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FREQUENCY OF HEPATITIS B AND C AMONGST THE GENERAL POPULATION OF RURAL AND URBAN AREAS OF LAHORE PAKISTAN

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Abstract

Introduction: *Hepatitis is a global health concern, and its ever-increasing prevalence in Pakistan has highlighted the need to study its epidemiology and develop preventative strategies.*

Objective: *To determine the frequency and identify the risk factors associated with hepatitis virus infections B and C among the population of Lahore city.*

Study Design: *It was cross-sectional study.*

Sampling Technique: *Convenient Sampling*

Study Setting: *Microbiology Laboratory of Arif memorial hospital.*

Study Duration: *6 months*

Methodology: *A total of 250 participants were recruited, with 125 from an urban hospital*
(National Hospital, Lahore) and 125 from a rural setting (Arif Memorial Teaching Hospital,
Lahore). The study employed a descriptive cross-sectional design, screening participants for HBV and HCV using the Advanced Quality™ Rapid Immunochromatographic Test Kits. Data on socio-demographic details, medical history, and risk factors were collected through structured information sheets. Further confirmation of positive HBV or HCV cases was conducted using fourth-generation ELISA.

Results: *Results revealed that the prevalence of HCV was higher in the rural cohort (17.6%) compared to the urban cohort (12.8%). Interestingly, no cases of HBV were detected in either population, suggesting a potential correlation with effective vaccination programs or low transmission rates. Risk factor analysis highlighted significant differences between urban and rural populations, particularly in relation to practices such as body piercing, tattooing, drug injection, and unsterilized medical procedures. These factors were more prevalent in rural areas, emphasizing the need for targeted public health interventions in rural communities.*

Conclusions: *The findings suggest that while the urban population exhibited a higher prevalence of certain medical procedures as risk factors, rural populations*

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had higher rates of risky behaviors such as sharing needles and razors. This underscores the importance of tailored public health campaigns to address the unique transmission risks in each setting. In conclusion, the study highlights the need for continuous public health efforts to mitigate the spread of hepatitis, particularly in rural areas where certain high-risk behaviors are more prevalent.

INTRODUCTION

Hepatitis B and C constitute two of the most severe public health problems in the world, caused by two different viruses, namely the Hepatitis B virus, HBV, and the Hepatitis C virus, HCV. These infections essentially afflict the liver and can cause some of the most dangerous and serious complications in health if left undiagnosed and untreated (Tsukuda &Watashi, 2020). Such infections bring about great global burden. Millions of patients suffering from chronic infection experience complications in the form of fatal outcomes of cirrhosis of the liver and hepatocellular carcinoma or simply referred to as liver cancer. In a bid to find cure, science of medicine made huge development yet the killers as well as morbidities among low and middle income countries remains the hepatitis B and C without basic infrastructures in terms of resources of health services (Te& Jensen, 2010).

Hepatitis B is a DNA virus belonging to the family of viruses known as Hep Adenoviridae, which is usually transmitted through direct contact with infectious fluids like blood, semen, or vaginal discharges. Infections can also occur perinatally from an infected mother, through unsafe sexual practices, and through contaminated medical procedures, for instance, injection through the reuse of needles and syringes (Pattyn et al., 2021). In its acute phase, hepatitis B ranges from asymptomatic or mild presentation to severe hepatitis that may kill. Most of the people regain the virus while a big fraction of them suffers chronic infection specially those infected during birth or within early childhood. Chronic hepatitis B is a persistent state predisposed to cirrhosis and to liver cancer, and most subjects require prolonged follow-up and therapy (Alsulaimany, 2023).

There is hepatitis C caused by an RNA virus and majorly falls in the family Flaviviridae while being primarily spread through blood-to-blood contact. Major modes of transmission include sharing of needles among those people who inject drugs, unsafe medical procedure, and transfusion of contaminated blood products (Cui et al., 2023). Unlike hepatitis B, there is no hepatitis C vaccine; hence its prevention will depend greatly on public health interventions and education. Most cases of acute hepatitis C are asymptomatic and therefore underdiagnosed. The majority of those infected do not clear the virus spontaneously and progress to chronic hepatitis C. Chronic infection may lead to progressive liver damage over decades, culminating in cirrhosis or liver cancer (Manns &Maasoumy, 2022).

The prevalence of hepatitis B and C varies substantially across regions around the world. According to WHO, it is estimated that about 296 million people had a chronic hepatitis B infection worldwide in 2019, where nearly 820,000 deaths around the world were recorded annually from a consequence of hepatocellular carcinomas after chronic hepatitis infection. (Cui et al., 2023). A similar estimate comes with a hepatitis C problem affecting up to 58 million of the global populaces, an average of an annual complication of death 290 000. High-prevalence regions for hepatitis B include sub-Saharan Africa and East Asia, where the disease is often transmitted perinatally or in early childhood. Hepatitis C, in contrast, is more prevalent in regions such as Central Asia, Eastern Europe, and North Africa, where unsafe medical practices and injecting drug use are significant contributors to transmission (Alberts et al., 2022).

The prevalence of hepatitis B and C is alarmingly high in developing countries like Pakistan, causing a severe public health crisis. Pakistan is among the countries with the highest burden of these infections, where millions of individuals live with chronic hepatitis. Inadequate healthcare infrastructure, lack of public awareness, and unsafe medical practices are factors contributing to the high prevalence (Schmelzer et al., 2020). The major transmission factors include reusing needles, lack of screening for blood transfusions, and insufficient

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infection control measures in healthcare settings. Low vaccination coverage against hepatitis B, especially in rural and underserved areas, worsens the situation. With hepatitis C, there is no vaccine to prevent the infections; this makes prevention quite a difficult task, so a well-coordinated information campaigns and harm reduction must be executed to reduce its prevalence (Tan et al., 2021).

