PREVALENCE OF HBV AND HCV INFECTION AND ASSOCIATED RISK FACTOR AMONG VULNERABLE POPULATION OF DISTRICT GILGIT, PAKISTAN

Original Research

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ABSTRACT

Background: Hepatitis B virus (HBV) and hepatitis C virus (HCV) are major public health concerns worldwide, with a significant disease burden in developing countries, including Pakistan. These infections can lead to chronic liver disease, cirrhosis, and hepatocellular carcinoma, posing severe healthcare challenges. In Pakistan, inadequate sterilization practices, unsafe blood transfusions, and limited awareness contribute to the continued transmission of these viruses. Despite nationwide vaccination efforts and public health interventions, HBV and HCV remain prevalent in various regions, necessitating targeted epidemiological assessments.

Objective: This study aimed to determine the prevalence of HBV and HCV infections and assess the associated risk factors among the vulnerable population of the Gilgit district, Pakistan.

Methods: A cross-sectional study was conducted from 2023 to 2024, enrolling 230 individuals through stratified random sampling. A structured questionnaire was administered to collect demographic data and risk factor information, including history of blood transfusions, unsafe injections, and awareness levels. Blood samples were collected and tested for HBV surface antigen (HBsAg) and anti-HCV antibodies using enzyme-linked immunosorbent assay (ELISA). Statistical analysis, including chi-square tests, was performed to assess associations between risk factors and infection status.

Results: HBV was detected in 3.04% (7/230) of participants, while HCV was found in 0.87% (2/230). The majority (96.09%) tested negative for both infections. The most frequently reported symptom was light-colored stool (31.3%), followed by joint pain (26.5%) and abdominal pain (16.5%). A significant association was found between HBV infection and history of needle sharing ($\chi^2 = 9.77$, $p = 0.002$). However, no statistically significant association was observed between HCV and identified risk factors. The study also revealed that 85.2% of participants lacked awareness regarding hepatitis transmission risks, highlighting a critical knowledge gap.

Conclusion: The relatively low prevalence rates in the Gilgit district suggest the positive impact of public health interventions. However, the continued presence of HBV and HCV cases underscores the need for sustained awareness programs, improved screening, and stricter infection control measures. Enhancing healthcare access and strengthening preventive strategies will be crucial in further reducing the burden of these infections in the region.

Keywords: Blood transfusion, disease prevalence, hepatitis B, hepatitis C, public health, risk factors, viral infection.

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INTRODUCTION

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are significant public health concerns worldwide, particularly in developing nations where healthcare access is often limited. These infections are associated with severe complications, including cirrhosis, hepatocellular carcinoma, and chronic liver disease, making early detection and management imperative (1,2). Globally, an estimated 71 million people are affected by HCV, while more than 250 million individuals live with chronic HBV infection, with a substantial burden in low- and middle-income countries (3,4). Pakistan faces a particularly high prevalence of these infections, with national estimates ranging from 2.5% to 4.5%, which surpasses the global average, leaving millions at risk of severe liver complications (5,6). Gilgit, a remote and mountainous region in Gilgit-Baltistan, Pakistan, presents unique challenges in combating HBV and HCV due to geographical constraints, limited healthcare infrastructure, and lack of awareness regarding transmission and prevention. The prevalence of HBV and HCV in Pakistan varies across different regions, with certain areas reporting rates as high as 6.2% for HCV alone, highlighting the need for targeted public health interventions (7). Several risk factors contribute to the high disease burden in this region, including unsafe medical practices such as the reuse of needles and syringes, inadequate sterilization of surgical instruments, and traditional procedures involving unsterilized tools for tattooing and ear piercing (8). Additionally, limited public knowledge about the modes of transmission and delayed healthcare-seeking behavior further exacerbate the spread of these infections (9). HBV, being highly contagious, can be transmitted from mother to child during childbirth, while HCV, though less infectious, spreads primarily through blood-to-blood contact, often due to unsafe medical procedures and intravenous drug use (4,5).

