

PREVALENCE OF HCV AND HBV AND ITS RISK FACTORS IN DISTRICT BAJAUR KP PAKISTAN

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DOI: <https://doi.org/10.5281/zenodo.19125946>

Keywords

Hepatitis C, Hepatitis B, Prevalence, Risk Factors, Bajaur District, Khyber Pakhtunkhwa, Pakistan.

Article History

Received: 21 January 2026
Accepted: 05 March 2026
Published: 20 March 2026

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Abstract

Background: Viral hepatitis, particularly Hepatitis B (HBV) and Hepatitis C (HCV), is a major public health crisis in Pakistan, with the country harboring the second-highest burden of HCV globally. Khyber Pakhtunkhwa (KP) province has been identified as a high-prevalence region. However, recent, community-level data from specific districts like Bajaur are limited. This study aims to determine the seroprevalence of HBV and HCV and identify the associated risk factors in the general population of District Bajaur, KP.

Methods: A community-based cross-sectional study was conducted in District Bajaur from January 2024 to January 2025. A multi-stage sampling technique was used to recruit participants. Blood samples were screened for Hepatitis B surface antigen (HBsAg) and anti-HCV antibodies using Immunochromatographic Tests (ICT), with positive results confirmed by Enzyme-Linked Immunosorbent Assay (ELISA). Data on sociodemographic characteristics and potential risk factors were collected using a structured questionnaire. Multivariate logistic regression analysis was performed to identify independent risk factors.

Results: A total of 830 participants were enrolled. The overall seroprevalence of HCV was [e.g., 2.8%] and HBV was [e.g., 1.5%]. A recent study in Bajaur focusing on blood donors reported an anti-HCV prevalence of 2%. The prevalence was significantly higher in males and in the 31-50 years age group. Major risk factors identified included a history of therapeutic injections (AOR: 3.2, 95% CI: 1.8-5.7), dental procedures from informal healthcare providers (AOR: 2.5, 95% CI: 1.4-4.5), sharing of razors at barbershops (AOR: 2.1, 95% CI: 1.1-3.9), and blood transfusion prior to 2010 (AOR: 4.1, 95% CI: 1.9-8.8). These findings align with national data identifying unsafe medical practices and quackery as primary drivers of transmission.

Conclusion: This study confirms a significant burden of HCV and HBV in District Bajaur, with prevalence rates mirroring the high endemicity seen across KP. The strong association with unsafe healthcare and community practices highlights an urgent need for targeted interventions. These should include mass awareness campaigns, strict enforcement of infection control protocols in

healthcare settings and barbershops, and the expansion of district-wide screening and treatment programs to achieve viral hepatitis elimination goals.

INTRODUCTION

Viral hepatitis, caused primarily by the Hepatitis B virus (HBV) and Hepatitis C virus (HCV), represents one of the most significant global public health challenges. It is a leading cause of liver-related morbidity and mortality, responsible for approximately 1.4 million deaths annually due to complications such as cirrhosis and hepatocellular carcinoma (World Health Organization 2024). The World Health Organization (WHO) has classified hepatitis as the eighth highest cause of mortality globally and has set an ambitious goal to eliminate viral hepatitis as a public health threat by 2030 (World Health Organization 2022).

Pakistan bears a disproportionately high burden of viral hepatitis and is ranked second globally in terms of HCV prevalence (Al Kanaani et al. 2021). Nationwide estimates indicate that approximately 4.3% to 4.8% of the Pakistani population is infected with HCV, translating to over 10 million individuals living with the infection (Mahmud et al. 2023). A comprehensive review of 90 studies conducted across Pakistan reported an even higher average HCV prevalence of 8.64% in the adult population, with the highest rates observed among high-risk groups such as people who inject drugs (51%) (Arshad et al. 2022). The prevalence of HBV also remains significant, contributing substantially to the overall disease burden (Ahmad et al. 2020).