The socio-economic implications of hepatitis B and C infections are enormous because it cuts across individuals, families, and health care system. In many cases, these infections trigger chronic liver disease conditions with the concomitant adverse quality of life and extensive use of healthcare resources. For individuals, managing chronic hepatitis can be burdensome from a financial standpoint; one needs to continue undergoing frequent medical check-ups and, if necessary, antiviral therapies or liver transplantation. For the health system, long-term care for chronic infections further exhaust already scarce resources that might be better spent on other crucial health issues. In addition, patients' economic productivity in terms of illness and disability suffers and hence results in higher community and national economic losses (RazaviShearer et al., 2018).

Global efforts to combat hepatitis B and C have emphasized prevention, early diagnosis, and treatment. Vaccination against hepatitis B has formed a core component of its preventive strategies. The entry of the hepatitis B vaccine into national immunization programs has greatly reduced new infections in many countries, particularly in those with high endemicity. In

Pakistan, the inclusion of the hepatitis B vaccine in the Expanded Program on Immunization (EPI) has improved vaccination coverage, though challenges remain in ensuring equitable access across rural and urban areas (Kazmi & Khan, 2007). Hepatitis C prevention relies more on public health interventions, including safe injection practices, sterile medical equipment, and rigorous blood screening protocols (Guntipalli et al., 2021).

Hepatitis B and C are widespread global health problems. They have a very significant prevalence and have had an enormous impact on morbidity and mortality worldwide. Viral infections cause millions of chronic cases, posing an enormous challenge to healthcare systems.

An estimated 296 million people are living with chronic hepatitis B infection, according to the WHO data of 2019 (Zhang et al., 2022). Around 58 million people suffered from chronic hepatitis C. Annually, hepatitis B causes approximately 820,000 deaths, primarily due to complications such as cirrhosis and hepatocellular carcinoma, while hepatitis C accounts for an estimated 290,000 deaths. These staggering figures highlight the critical need for targeted interventions to reduce transmission, improve access to treatment, and ultimately eliminate these infections as major public health threats (Alberts et al., 2022; Manns et al., 2017).

The global distribution of hepatitis B and C varies widely, reflecting differences in healthcare systems, public health infrastructure, and socio-economic conditions. Hepatitis B is highly endemic in the regions of sub-Saharan Africa, East Asia, and parts of the Western Pacific where prevalence rates exceed 8% in the general population (Alberts et al., 2022). Prevalence rates in regions such as North America and Western Europe are low, less than 1%, owing to good vaccination programs, safe medical practices, and good access to health care. Hepatitis C is also found in a rather uneven manner. The highest-burden areas include Central Asia, Eastern Europe, and the Middle East, where unsafe medical practices and injecting drug use greatly contribute to its spread. Conversely, low prevalence rates of hepatitis C are observed in regions

such as Western Europe and North America, where harm reduction programs and stringent infection control measures are more widespread (Petruzziello, 2018).

A stark contrast exists in the epidemiology of hepatitis B and C between low-income and highincome countries. The prevalence of hepatitis B and C remains alarmingly high in lowincomeregions due to several interrelated factors, including limited access to vaccination, inadequate healthcare infrastructure, and poor awareness of preventive measures. In such settings, unsafe medical practices, such as the reuse of syringes and unsterilized surgical equipment, are very common and contribute significantly to the spread of both viruses. Also, the lack of a broadscreening policy in blood further

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enhances transmission. In rural areas where good healthcare facilities are rare, coupled with poor equipment, hepatitis B is easily transmitted in the perinatal mode because of the absence of screening of mothers and any type of prophylactic treatment for newborns. Meanwhile, hepatitis C is often associated with unsafe medical procedures and injecting drug use, combined with poor harm reduction measures and scarce antiviral drugs (Nelson et al., 2011).

In high-income countries, the prevalence of hepatitis B and C is relatively low, primarily because of effective public health measures and the advancement of medical technology. There are strong indications that widespread vaccination against hepatitis B, introduced to routine immunization schedules, will reduce new infections significantly in children and young adults. For hepatitis C, controlling infections in healthcare settings by emphasizing infection control practices, proper blood transfusion safety systems, and harm reduction for persons who inject drugs have formed significant components of lowering the rate of transmission. Moreover, the availability of advanced diagnostic tools and antiviral therapies allows for the early detection and management of chronic cases, minimizing the risk of long-term complications such as liver failure and cancer. However, disparities persist even within high-income countries, where marginalized populations, including migrants, homeless individuals, and people who inject drugs, are more likely to be affected by these infections (Zou et al., 2024).

South Asia bears a high burden of hepatitis B and C, with Pakistan being one of the worst affected countries in the region. The prevalence of hepatitis B in South Asia varies between 2% and 5% in endemic areas. However, hepatitis C remains a very specific challenge in this region, as Pakistan is among the top countries in the world in terms of its alarmingly high prevalence rate of around 6.8%. This burden in Pakistan is based on various socio-economic, cultural, and healthcare-related reasons. Poor sterilization and reuse of syringes without proper cleaning have become a part of medical practices in almost all healthcare setups in rural as well as urban settings. Inadequate blood screening practices contribute to the transmission of hepatitis B and C, as do cultural practices such as sharing razors or toothbrushes, especially in rural communities (Wait et al., 2016).

Vaccination coverage for hepatitis B in Pakistan is suboptimal, especially in rural areas where access to healthcare services is limited. Although the hepatitis B vaccine is incorporated into the national Expanded Program on Immunization, this has not been fully adopted due to logistical and vaccinal hesitancy issues. Therefore, most newborns miss birth vaccination, which leads to vertical transmission from an infected mother. For hepatitis C, since there is no vaccine, prevention is even harder; therefore, more dependence will be on public health intervention measures to reduce transmission. Despite the availability of highly effective direct-acting antivirals (DAAs) for hepatitis C, their high cost and limited accessibility in Pakistan restrict their use, especially among low-income populations (Ali et al., 2009).