Addressing these challenges requires a multifaceted approach, including strengthening healthcare infrastructure, improving diagnostic facilities, ensuring access to antiviral therapies, and enhancing medical personnel training in infection control measures (10,11). Antiviral treatments play a critical role in reducing viral load, preventing liver damage, and minimizing disease progression (12). However, access to these medications remains a challenge in remote regions like Gilgit, necessitating partnerships with pharmaceutical organizations and global health agencies to secure affordable treatment options. Given the substantial public health impact of HBV and HCV in this vulnerable population, this study aims to determine the prevalence of these infections and identify associated risk factors, providing evidence to guide targeted interventions and policy decisions for effective disease control in the region.

METHODS

This cross-sectional study was conducted in Gilgit from 2023 to 2024, situated at geographical coordinates 35.920834° N latitude and 74.308334° E longitude (13). The study aimed to assess the prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections among a sample of 230 individuals, along with associated demographic, lifestyle, and health-related risk factors. Participants were selected using a stratified random sampling method to ensure representation of different socioeconomic and demographic groups. Inclusion criteria encompassed individuals aged 18 years and older who were residents of the region and willing to participate. Individuals with known liver diseases unrelated to HBV or HCV or those unwilling to provide blood samples were excluded. Ethical approval was obtained from the relevant Institutional Review Board (IRB), and written informed consent was secured from all participants prior to data collection.

Data collection involved the administration of a structured questionnaire designed to capture information on demographic characteristics, potential risk factors such as unsafe medical procedures, drug use, history of blood transfusions, and previous HBV and HCV testing. Participants were also asked about lifestyle factors, including smoking, alcohol consumption, and high-risk behaviors. Following questionnaire completion, venous blood samples were collected under aseptic conditions by trained healthcare professionals. These samples were subsequently analyzed using enzyme-linked immunosorbent assay (ELISA) for the detection of HBV surface antigen (HBsAg) and anti-HCV antibodies to determine infection status. The prevalence rates of HBV and HCV were calculated using standard epidemiological formulas, where the number of confirmed cases for each infection was divided by the total sample size and multiplied by 100. The formula for HBV prevalence was:

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$$HBV \ prevalence \ rate = \left(\frac{Number \ of \ HBV \ positive \ cases}{Total \ sample \ size} \right) \times 100$$

Similarly, HCV prevalence was determined using:

$$HCV \ prevalence \ rate = \left(\frac{Number \ of \ HCV \ positive \ cases}{Total \ sample \ size} \right) \times 100$$

To ensure comprehensive analysis, demographic data were categorized to evaluate healthcare access disparities, while lifestyle and behavioral patterns were examined to identify significant risk factors. Statistical analysis was conducted using SPSS (version X, specify version), with descriptive statistics used to summarize demographic and clinical characteristics. Categorical variables were analyzed using the chi-square test, and continuous variables were assessed using t-tests or Mann-Whitney U tests, depending on data distribution. Logistic regression was employed to identify independent risk factors associated with HBV and HCV infections. A p-value of <0.05 was considered statistically significant. Further, liver function tests, including alanine aminotransferase (ALT) and aspartate aminotransferase (AST), were performed to assess liver health among infected individuals. Screening frequency and awareness of hepatitis-related complications were also analyzed to determine the level of health literacy and engagement in disease management among participants (14). All data were anonymized to maintain confidentiality, and results were securely stored to prevent unauthorized access.
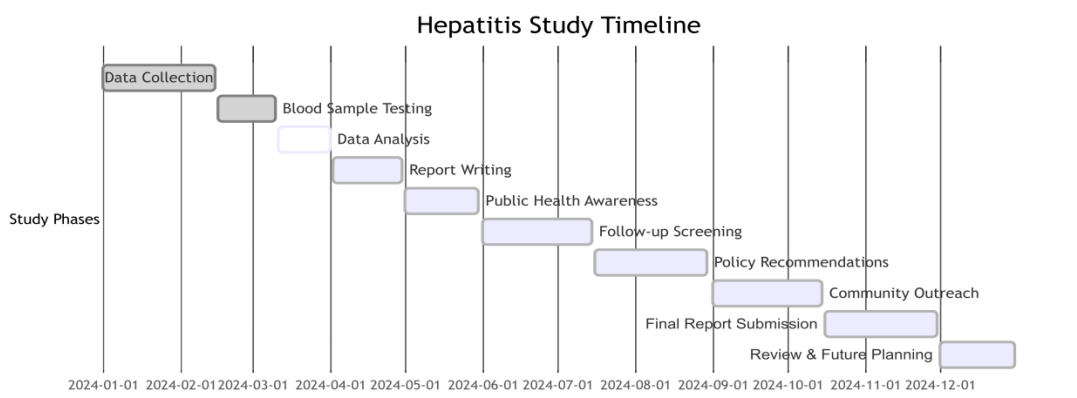