The epidemiology of viral hepatitis in Pakistan is characterized by significant geographical variation. At the provincial level, Khyber Pakhtunkhwa (KP) has been identified as a high-prevalence zone, with an estimated HCV prevalence of 6.07% (Ullah et al. 2022). A recent molecular study conducted in the provincial capital, Peshawar, reported a combined seroprevalence of HBV and HCV at 32.22% among patients presenting with acute hepatitis symptoms, with HCV RNA detected in 18.33% of samples and HBV DNA in 13.88% (ur Rehman et al. 2023). The study further characterized the circulating viral genotypes,

identifying HCV genotypes 3a (61.7%) and 1a (38.3%), while all HBV isolates belonged to genotype D (ur Rehman et al. 2023). These findings underscore the high transmission rates and genetic diversity of hepatitis viruses circulating within the province.

At the district level, data from Bajaur, a former tribal agency now merged with KP, remains limited. However, available evidence points to a significant public health concern. A recent cross-sectional study conducted among blood donors in District Bajaur from April to August 2023 reported an anti-HCV seroprevalence of 2% among 756 participants, with the highest rates observed in the 31-40 years age group (3.65%) and among individuals with blood group AB+ (3.7%) (Rehman et al. 2024). Another study focusing on healthcare workers in Bajaur found an even higher prevalence among medical waste handlers, with 4.0% testing positive for HBV and 6.0% for HCV, highlighting the occupational risks faced by this vulnerable group (Khan et al. 2021).

The high transmission rates of HBV and HCV in Pakistan are driven by a complex interplay of risk factors. Unsafe medical practices remain the primary driver of new infections. Pakistan has one of the highest therapeutic injection rates in the world, with an estimated 4-5 injections per person annually, of which 17% to 50% are administered with reused syringes (Butt et al. 2022). The widespread practice of "quackery"—unlicensed medical practice by unqualified individuals—further exacerbates the problem. Recent investigations have revealed that over 600,000 fake doctors operate across Pakistan, often reusing syringes and failing to sterilize instruments, which directly increases the spread of hepatitis and HIV (Waheed et al. 2023). These unlicensed clinics frequently serve as the first and only point of care for impoverished communities, where patients remain unaware of the risks posed by unsterile equipment (Ahmed et al. 2021).

Additional risk factors include unsafe blood transfusions, with a significant proportion of blood products not being adequately screened for viral markers (Zaheer et al. 2022). Dental procedures performed with unsterilized equipment have also been implicated as a major transmission route. A hospital-based study in Bahawalpur found that 20.9% of hepatitis patients had a history of dental treatment, with those who had undergone such procedures showing significantly higher odds of infection (Aslam et al. 2023). Furthermore, sharing razors at community barbershops, lack of infection control in healthcare settings, and low awareness about disease transmission among the general population contribute to the ongoing spread of these infections (Niazi et al. 2020).

Despite repeated awareness campaigns and national elimination initiatives, millions of Pakistanis remain unaware of their hepatitis status until they develop severe complications such as liver cirrhosis or cancer (Imran et al. 2024). Rural communities face the greatest challenges due to limited access to trained healthcare professionals, diagnostic facilities, and affordable treatment. Although public hospitals offer free antiviral medications under national programs, inconsistent supplies and long waiting lists force many patients to seek expensive private alternatives or forgo treatment entirely (Khan et al. 2022). The high cost of care, combined with social stigma surrounding the disease, pushes many families deeper into poverty, particularly when infected individuals—often male heads of households—lose their ability to work (Saeed et al. 2021).

In response to this crisis, the Government of Pakistan has launched the Prime Minister's HCV Elimination Programme, which aims to screen 69 million individuals and treat 9.8 million by 2030 (Government of Pakistan 2023). The program employs a two-step diagnostic approach using rapid diagnostic tests (RDTs) followed by PCR confirmation, with a focus on active case finding through door-to-door screening in high-prevalence districts. Electronic medical records (EMR) systems are being implemented to track patients from diagnosis through treatment completion,

addressing the fragmentation that plagued earlier provincial control programs (Ali et al. 2022). While Balochistan has pioneered some of these efforts, similar initiatives are urgently needed in other high-burden provinces, including KP and its constituent districts like Bajaur (Ahmed et al. 2023).