The socio-economic implications of hepatitis B and C in Pakistan are profound, straining both individuals and the healthcare system. Chronic liver diseases resulting from these infections account for a significant proportion of hospital admissions and healthcare expenditures. For individuals, loss of productivity and the financial burden because of long-term medical care are devastating. At a national level, the country faces economic losses due to lack of management in the healthcare systems because of growing chronic conditions and complications of the liver. These are further compounded by the lack of comprehensive surveillance systems to monitor the true scale of the problem and guide evidence-based interventions (Mehmood et al., 2020). Pakistan is among the countries that suffer a significant burden of hepatitis B and C; prevalence rates are some of the highest worldwide. These infections significantly challenge the nation's public health system and contribute to a growing incidence of chronic liver diseases, such as cirrhosis and hepatocellular carcinoma. Hepatitis B and C are thought to be endemic in Pakistan, with an estimated prevalence of around 2.5% for hepatitis B virus (HBV) and 6.8% for hepatitis C virus (HCV) among the general population. Millions are thus living with chronic infections; hence, it is considered a critical public health concern in the country. The prevalence rates

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are unevenly distributed in various regions; certain areas, especially rural areas, have significantly higher rates compared to others, primarily because of poor healthcare infrastructure, unawareness, and unsafe medical practices (Zahoor et al., 2021).

The epidemiology of hepatitis B and C in Pakistan indicates the presence of regional disparities in these conditions, with the role of socio-economic conditions and healthcare inequities coming into play. Urban centers like Lahore, Karachi, and Islamabad have lower prevalence rates compared to rural areas where the quality of healthcare services is not accessible. However, even in urban settings, hepatitis C is a serious issue, and research shows that infection rates range from 5–8% among certain population groups. Lahore is a big and populous city of Pakistan and can be considered a microcosm for the study of the complexities associated with the transmission of hepatitis in urban settings. Rapid urbanization, high population density, and inadequate regulation of healthcare practices contribute to the spread of these infections. Lahore, though a relatively more advanced healthcare system than the rural areas, faces the challenges of universal screening, proper sterilization of medical equipment, and safe blood transfusion. The city's marginalized groups, including low-income people and migrants, are also vulnerable to the same issues because they have less access to health care and poor living conditions (Shafiq et al., 2015).

The national statistics on hepatitis B and C are alarming, with nearly 15 million people estimated to be living with chronic HCV and around 7–8 million with chronic HBV. These numbers place a significant burden on the healthcare system, where management of hepatitis-related complications accounts for a significant percentage of hospital admissions and expenditures in healthcare. Some other groups, such as health workers, injecting drug users, and repeated users of medical procedures, have significantly higher prevalence rates. For example, research has shown that nearly 18% of Pakistan's injecting drug users are infected with HCV, an incidence indicative of unsafe needle-sharing practices leading to disease transmission. The risks of HBV are at a higher level among the health care workers due to occupational exposure, especially in institutions where vaccination and post-exposure prophylaxis are not commonly practiced (Samo et al., 2020).

Multiple socio-economic and healthcare related factors have led to this high prevalence of hepatitis B and C in Pakistan. Unsafe medical practices are a major mode of transmission, with the reuse of syringes, improper sterilization of surgical instruments, and unregulated dental and cosmetic procedures common in both rural and urban areas. Blood transfusions, often carried out without proper screening for hepatitis viruses, are another significant source of infection.

The spread of HBV and HCV is further compounded by a lack of strict regulatory oversight in most healthcare facilities, especially in rural areas where informal practitioners practice without adherence to standard infection control protocols. Other factors are also prevalent, such as cultural practices where individuals share razors or other personal items, mostly among rural communities where people are not aware of the dangers of disease transmission (Saeed et al., 2015).

The Pakistan healthcare system is plagued by several problems in dealing with the hepatitis epidemic. Although the hepatitis B vaccine is included in the national Expanded Program on Immunization (EPI), coverage remains suboptimal, especially in rural areas where logistical issues, vaccine hesitancy, and limited access to healthcare hinder widespread implementation.

The situation for hepatitis C is even worse because no vaccine exists, making prevention depend on public health measures like education, harm reduction strategies, and infection control. In addition, the availability and cost of antiviral therapy for chronic hepatitis B and C are also limited for low-income populations. While direct-acting antivirals (DAAs) have revolutionized the treatment of hepatitis C, their high cost and inconsistent supply in Pakistan prevent many patients from accessing these life-saving medications (Mahmood et al., 2016).

Urban and rural disparities in accessing healthcare are a crucial factor in determining the epidemiology and treatment of hepatitis B and C in Lahore, Pakistan. The factors that account for these disparities include differences in healthcare

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infrastructure, hygiene standards, levels of education, and awareness levels regarding health issues. Urban sectors, such as central Lahore, have relatively easier access to the healthcare system, with well-equipped public and private hospitals, advanced diagnostic laboratories, and proper specialized care. However, even in urban areas, the availability and quality of healthcare services are not uniform, and marginalized communities are highly disadvantaged. In rural areas, there is a grave scarcity of medical facilities and qualified healthcare providers. This scarcity forces them to rely on unqualified practitioners or traditional healers, whose practices often involve unsafe medical procedures, further contributing to the spread of hepatitis B and C. This gap in healthcare infrastructure between urban and rural Lahore is urgent to address with targeted interventions for the inequities that exist (Li et al., 2024).

In rural Lahore, the main challenge is that there are inadequate healthcare facilities. Many villages do not have basic medical centers or have only poorly equipped dispensaries. Preventive measures, such as vaccination programs for hepatitis B and routine screenings for hepatitis C, are limited or absent in these areas. Raising an awareness campaign about the hazards posed by harmful healthcare systems, where cases would be detected early, remains something unheard of in rural settings and, therefore, not taught among the communities. There tends to exist poor hygiene habits such as having razors, needles, or other personal items shared as well, especially in less knowledgeable, educated, and aware environments found mainly in rural areas. The absence of access to even safe drinking water and proper sanitation can exacerbate the spread of infectious diseases, including hepatitis (Alenzi&Almeqdadi, 2024).

Urban areas of Lahore, though better equipped in terms of health infrastructure, have their own set of problems in dealing with hepatitis B and C. Overcrowding in hospitals and clinics often leads to compromised quality of care, increasing the risk of transmission through improper sterilization of medical equipment or unsafe blood transfusion practices. Although urban residents are more likely to have access to vaccination programs and diagnostic services, gaps in health policy implementation mean that not everybody benefits equally. Low-income inhabitants of urban areas often face informal medical practitioners who adopt unsafe medical practice such as reusing syringes or inadequately screening blood donors, leading to spread of these infections. In addition, the lack of integration between public health programs and private healthcare providers in urban settings creates inconsistencies in prevention and treatment efforts (Njei et al., 2019).