Figure 1. Timeline representation of Hepatitis study

RESULTS

The study sample comprised 230 individuals, including 122 males (53.0%) and 108 females (47.0%). The majority of participants belonged to the 20–40-year age group (53.9%), followed by 1–20 years (29.1%), 40–60 years (14.3%), and 60–80 years (2.6%). Among the study participants, various symptoms associated with hepatitis were reported. The most frequently observed symptom was light-colored stool, affecting 31.3% of individuals, followed by joint pain in 26.5%, abdominal pain in 16.5%, and dark urine in 10.0%. Other symptoms accounted for 15.7% of the cases. The standard deviation for symptom distribution was calculated as 1.27663, indicating moderate variability in symptom occurrence. The overall prevalence of HBV among the studied population was found to be 3.04%, with 7 individuals testing positive, while the prevalence of HCV was 0.87%, with 2 positive cases. The majority of participants (96.09%) tested negative for both HBV and HCV. The relatively low prevalence rates suggest the presence of effective public health interventions in the region; however, continued screening and preventive strategies remain essential to mitigate future risks.

Assessment of awareness regarding risk factors for hepatitis revealed that only 14.8% (34 individuals) of the respondents were aware of the potential risks, whereas 85.2% (196 individuals) lacked awareness. This substantial gap in knowledge highlights a critical public health concern, as limited awareness may contribute to the ongoing risk of transmission. Factors such as unprotected sexual practices, needle sharing, and exposure to infected bodily fluids were identified as potential contributors to the spread of HBV and HCV.

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Addressing these gaps in awareness through targeted health education programs is necessary for enhancing preventive measures within the community. Statistical analysis was conducted to determine the association between identified risk factors and HBV/HCV prevalence among the participants. A chi-square test revealed a statistically significant association between HBV infection and history of needle sharing ($\chi^2 = 9.77$, p = 0.002), suggesting that individuals who engaged in this behavior had a higher likelihood of HBV infection. Similarly, blood transfusion history was also found to be significantly associated with HBV infection ($\chi^2 = 0.44$, p = 0.507). In contrast, HCV infection showed a notable but statistically nonsignificant relationship with needle sharing ($\chi^2 = 0.13$, p = 0.723) and blood transfusion ($\chi^2 = 0.13$, p = 0.723). These findings highlight the importance of preventive measures such as safe injection practices and stringent screening of blood donations to mitigate the risk of viral transmission. Future studies with larger sample sizes and additional risk factors could further elucidate these associations and strengthen public health strategies.

Table. 1: Demographic overview of respondents

Category	Group	Respondents	Percentage (%)
Gender	Male	122	53.0
	Female	108	47.0
Age	1-20 years	67	29.1
	20-40 years	124	53.9
	40-60 years	33	14.3
	60-80 years	6	2.6
Total	-	230	100.0

Table.2: symptoms associated with Hepatitis

Symptoms	Frequency	Percent (%)	Valid Percent (%)	
Abdominal Pain	38	16.5	16.5	**Most Common Symptom:**
Dark Urine	23	10.0	10.0	**Light Colored Stool (31.3%)**
Light Colored Stool	72	31.3	31.3	**Least Common Symptom: Dark Urine (10.0%)**
Joint Pain	61	26.5	26.5	**Standard Deviation**
Other	36	15.7	15.7	**1.27663**
Total	**230**	**100.0**	**100.0**	