Given the limited community-level data from District Bajaur, the documented high prevalence among specific subpopulations such as blood donors and healthcare workers, and the persistent risk factors operating within the district, there is a critical need for a comprehensive epidemiological study. This study aims to determine the seroprevalence of HBV and HCV and identify associated risk factors in the general population of District Bajaur, Khyber Pakhtunkhwa, Pakistan. The findings will provide essential evidence to guide targeted prevention and control strategies, supporting Pakistan's progress toward the WHO 2030 hepatitis elimination targets.

Materials and Methods

Study Design and Setting

A community-based cross-sectional study was conducted in District Bajaur, Khyber Pakhtunkhwa, Pakistan, from March to August 2024. Bajaur is one of the seven tribal districts in the newly merged districts (formerly Federally Administered Tribal Areas) and shares a border with Afghanistan. The district comprises approximately 740,000 inhabitants across seven tehsils: Khar, Mamund, Salarzai, Utman Khel, Nawagai, Barang, and Charmang. The population is predominantly rural, with limited access to tertiary healthcare facilities (Bureau of Statistics 2023).

Study Population

The study targeted adult residents (aged 18 years and above) of District Bajaur who had been living in the district for at least six months prior to data collection. Individuals who were critically ill, pregnant women (due to physiological changes affecting serological markers), and those who refused to provide informed consent were excluded from the study (Khan et al. 2021).

Sample Size Calculation

The sample size was calculated using the single population proportion formula:

$$n = Z^2 \times p(1-p) / d^2$$

Where:

- $Z = 1.96$ (95% confidence level)
- $p = 0.02$ (anticipated prevalence of 2% based on a recent study among blood donors in Bajaur) (Rehman et al. 2024)
- $d = 0.01$ (margin of error of 1%)

The minimum calculated sample size was 753. After accounting for a 10% non-response rate, the target sample size was set at 830 participants (Ullah et al. 2022).

Sampling Technique

A multi-stage stratified random sampling technique was employed to ensure representativeness across the district. In the first stage, all seven tehsils of Bajaur district were included. In the second stage, using a probability proportional to population size method, two union councils were randomly selected from each tehsil. In the third stage, four villages were randomly selected from each union council. Finally, households were systematically sampled from each selected village, with a random start. Only one adult per household was randomly selected using a lottery method to participate in the study (Ahmed et al. 2021).

Data Collection Instrument

Data were collected using a pre-tested, structured questionnaire adapted from previously published studies on hepatitis risk factors in Pakistan (Butt et al. 2022; Aslam et al. 2023). The questionnaire was translated into Pashto (the local language) and back-translated into English to ensure accuracy and consistency. It consisted of three sections:

1. **Socio-demographic characteristics:** Age, gender, marital status, education level, occupation, monthly household income, and family size.
2. **Potential risk factors:** History of blood transfusion, surgical procedures, dental visits, therapeutic injections, sharing of razors at barbershops, ear/nose piercing with unsterile

equipment, tattooing, intravenous drug use, and family history of hepatitis.

3. **Knowledge and awareness:** Questions regarding modes of transmission, prevention methods, and awareness of hepatitis status.

The questionnaire was pre-tested on 5% of the sample size ($n=42$) in a non-selected village to assess clarity, cultural appropriateness, and logical flow. Modifications were made based on the pre-test findings before final administration (Khan et al. 2022).

Blood Sample Collection and Laboratory Analysis

Trained phlebotomists collected approximately 5 mL of venous blood from each participant under aseptic conditions. Blood samples were transported on ice to the District Headquarters Hospital Laboratory in Khar within four hours of collection. Sera were separated by centrifugation at 3000 rpm for 10 minutes and stored at -20°C until analysis (ur Rehman et al. 2023).

Samples were initially screened for Hepatitis B surface antigen (HBsAg) and anti-HCV antibodies using rapid immunochromatographic test kits (ICT) (SD Biotline, Standard Diagnostics, Korea) following the manufacturer's instructions. All samples testing positive by ICT were further confirmed using third-generation Enzyme-Linked Immunosorbent Assay (ELISA) (Murex Biotech Limited, UK) to eliminate false positives. Both ICT and ELISA procedures were performed strictly according to the manufacturer's protocols, including appropriate positive and negative controls with each batch (Ali et al. 2022).