The higher prevalence of hepatitis B and C in rural areas as compared to urban Lahore is due to various factors. Among these factors, the most significant one is unsafe medical practices that prevail in most rural healthcare settings. Most practitioners who are unqualified are in the habit of reusing syringes, needles, and surgical instruments without proper sterilization, thus exposing the individual to a high risk of acquiring hepatitis. Blood transfusions in rural areas are rarely tested with strict screening protocols, and this is part of the problem. In addition, a lack of education on disease prevention means that those in rural areas are less likely to adopt hygienic practices or seek early medical care. Cultural taboos and stigma related to hepatitis infections also make rural populations less likely to seek diagnosis or treatment, allowing the disease to spread unchecked (Du et al., 2021).

In urban Lahore, while healthcare services are more advanced, there exist challenges unique to the area, which explain why hepatitis B and C have not been eradicated. There is overcrowding in health care facilities, leading to hurried procedures and failure to adhere to infection control protocols. This is particularly worrisome in public hospitals with heavy patient loads and insufficient resources. Private healthcare providers, although more resourceful, are often inaccessible to low-income populations due to their high costs. As a result, informal medical practitioners in urban slums fill the gap, frequently employing unsafe practices that increase the risk of hepatitis transmission. In addition, urban areas face challenges related to mobility and migration, with a high influx of people from rural regions bringing diverse healthcare needs and potentially contributing to the spread of infections (Zhu et al., 2018).

The modes of transmission of hepatitis B and C in Pakistan are highly interwoven with the healthcare

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practices and socio-economic conditions prevalent in rural and urban settings. Unsafe medical practices are the leading cause of hepatitis transmission in the country. A significant proportion is due to the reuse of syringes, mainly due to cost-cutting measures in underfunded healthcare settings. This practice is especially prevalent in the countryside, where medical facilities are fewer and many are run by unqualified operators. Blood transfusions contaminated with diseases are also an important factor in the disease because most blood banks operating in Pakistan do not strictly check on the presence of hepatitis B and C. In the rural regions, this issue becomes further compounded by the tendency of relying on informal blood donation systems that don't even check for infectious diseases (Stroffolini&Stroffolini, 2024).

The prevention of hepatitis B through vaccination is applied inconsistently throughout the city of Lahore. The vaccination campaign in rural areas is undermined by logistic difficulties, reluctance toward vaccines, and a low level of awareness. A large proportion of individuals living in rural communities are not vaccinated against hepatitis B. In the city, vaccination coverage is relatively higher; however, in several respects, gaps still remain: low-income populations and migrant workers, who may not be accessible for immunization services. Hepatitis C, for which no vaccine is available, remains even more difficult to control, with prevention relying entirely on public health measures and safe medical practices (Sabeena & Ravishankar, 2022).

Some specific socio-cultural factors influence hepatitis transmission dynamics in both urban and rural Lahore. For example, rural areas include some socio-cultural factors contributing to infection in this population because of commotal practices of shared use of razors by the barbers and contamination tools use by healers. Cultural practice, like mass circumcision ceremonies or ear piercing under less than satisfactory sanitation, compounds this problem. In urban areas, although these traditional practices are less common, the high demand for cosmetic procedures, tattooing, and dental treatments in unregulated clinics poses a significant risk. The use of improperly sterilized instruments in such settings can facilitate the transmission of hepatitis B and C, particularly among younger, urban populations (Coppola et al., 2016).

Improving healthcare access and modes of transmission in Lahore needs a multi-faceted approach. Improvement in health infrastructure in rural areas, training healthcare providers, and spreading awareness among people regarding prevention from diseases need to be taken care of. More extensive vaccination campaigns targeting the un-reached groups are needed. In urban places, there is a need to exercise stricter regulation of healthcare practices, including such screening of blood donors and enforcing proper sterilization. Public awareness needs to be created among both the rural and urban populations regarding the dangerous unsafe medical practices and the prompt onset of diagnosis and treatment in them. By addressing these challenges, there is the possibility of reducing hepatitis B and C burden and improving health outcomes of residents of Lahore (Karnsakul& Schwarz, 2017).

Hepatitis B and C are major health and economic challenges globally and domestically. The diseases seriously impact the individual, family, and community directly and indirectly. Chronic infection leads to serious complications such as cirrhosis of the liver and hepatocellular carcinoma at the individual level and requires lifelong medical care while diminishing the quality of life significantly (Wallace et al., 2022). Families of affected individuals have psychological trauma and financial burdens, more so in the case of the poor with limited access to specialized medical care. It also affects the national economy as the high costs of treatment for such patients, like hospitalizations, drugs, and diagnostic tests, take a financial toll on the health sector. In addition, the diseases will reduce the productivity of workers because the more time spent lying in bed, the faster people die. The effects outlined above indicate why hepatitis B and C must be addressed at both the public health level and economic levels (Palladino et al., 2024).

Despite the high burden of hepatitis B and C in Pakistan, region-specific studies focused on urban and rural populations are limited, particularly in Lahore. The epidemiological patterns of these diseases in both settings are critical to understand, because the factors driving their prevalence vary significantly across geographic and socioeconomic

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divides. Urban populations may be exposed to overcrowded health care facilities, while the rural population is exposed to unsafe medical practices and poor healthcare infrastructure. A comprehensive comparison of these settings may point out specific risk factors, barriers to prevention, and areas for intervention. Additionally, identifying gaps in public awareness and healthcare access may guide the development of targeted strategies for controlling these infections. The findings of this research will give actionable information on the development of public health initiatives, resource allocation, and policy formulation in Lahore and other cities.

