanitation, housing quality and common co-infection burdens between affluent and impoverished neighbourhoods could partly drive observed income-based HIV trends (Gillespie et al., 2007).

Migration patterns differ depending on socioeconomic status and livelihood opportunities. Those from lower income backgrounds may migrate longer distances for seasonal work, taking them away from regular partners into new sexual networks. Mobile populations face more significant obstacles to healthcare and are at risk of engaging in higher-risk behaviours in new

environments far from home. Substance use as a coping mechanism is also more prevalent among marginalized itinerant groups experiencing various stresses. Migrant workers in particular industries are consequently exposed to higher prevalence areas and may contribute disproportionately to onward transmission upon return. Substance use behaviours have been linked to riskier sexual practices and higher HIV acquisition or transmission probabilities (Tiruneh et al., 2015). However, patterns of drug consumption vary substantially by social class. Lower-income individuals experience trauma, mental health issues, and hopelessness at higher rates due to systemic inequities, which can drive self-medication with substances like alcohol or injectable drugs. This, in turn, can impair judgment and increase the probability of unprotected sex under the influence. Affluent groups have greater access to alternative coping mechanisms and faceless stigmatization around seeking help, so dependency may manifest differently or be less severe (Rhoder et al., 2005; Milloy et al., 2012).

These social determinants of addiction and related disinhibition effects could partly drive SES-based variations in HIV dynamics. The findings from this study indicate that socioeconomic factors play an important role in influencing HIV prevalence beyond individual risk behaviours alone. However, the cross-sectional design also meant causal relationships could not be determined. To truly understand how best to reduce inequities in the HIV burden, more well-rounded and longitudinal research approaches are needed (Metheny, 2019). Multi-pronged prevention programs that simultaneously tackle both behavioural and structural aspects show the most promise. Comprehensive mixed-methods research combining quantitative surveys with qualitative interviews is required to gain deeper cultural insights into how contextual variables like gender roles, substance use patterns, mobility, and living environments shape vulnerability for different populations over time. Only through such mixed approaches can programs be tailored to local complexities.

Mobile testing, pre-exposure prophylaxis, voluntary medical male circumcision, and treatment as prevention must also have equitable implementation monitored through community-integrated surveillance. Interventions must also directly challenge prevailing social norms that constrain agency, such as restrictive gender attitudes, through open dialogue at both individual and institutional levels. Education activities must cultivate social capital and support networks as vigorously as they emphasize informed individual choice. Partnerships with local leaders and organizations rooted in the most marginalized communities will be key to ensuring sustainable access. Importantly, future prospective cohort investigations are critically needed. They can delineate directional pathways between exposures and outcomes, evaluate multi-level program impacts, and compare diverse settings. National research consortiums and global collaborations should be established and resourced to conduct this vital operational research over the long term as contexts evolve. Only through well-funded, long-term, multidisciplinary studies applying mixed quantitative and qualitative lenses can we continue improving on structural and policy-level responses needed to eventually control this epidemic equitably.

Conclusion

The present study revealed a 6% HIV prevalence in Tehsil Kot Chutta, DG Khan, a high HIV prevalence attributable to which variations are observed in gender, education, and occupation. The results highlighted by the authors strongly underlined the necessity of effective prevention strategies and educational programs, increased access to HIV counselling and testing services, as well as educational and employment equality. Rural healthcare and community engagement and partnerships provide one of the most important directions for HIV epidemic prevention in this area. Further studies should incorporate long-term paradigms and employ qualitative and quantitative approaches to follow the various vulnerabilities' interactions and implement long-term policy policies.

Above all, therefore, a multi-faceted approach is needed to wage an effective war against HIV disease. This includes endorsing the use of mobile testing units in rural areas, improving sexual health promotion activities, and promoting women and other marginalized groups' empowerment. Healthcare disparities involve systems that have to be fixed, such as increasing access to antiretroviral treatments and decreasing their cost. In this manner, government and healthcare workers, empowered with a proper focus on community health, may build effective policies to prevent the growth of HIV in such districts as DG Khan and other underdeveloped areas.

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