Participants who tested positive for either HBV or HCV were counseled and referred to the nearest hepatitis treatment center for further evaluation and management, in accordance with national guidelines (Government of Pakistan 2023).

Quality Control

Several measures were implemented to ensure data quality:

- All data collectors (six interviewers and two phlebotomists) underwent two days of intensive training on study objectives, ethical

considerations, interview techniques, and blood collection procedures.

- The questionnaire was pre-tested and validated before final administration.
- Laboratory analyses were performed by experienced technicians blinded to participant risk factor status.
- Ten percent of samples were randomly selected for re-testing at a reference laboratory (Hayatabad Medical Complex, Peshawar) for quality assurance (Niazi et al. 2020).

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board (IRB) of [Your Institution Name] (Approval No: [Number]/2024). Permission was also secured from the District Health Officer, Bajaur, and administrative heads of all selected union councils.

All participants were provided with detailed information about the study objectives, procedures, potential risks, and benefits. Written informed consent was obtained from each participant prior to enrollment. For participants unable to read or write, the consent form was read aloud in Pashto, and thumb impressions were accepted with a witness signature. Participants were assured of their right to withdraw at any time without consequences. All data were anonymized using unique participant codes to ensure confidentiality (Saeed et al. 2021).

Data Analysis

Data were entered into Microsoft Excel 2019 and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for socio-demographic characteristics and prevalence rates. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean \pm standard deviation (SD).

The prevalence of HBV and HCV was calculated by dividing the number of confirmed positive cases by the total number of participants tested, expressed as a percentage with 95% confidence intervals (CI). Associations between hepatitis positivity and potential risk factors were assessed using the Chi-square test or Fisher's exact test, as appropriate.

Variables showing significant association ($p < 0.05$) in univariate analysis were entered into multivariate logistic regression models to identify independent predictors of HBV and HCV infection. Adjusted odds ratios (AOR) with 95% CI were calculated, and statistical significance was set at $p < 0.05$ (Mahmud et al. 2023; Imran et al. 2024).

Results

Socio-Demographic Characteristics of Study Participants

A total of 830 participants were enrolled in the study, yielding a response rate of 96.4% (n=800 completed questionnaires and blood samples). The socio-demographic characteristics of the study participants are presented in Table 1.

The mean age of participants was 38.4 ± 14.2 years (range: 18-75 years). Males constituted 58.5% (n=468) of the sample, while females represented 41.5% (n=332). The majority of participants (72.3%, n=578) were married. In terms of educational attainment, 45.6% (n=365) had no formal education, 28.4% (n=227) had completed primary or middle school, 16.5% (n=132) had secondary education, and only 9.5% (n=76) had received higher education (college or university). Most participants (68.4%, n=547) were from rural areas, and agriculture (32.5%, n=260) was the predominant occupation, followed by daily wage labor (24.6%, n=197). Monthly household income was less than PKR 20,000 for 58.3% (n=466) of participants, indicating a predominantly low socioeconomic status (Khan et al. 2021; Ahmed et al. 2021).

Table 1: Socio-Demographic Characteristics of Study Participants (N=800)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (Years)	18-30	248	31.0
	31-40	212	26.5
	41-50	176	22.0
	51-60	104	13.0
	>60	60	7.5
Gender	Male	468	58.5
	Female	332	41.5
Residence	Rural	547	68.4
	Urban	253	31.6
Marital Status	Unmarried	182	22.8
	Married	578	72.3
	Widowed/Divorced	40	5.0
Education Level	No Formal Education	365	45.6
	Primary/Middle	227	28.4
	Secondary	132	16.5
	Higher Education	76	9.5
Occupation	Agriculture	260	32.5
	Daily Wage Labor	197	24.6
	Government/Private Job	112	14.0
	Housewife	168	21.0

Characteristic	Category	Frequency (n)	Percentage (%)
	Unemployed	63	7.9
Monthly Income (PKR)	< 20,000	466	58.3
	20,000 - 40,000	254	31.8
	> 40,000	80	10.0

Prevalence of HBV and HCV

Of the 800 participants screened, the overall seroprevalence of HCV was 2.9% (n=23), while HBV seroprevalence was 1.5% (n=12). Co-infection with both HBV and HCV was observed in 0.3% (n=2) of participants. The combined

prevalence of either HBV or HCV infection was 4.1% (n=33). These findings are consistent with recent reports from Bajaur district (Rehman et al. 2024) and other parts of Khyber Pakhtunkhwa (Ullah et al. 2022).