It thus offers utmost relevance in public health planning and resources usage in Pakistan. It adds an insight to the burden faced by hepatitis B and C in Lahore and thereby puts a clearer picture on inequalities at the urban-rural and spatial differences observed during healthcare access and prevalence patterns for that particular disease. It finds direct application in control programs of hepatitis as it categorizes the populations that must undergo interventions urgently. On a larger scale, the study will boost the national effort to reduce the burden of viral hepatitis, which is part of the global health targets set by the WHO. Furthermore, the research will fill in knowledge gaps in the field and be a reference for future studies and policy-making. This research focuses on the crucial need for targeted interventions that will eventually pave the way toward more effective strategies to combat hepatitis B and C in Pakistan.

Objective

To determine the frequency and identify the risk factors associated with hepatitis virus infections B and C among the population of Lahore city.

LITTERATURE REVIEW

Studies have pointed out that the infections of hepatitis C (HCV) worldwide are on the rise, especially in Pakistan, which has highly reported mortality rates from HCV infections. There is no availability of a vaccine and the treatment is costly, making it an added public health burden. It is quite essential to identify and mitigate risk factors through proper prevention strategies. A cross-sectional survey conducted with 400 patients in Lahore had found urban and rural disparities in risk factors associated with HCV. Logistic Regression Models applied herein found the following results; ever-married, history of maternal illiteracy, hepatitis in family, surgical, or road accidents as predominant risk factors for urban patients, but with age, history of jaundice, barber related shaving in rural people. Road accidents emerged as a hitherto unreported risk factor, and the study concluded that risk factors vary by setting, thus requiring context-specific interventions as well as predictive models for proper management of HCV in Pakistan (Ghias et al., 2010).

A study conducted in Badin city evaluated 767 individuals for Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) using immunochromatographic methods. HCV was found to be significantly higher than HBV; more men were infected as compared to women. Important risk factors identified included barber/parlor shaving, reuse of syringes, and intravenous drugs use, with 61.7%, 46.7%, and 8.6% participants involved, respectively. Also, female subjects who participated in the survey exhibited commonly recurring risk factors of obstetrical procedures and body piercings. It was concluded that HBV and HCV were spreading because of both traditional practices, such as barber-related services, and newer ones, such as body piercings (Jamali et al., 2024).

A prevalence study of Hepatitis B and C in patients undergoing cataract surgery was conducted in Karachi. It involved 377 patients from the Department of Ophthalmology Unit I at CHK from April 2010 to May 2011. A prevalence rate of 12.99% for both hepatitis infections was observed. Specifically, 2.1% of patients tested positive for Hepatitis B surface antigen (HBsAg), while 11.1% were positive for Anti-HCV antibodies. Only one patient was found to be co-infected with both hepatitis B and C. The study emphasized the need for routine preoperative screening for Hepatitis B and C in cataract surgery patients to prevent asymptomatic individuals from unknowingly spreading the infections (Naeem et al., 2012).

A baseline survey was conducted on the knowledge, attitudes, and practices (KAP) related to hepatitis B and C among a randomly selected population of 560 individuals aged 16 and above. The study found a

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high prevalence of hepatitis C (18.6%) compared to hepatitis B (3.2%), with a small proportion (3%) testing positive for both. Despite this, the survey revealed a significant lack of awareness, with 39.6% of participants unaware of the signs and symptoms of hepatitis, and 80.5% not knowing about the availability of the hepatitis B vaccine. The majority of respondents (60%) understood the fatal potential of hepatitis, and 57.5% correctly identified blood transfusion from hepatitis-positive individuals as a transmission route. But still, in the study, 85.7% of participants were never vaccinated for hepatitis. The findings put across that there is a need to carry out more awareness campaigns and community-based screening programs to educate people about the prevention and treatment of hepatitis (Sohail, 2023).

The research was conducted in Lahore, Pakistan, to determine the prevalence of HBV and HCV infection in children under the age of 15 years. The survey included screening of 3,500 children attending a specialized outpatient clinic over one year; 0.8% tested positive for HBV and 1.88% for HCV. Risk factors associated with infection were identified by comparing 94 children positive for HBV or HCV with 100 age- and sex-matched controls. Interestingly, 35.7% of HBVpositive children were born to HBV-negative mothers and had been vaccinated during infancy, highlighting unexpected transmission routes. It had more frequency of HCV as compared to HBV in the children and indicated a need for further study in horizontal risk factors contributing to viral hepatitis in this population (Seerat et al., 2020).

A study between June 2007 and May 2008 in rural and peri urban Sindh was conducted to estimate the prevalence of HBV and HCV and identify associated transmission risk factors. The study screened 573 participants, including children older than one year and unscreened adults, in remote villages and a peri urban area. The prevalence of HBsAg was found to be higher in rural areas (7.0%) compared to the peri urban area (3.1%), while HCV prevalence was alarmingly high in rural areas (28.6%) compared to 3.9% in the peri urban area. The main risk factors identified were unsafe blood-related procedures, such as surgeries, dental treatments, and body piercings, which were more common in rural areas. The study stressed mass HBV vaccination and the implementation of urgent measures to limit the spread through proper sterilization and less usage of non-sterilized medical instruments (Aziz et al., 2010).

A study carried out in Farash Town from January to December 2013 aimed to determine the prevalence of hepatitis B (HBV) and hepatitis C (HCV) as well as identify associated risk factors in the local community. Of 345 participants of all ages and genders, 33% were found to be infected with HCV while 9% had HBV. The common risk factors identified were the use of unsterilized therapeutic injections and visits to community barbers, with 58.6% of hepatitis cases linked to the latter. In the minority of cases, a history of dental procedures was reported. Therefore, the study underlines the importance of unsafe medical practices and emphasizes the call for educational interventions, more so targeting barbers as a means of reducing the spread of the infections in the community (Munazza Asad et al., 2015).

A study conducted in Lahore, Pakistan, aimed to investigate the frequency of Hepatitis B and C and identify socio-demographic and lifestyle risk factors associated with these infections. Data were collected from 5095 patients at Mayo and Jinnah hospitals, with 146 patients (67 males and 79 females) completing a questionnaire. The study revealed a higher frequency of hepatitis C compared to hepatitis B. High risks for both types of hepatitis included education level, marital status, family history, household income, and dietary habits. These results pointed out the need for focused interventions that would target the identified socio-demographic and lifestyle factors in reducing the prevalence of Hepatitis B and C in the population (Raza et al., 2022).