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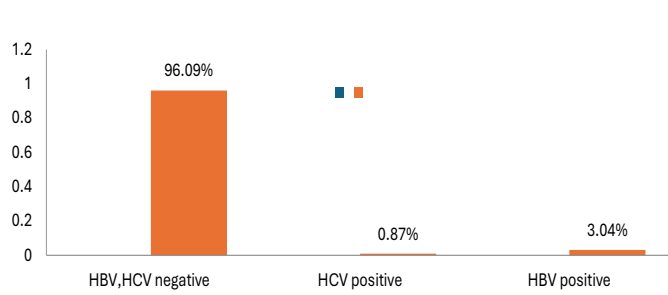AND REHABILITATION ■ ■ ■

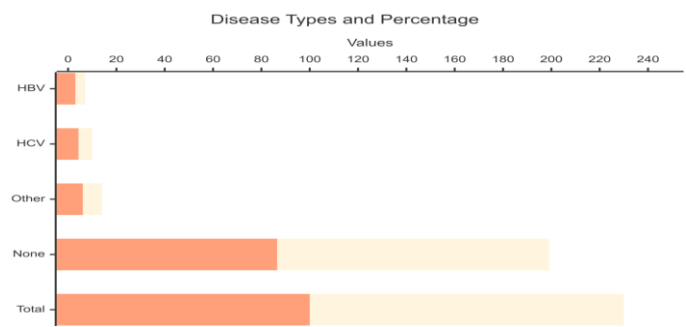Figure .2 positive and negative causes of HBV and HCV

Figure.3 Different types of diseases reported from the study area
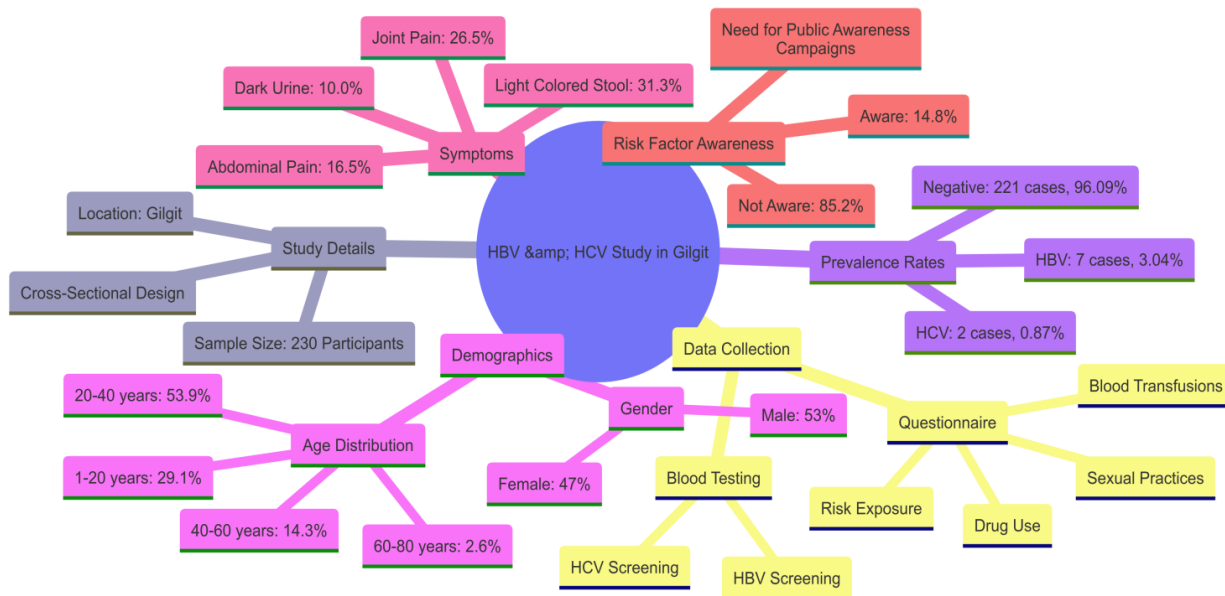