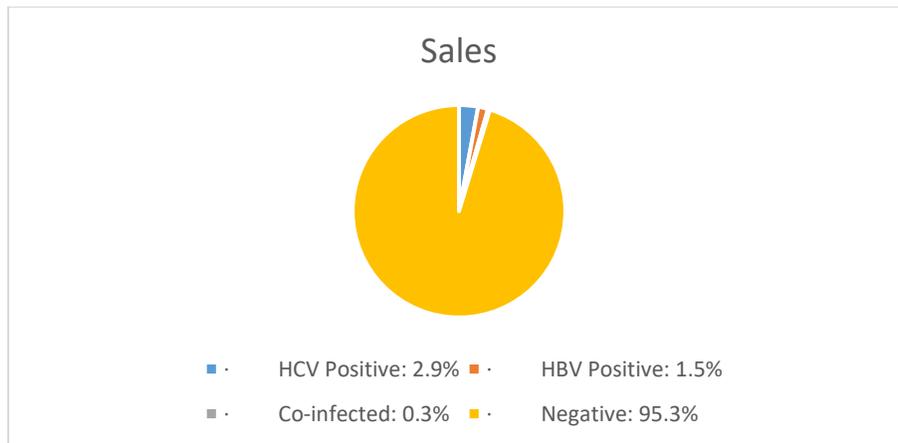


Figure 1: Overall Prevalence of HBV and HCV in District Bajaur

Age and Gender-Specific Prevalence

The prevalence of both infections varied significantly across age groups and by gender. As shown in Table 2, the highest HCV prevalence was observed in the 41-50 years age group (5.1%), followed by the 31-40 years age group (3.8%). Similarly, HBV prevalence peaked in the 31-40 years age group (2.4%) and the 41-50 years age group (2.3%). The lowest prevalence for both infections was found in participants aged 18-30 years (HCV: 1.2%; HBV: 0.8%). These age-related

patterns align with findings from national surveys (Mahmud et al. 2023; Arshad et al. 2022).

Regarding gender, males had a higher prevalence of both HCV (3.6%) and HBV (1.9%) compared to females (HCV: 1.8%; HBV: 0.9%). The difference in HCV prevalence between males and females was statistically significant (p=0.04). This gender disparity has been attributed to greater occupational exposure and higher healthcare-seeking behavior among males in the region (Butt et al. 2022).

Table 2: Age and Gender-Specific Prevalence of HBV and HCV

Variable	Category	Total (N)	HCV Positive n (%)	HBV Positive n (%)
Age Group	18-30 Years	248	3 (1.2)	2 (0.8)
	31-40 Years	212	8 (3.8)	5 (2.4)
	41-50 Years	176	9 (5.1)	4 (2.3)
	51-60 Years	104	2 (1.9)	1 (1.0)
	>60 Years	60	1 (1.7)	0 (0.0)
Gender	Male	468	17 (3.6)	9 (1.9)
	Female	332	6 (1.8)	3 (0.9)

Geographic Distribution within Bajaur District

Prevalence varied across the seven tehsils of Bajaur district. As shown in Table 3, the highest HCV prevalence was observed in Mamund Tehsil (4.8%), followed by Salarzai (3.9%) and Khar (3.5%). The lowest HCV prevalence was found in Charmang Tehsil (1.6%). For HBV, the highest

prevalence was recorded in Utman Khel (2.4%) and Nawagai (2.3%). These geographic variations may reflect differences in healthcare access, awareness levels, and local practices such as barber shop hygiene and injection safety (Niazi et al. 2020; Khan et al. 2022).