A review on the prevalence and risk factors of viral hepatitis in Pakistan shows that HBV and HCV infections are a huge concern. The study revealed that national prevalence rates for HBV and HCV were 1.98% and 7.44%, respectively, and the rates are higher among blood donors. HBV was highly associated with chronic liver disease, whereas HCV showed higher prevalence in thalassemia patients and intravenous drug users. Genotype 3 of HCV was found more than genotypes 1 and 2. The review also brought into view that the regions of Punjab and Sindh, along with the conflict-affected areas, have the

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highest infection rates. The high-risk routes included barbers, blood transfusions, IDUs, and newly identified sources like ear and nose piercing, which were increasingly being found among IDPs (Mehmood et al., 2020).

Material and Methods

3.1 Objective:

To determine the frequency and identify the risk factors associated with hepatitis virus infections B and C among the population of Lahore city.

3.2 Study design:

This was a cross-sectional study.

3.3 Study Duration:

This study was done in the life span of 6 months from August 2024 to January 2025.

3.4 Study Setting:

The study was conducted at the Microbiology department of Arif Memorial Teaching Hospital (AMTH) Lahore.

3.5 Sampling technique:

The study employed a convenience sampling technique to efficiently gather data while maintaining relevance to the research objectives.

3.6 Sample size:

The sample size of 150 participants was calculated by WHO calculator version 0.618 with a 95% confidence level. The sample size formula for estimating a population proportion with given absolute precision was:

$$n = Z^2 1\text{-}\alpha/2\ P(1\text{-}P)$$

$$d^2$$

1-α is confidence level [95%].

P is the anticipated population proportion.
d-is absolute precision.
n is sample size.

3.7 Inclusion Criteria:

All apparently healthy asymptomatic individuals aged one year and older who had never previously been screened or vaccinated for either HBV or HCV were included.

3.8 Exclusion Criteria:

Exclusions included prior confirmed diagnosis of HBV or HCV, any form of treatment for the conditions, any previous vaccination against the diseases, children under one year of age, or any other individual identified as having a self-report history of being a drug addict.

3.9 Data/ Specimen Collection:

Recruitment Process:

Recruitment was done through public awareness campaigns conducted with the assistance of either a health worker or any local social influencer. Information material in respect of the study including its objectives, procedures and the benefits was distributed within both the urban and rural settings. At the rural level, community leaders and local social workers were influential in mobilizing participation. Throughout the study, venue and time communicated well to maximize attendance throughout both the areas.

Screening Procedure

HBV and HCV screening were performed using the Advanced Quality™ Rapid Immunochromatographic Test Kits from Intec® production, Inc., Xiamen, China. Sensitive and specific for 99.8% with 95% CI results are guaranteed using this kit for HCV testing. For each HCV specimen, 10µL whole blood was put in the well S of the test card with two drops sample diluent being placed in well D. Reading results were to be done at 15 minutes.

IMMUNOCHROMATOGRAPHY (ICT)

Immunochromatography (ICT) is a rapid diagnostic procedure used to detect Hepatitis B (HBV) and Hepatitis C (HCV) infections. This assay employs specific antibodies that recognize HBV surface antigen (HBsAg) and HCV antibodies in blood samples. The ICT test involves a membrane strip containing immobilized antigens. When the patient's blood sample 80-10 microliter is applied to the strip, it migrates along the membrane. If HBsAg or HCV antibodies are present, they bind to the

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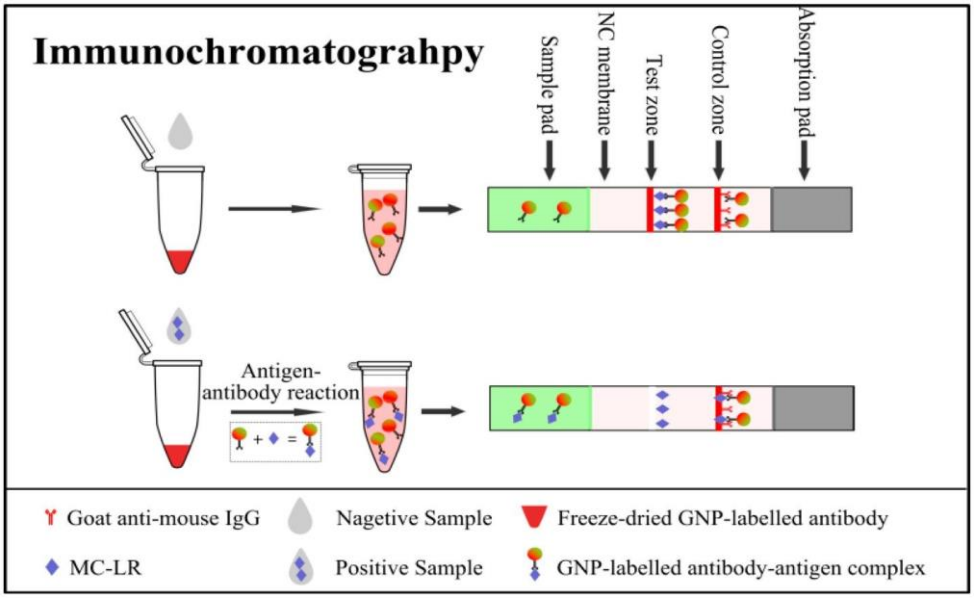
corresponding antibodies on the strip, forming visible lines, indicating a positive result. The simplicity, speed, and effectiveness of the ICT procedure make it valuable in swiftly identifying individuals with HBV or HCV infections, enabling timely intervention and appropriate patient management.