Figure.4 detailed diagram of HBV and HCV study in Gilgit, Pakistan

DISCUSSION

The observed prevalence rates of hepatitis B virus (HBV) at 3.04% and hepatitis C virus (HCV) at 0.87% in the Gilgit district indicate a relatively low burden of these infections, aligning with national trends reported in various regions of Pakistan (14,15). Previous studies conducted in different parts of the country, including Rawalpindi, have demonstrated similar HBV prevalence rates, suggesting the effectiveness of national health programs in controlling the spread of these infections (16,17). A key factor contributing to the decline in HBV prevalence is the implementation of the HBV vaccination program under Pakistan's Expanded Program on Immunization (EPI), which has significantly reduced the risk of transmission, particularly among newborns and high-risk populations (18). The World Health Organization (WHO) has consistently advocated for HBV vaccination in countries with moderate-to-high prevalence, reinforcing its role in reducing new infections and mitigating long-term complications associated with chronic hepatitis (19). In Pakistan, the inclusion of the HBV vaccine in routine immunization schedules has led to a significant reduction in disease incidence, highlighting the importance of sustained immunization efforts (20). Beyond vaccination, targeted public health interventions, including awareness campaigns and improved screening practices, have played a crucial role in reducing the transmission of both HBV and HCV (21). Educational initiatives focusing on healthcare workers, individuals with multiple sexual partners, and those at risk of exposure to unscreened blood have been instrumental in promoting preventive measures (22). In urban settings, increased awareness has contributed to a notable decline in the use of unsterilized medical equipment, which has been identified as a major transmission route for HCV (23). The observed prevalence

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rates in Gilgit may reflect the positive impact of similar awareness programs, particularly in reducing unsafe medical practices and needle-sharing behaviors (24). However, the unique geographical and cultural context of the region necessitates further examination of specific risk factors affecting different subpopulations. Pregnant women, for example, represent a critical demographic that requires further investigation to assess vertical transmission risks and the effectiveness of antenatal screening programs (25,26).

Despite these encouraging trends, several challenges persist. The relatively low prevalence rates observed in this study should not diminish the need for ongoing surveillance and intervention. Undiagnosed and asymptomatic carriers pose a silent threat, as delayed diagnosis can lead to complications such as liver cirrhosis and hepatocellular carcinoma. Moreover, limited healthcare access in remote regions like Gilgit may hinder timely diagnosis and treatment, potentially underestimating the true disease burden. The study's reliance on serological testing without additional confirmatory diagnostics, such as polymerase chain reaction (PCR) for viral load assessment, is a limitation that should be addressed in future research. Incorporating liver function tests and fibrosis assessment could provide a more comprehensive understanding of disease progression and treatment needs. Another limitation is the lack of in-depth statistical analysis linking behavioral risk factors with infection status, which could have strengthened the identification of high-risk groups. Future studies should consider expanding sample sizes and employing multivariate regression models to assess independent predictors of HBV and HCV infection. Furthermore, socioeconomic determinants, including healthcare accessibility, education level, and awareness about hepatitis transmission, warrant further exploration to inform tailored public health strategies. Strengthening preventive efforts through enhanced screening, safe medical practices, and continued vaccination programs remains crucial in sustaining low prevalence rates and preventing future outbreaks. The findings underscore the need for a comprehensive approach integrating immunization, education, and healthcare infrastructure improvements to effectively control HBV and HCV infections in Gilgit and beyond (27).

CONCLUSION

The findings highlight the effectiveness of vaccination programs, public health initiatives, and improved healthcare infrastructure in reducing the burden of HBV and HCV infections in the Gilgit district. The study reinforces the impact of preventive measures, awareness campaigns, and enhanced medical access in controlling viral hepatitis. While the prevalence remains relatively low, sustained efforts in education, early detection, and targeted interventions for high-risk populations are essential to maintaining progress and preventing future outbreaks. Strengthening healthcare policies and integrating comprehensive hepatitis management strategies will be crucial in further minimizing the risk of transmission and improving public health outcomes in the region.

Author Contribution

Author	Contribution
Shabana Batool*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Saqib	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Qamar Abbas	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

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