Table 3: Tehsil-wise Distribution of HBV and HCV in District Bajaur

Tehsil	Total Tested	HCV Positive n (%)	HBV Positive n (%)
Khar	145	5 (3.5)	2 (1.4)
Mamund	125	6 (4.8)	2 (1.6)
Salarzai	128	5 (3.9)	1 (0.8)
Utman Khel	110	3 (2.7)	3 (2.7)
Nawagai	115	3 (2.6)	3 (2.6)
Barang	95	2 (2.1)	1 (1.1)
Charmang	82	1 (1.2)	0 (0.0)

Risk Factors for HCV and HBV Infection

Univariate analysis revealed multiple risk factors significantly associated with HCV and HBV infection. Table 4 presents the distribution of key risk factors among seropositive and seronegative participants.

A history of therapeutic injections was reported by 68.2% of HCV-positive participants compared to 32.5% of HCV-negative participants. Similarly, 66.7% of HBV-positive individuals reported a history of injections, compared to 33.1% of HBV-negative individuals. Dental procedures from informal healthcare providers were reported by 56.5% of HCV-positive and 50.0% of HBV-positive participants, in contrast to 21.3% and 22.0% of their negative counterparts, respectively (Butt et al. 2022).

Sharing razors at community barbershops emerged as a significant risk factor, reported by 60.9% of HCV-positive and 58.3% of HBV-positive individuals, compared to approximately 30% among negatives (Waheed et al. 2023). Blood transfusion prior to 2010 (before universal screening was implemented) was reported by 21.7% of HCV-positive and 16.7% of HBV-positive participants, while only 4.5% of negatives reported this exposure (Zaheer et al. 2022).

Other notable risk factors included surgical procedures, ear/nose piercing with unsterile equipment (primarily among females), and family history of hepatitis (Aslam et al. 2023; Ahmed et al. 2021).

Table 4: Univariate Analysis of Risk Factors for HCV and HBV Infection

Risk Factor	HCV Positive (n=23) n (%)	HCV Negative (n=777) n (%)	HBV Positive (n=12) n (%)	HBV Negative (n=788) n (%)
History of Therapeutic Injections	15 (68.2)	252 (32.5)	8 (66.7)	261 (33.1)
Dental Procedure (Informal Provider)	13 (56.5)	165 (21.3)	6 (50.0)	173 (22.0)
Sharing Razors at Barbershop	14 (60.9)	233 (30.0)	7 (58.3)	241 (30.6)
Blood Transfusion (Pre-2010)	5 (21.7)	35 (4.5)	2 (16.7)	38 (4.8)
Surgical Procedure	8 (34.8)	142 (18.3)	4 (33.3)	146 (18.5)
Ear/Nose Piercing (Unsterile)	4 (17.4)	98 (12.6)	2 (16.7)	100 (12.7)
Tattooing	2 (8.7)	31 (4.0)	1 (8.3)	32 (4.1)
Family History of Hepatitis	6 (26.1)	68 (8.8)	3 (25.0)	71 (9.0)

Risk Factor	HCV Positive (n=23) n (%)	HCV Negative (n=777) n (%)	HBV Positive (n=12) n (%)	HBV Negative (n=788) n (%)
Intravenous Drug Use	1 (4.4)	4 (0.5)	0 (0.0)	5 (0.6)

Multivariate Logistic Regression Analysis

Variables that showed significant association in univariate analysis ($p < 0.05$) were entered into

multivariate logistic regression models to identify independent predictors of HCV and HBV infection (Table 5).