Figure 1



ELISA

The Enzyme-linked immunosorbent assay (ELISA) for Hepatitis B (HBV) and Hepatitis C (HCV) diagnosis follows a step-by-step process. Initially, the patient's serum, containing potential HBV or HCV antibodies, is added to a microplate pre-coated with specific antigens related to HBV or HCV. Any present antibodies bind to these antigens. After a washing step to remove unbound material, enzyme-linked secondary antibodies that are specific to human antibodies attach to any bound antibodies. Another wash follows to eliminate excess secondary antibodies. Then, a substrate solution is added to produce a detectable signal. The reaction between the enzyme and substrate generates a color change, indicating the presence of HBV or HCV antibodies. The intensity of the color change corresponds to the concentration of antibodies, allowing for the identification and quantification of the infection. This highly sensitive and specific diagnostic method aids in accurately detecting HBV and HCV infections in clinical settings.

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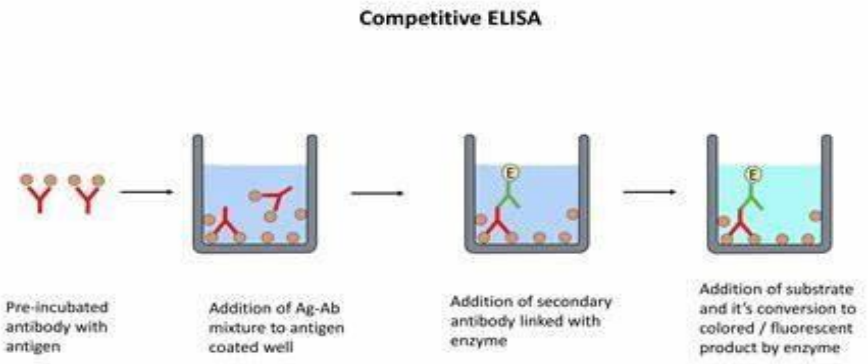
Figure 2



Ethical Considerations

All participants had their informed consent obtained before participating in the study. They explained the nature of the study, the screening procedure, and that they can withdraw at any given time. The demographic data as well as any possible risk factor of transmission for HBV and HCV was taken on a structured information sheet. All participants' information was kept confidential during the whole period of the study.

Data Collection and Management

A team consisting of doctors, laboratory technicians, and trained volunteers conducted the screening. All the data were captured in a standardized format, incorporating demographic details, medical history, and screening results. All patients who screened positive for HBV or HCV were subjected to further confirmation through fourth-generation Enzyme-Linked Immunosorbent Assay (ELISA) to ensure that only positive results are reported. Separate and comparative analysis of data collected from both the urban and rural samples would provide insights into prevalence and risk factors.

Adopting a systematic and standardized approach toward participant recruitment, data collection, and testing makes this study all the more reliable and valid to establish findings in relation to HBV and HCV prevalence within the urban and rural populations of Lahore.

Statistical analysis

The collected data was entered into excel sheet from electronic media reports and statistical analysis was performed by using software SPSS version 25. The quality metrics of data were mean, frequencies, percentages.

RESULTS

4.1-Age distribution:

Table 1 presents the age distribution of rural and urban participants. Among rural participants, there were more women (30.8%) and fewer men 19.2%. The rural participants were majorly found to be within the 16–30 years and 31–45 years age groups where females were relatively much higher compared to males. The urban respondents were more almost equally spread throughout the age categories. Male participants were 23.2% of the total while females were 26.8%. More participants in the urban group were in the older age groups, 46–60 and 61–75 years compared to the rural group.

Table 4.1: Age Distribution of Rural and Urban Participants.

Rural				
Age	Male (Number)	Percent	Female	Percent
0-15	7	2.8	0	0
16-30	10	4	30	12
31-45	10	4	27	10.8

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46-60	13	5.2	15	6
61-75	8	3.2	5	2
Total	48	19.2	77	30.8
Urban				
0-15	0	0	2	0.8
16-30	10	4	16	6.4
31-45	14	5.6	23	9.2
46-60	16	6.4	17	6.8
61-75	18	7.2	9	3.6
Total	58	23.2	67	26.8

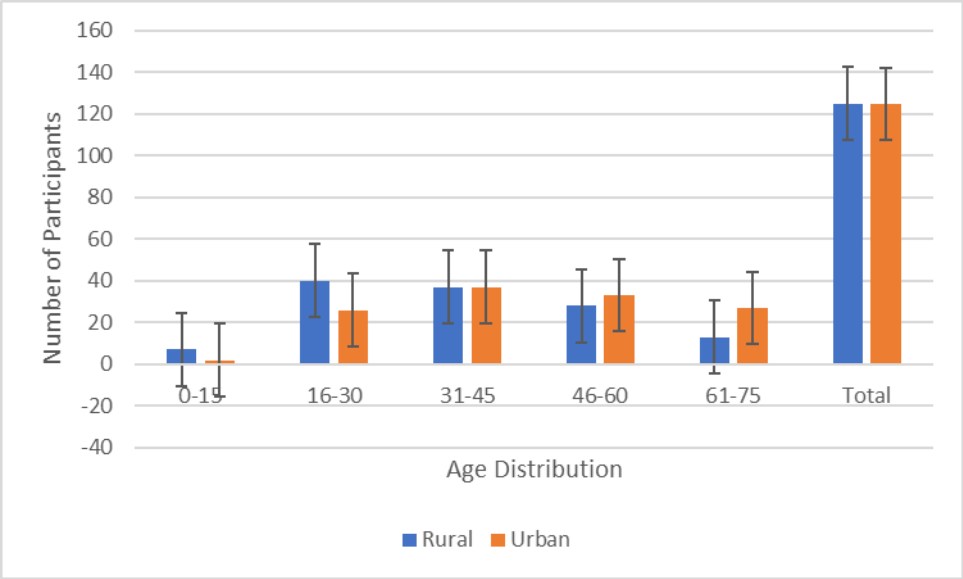

Figure 4.1: Age Distribution of Participants.

Age Distribution among Rural and Urban Population:

Table 2 summarizes the descriptive statistics of the age distribution of the rural and urban populations. The mean age of the rural population was 38.31 years (±15.12), ranging between 6 to 73 years, whereas for the urban population, the average age was higher at 45.06 years (±16.39) with the range being between 12 to 75 years. In the study, a total of 250 participants participated, with a quite balanced age distribution of the populations in the two settings. A higher mean age in the urban population implies a relatively older demographic than that in the rural cohort, which also is in agreement with the higher proportion of people represented in the 46–75 age groups in urban areas.