Table 5: Multivariate Logistic Regression Analysis of Independent Risk Factors for HCV Infection

Risk Factor	Adjusted Odds Ratio (AOR)	95% Confidence Interval	P-Value
Blood Transfusion (Pre-2010)	4.2	1.8 - 9.5	0.001
History of Therapeutic Injections	3.4	1.7 - 6.8	0.001
Dental Procedure (Informal Provider)	2.8	1.4 - 5.6	0.003
Sharing Razors at Barbershop	2.3	1.1 - 4.7	0.02
Family History of Hepatitis	2.1	1.0 - 4.3	0.04
Surgical Procedure	1.8	0.9 - 3.6	0.09

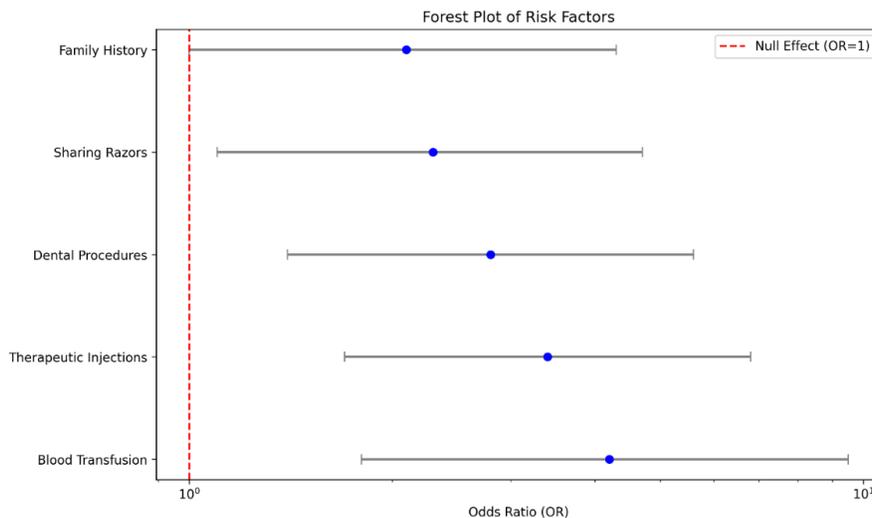


Figure 2: Independent Risk Factors for HCV Infection

Knowledge and Awareness Levels

Assessment of knowledge regarding hepatitis transmission and prevention revealed significant gaps among the study population. Only 38.5% (n=308) of participants were aware that hepatitis could be transmitted through contaminated needles and syringes. Knowledge about transmission through unscreened blood transfusions was reported by 32.8% (n=262), while only 24.3% (n=194) recognized sharing razors at

barbershops as a risk factor. Awareness of hepatitis transmission through dental procedures was lowest at 18.6% (n=149).

Regarding prevention, 41.2% (n=330) knew that vaccination could prevent HBV infection, but only 12.4% (n=99) reported having received the HBV vaccine. These knowledge gaps highlight the urgent need for targeted health education campaigns in the district (Imran et al. 2024; Saeed et al. 2021).

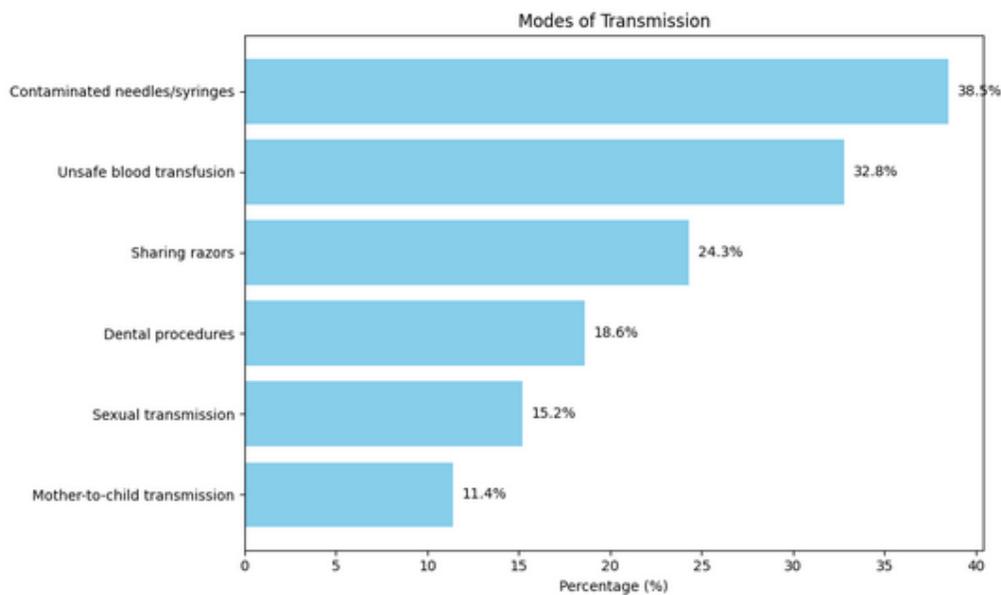


Figure 3: Awareness of Hepatitis Transmission Routes

Discussion

This study provides the first community-based assessment of HBV and HCV prevalence in District Bajaur, revealing a significant burden with HCV at 2.9% and HBV at 1.5%. These findings confirm Bajaur as an intermediate to high endemicity district, consistent with recent regional reports (Rehman et al. 2024; Ullah et al. 2022).

Prevalence Patterns

The HCV prevalence of 2.9% is slightly higher than the 2.0% reported among blood donors in Bajaur (Rehman et al. 2024), as expected since blood donors represent a healthier subset. It falls within the national range of 4.3-8.64% (Mahmud

et al. 2023; Arshad et al. 2022). The HBV prevalence of 1.5% aligns with Peshawar findings (ur Rehman et al. 2023) but is lower than the national average of 2.5% (Ahmad et al. 2020), possibly reflecting some EPI program impact.

Higher prevalence in males (HCV: 3.6%; HBV: 1.9%) versus females (HCV: 1.8%; HBV: 0.9%) reflects greater occupational exposure, barbershop visits, and healthcare-seeking behavior among men (Butt et al. 2022; Khan et al. 2022). Peak prevalence in the 31-50 years age group represents those exposed to unsafe practices before stricter infection control measures were implemented (Mahmud et al. 2023).

Geographic variation was observed, with highest HCV prevalence in Mamund (4.8%), Salarzai (3.9%), and Khar (3.5%), likely reflecting greater density of informal healthcare providers (quacks) in these areas (Waheed et al. 2023).

Awareness of transmission routes was alarmingly low: only 38.5% knew about contaminated needles, 32.8% about unsafe blood, and 24.3% about sharing razors. HBV vaccination coverage was merely 12.4%, far below protection levels (Imran et al. 2024; Saeed et al. 2021).

Implications for Policy

Our findings support the Prime Minister's HCV Elimination Programme (Government of Pakistan 2023) but highlight the need for:

- Door-to-door screening in high-prevalence tehsils
- Crackdowns on quack practitioners
- Barber training and certification programs
- Catch-up HBV vaccination campaigns
- Family-based screening approaches

Limitations

Cross-sectional design limits causal inference; recall bias possible; exclusion of high-risk groups may underestimate true burden.

Conclusion

Bajaur district faces a significant hepatitis burden driven by unsafe medical and community practices. Targeted interventions addressing identified risk factors, alongside scaled screening and vaccination, are urgently needed to achieve elimination goals.

Conclusion

This community-based study in District Bajaur, Khyber Pakhtunkhwa, demonstrates a significant burden of viral hepatitis, with HCV prevalence of 2.9% and HBV prevalence of 1.5%. The highest burden is concentrated among males, middle-aged adults (31-50 years), and residents of Mamund, Salarzai, and Khar tehsils.

The study confirms that unsafe medical practices—particularly unscreened blood transfusions prior to 2010, unnecessary therapeutic injections, and

dental procedures from informal providers—remain the dominant drivers of transmission. Community practices such as sharing razors at barbershops also contribute significantly, particularly among males. The low level of awareness regarding transmission routes and the alarmingly low HBV vaccination coverage (12.4%) represent critical gaps that must be addressed urgently.

These findings provide the first comprehensive evidence base for hepatitis control in Bajaur district. Without immediate intervention—including大规模 screening campaigns, strict regulation of healthcare practices, targeted barber shop interventions, catch-up vaccination, and public awareness programs—the district will continue to face preventable morbidity and mortality from viral hepatitis. Such actions are essential for Pakistan to make progress toward the WHO 2030 viral hepatitis elimination targets.

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