Table 4.2: Descriptive Statistics of Age Distribution among Rural and Urban Participants.

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age (Rural)	125	6	73	38.31	15.12

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Age (Urban)	125	12	75	45.06	16.39
Total Number of Participants	250				

Gender distribution

Table 3 and Figure 2 represent the gender distribution of participants recruited from rural and urban settings. The female population accounted for a greater percentage of participants in the rural cohort (61.6%) compared to the male population (38.4%). This was statistically significant with a p-value of <0.001 and a 95% confidence interval of 0.5296–0.7024, thus confirming that the rural sample was more predominantly female.

The distribution in the urban group was close to balanced: men constituted 45.6%, and women were 54.4%. Women were only marginally overrepresented in the sample, although their proportion in this group was also not more dissimilar than that in the rural population: this is expressed through the less spread confidence interval 0.4555–0.6325 and a pvalue of <0.001. **Table 4.3:** Gender Distribution of Rural and Urban Participants.

Rural					
Gender	**Frequency**	**Percent**	**95% Confidence Interval of the Difference**		**P-value**
			Lower	Upper	
Male	48	38.4	.5296	.7024	<0.001
Female	77	61.6			
Total	125	100.0			
Gender Urban					
Male	57	45.6	.4555	.6325	<0.001
Female	68	54.4			
Total	125	100.0			

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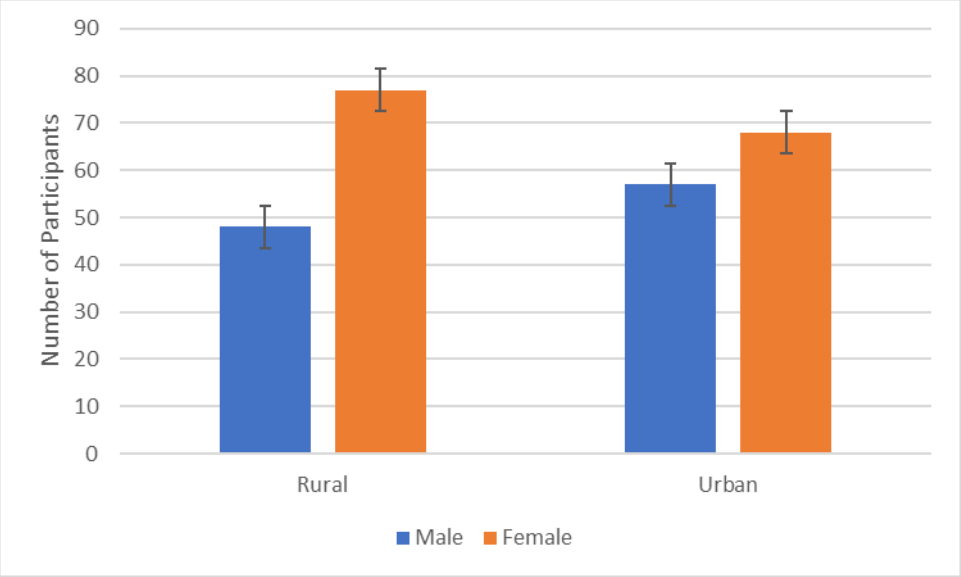

Figure 4.2: Gender Distribution of Rural and Urban Participants.

Prevalence of HCV and HBsAg

Table 4 summarizes the prevalence of HCV and HBsAg among participants in urban and rural settings. In the rural cohort, 22 participants (17.6%) had positive results for HCV, while 103 participants had negative results, at 82.4%. The 95% confidence interval for the difference in prevalence was from 0.1083 to 0.2437, while the p-value was less than 0.001. Conversely, no HBsAg positive result was detected in the rural population. This suggests that there is no hepatitis B infection prevalence among the rural participants. The prevalence of HCV among the urban participants was also a little low with 16 (12.8%) having tested positive while 109 (87.2%) were negative. The difference in urban HCV prevalence was statistically significant with a confidence interval ranging from 0.0686 to 0.1874 and a p-value of <0.001. Such was not the case of the urban set as none was positive for HBsAg in this sample either; therefore, an absolute absence of hepatitis B could be said about this sample, though HCV would seem to dominate more in this rural population set compared to their urban counterparts. This means that the HBsAg is absent in the two groups may be due to successful immunization programs or that the hepatitis B transmission rates in these populations may be low. Table 4: Comparison of HCV and HBsAg seroprevalence, by geographic region highlighting the differences between the two groups' hepatitis C seroprevalence.

Table 4.4: HCV and HBsAg prevalence from an urban setting (National Hospital, Lahore) and rural setting (Arif Memorial Teaching Hospital, Lahore).

HCV (Rural)							
	Negative (Frequency)	**Percent**	**Positive (Frequency)**	**Percent**	**95% Confidence Interval of the Difference**		**P-value**
					Lower	Upper	
HCV	103	82.4	22	17.6	.1083	.2437	<0.001

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HBsAg	125	100.0	0	0	-	-	-
HCV (Urban)							
HCV	109	87.2	16	12.8	.0686	.1874	<0.001
HBsAg	125	100.0	0	0	-	-	-

Percentage comparison of major risk factors

Table 5 Percentage comparison of major risk factors of hepatitis B and C among respondents from rural and urban areas Differences in analysis many differences were seen in the analysis, indicating a difference in exposure and behavior towards hepatitis transmission among these two populations.

A family history of hepatitis was reported by 46.4% of the rural participants against 36.8% of the urban dwellers, where the p-value was less than 0.001, implying a statistically significant difference. There is thus increased familial clustering in rural areas which may be caused by close living conditions or an ignorance of its prevention. Likewise, another risk factor, kidney dialysis was higher in the urban participants than the rural (48% vs 43.2%, $p < 0.001$). A dental surgery had also been experienced by more cases in the urban group (56.8%) compared to rural group (47.2%) possibly due to the better utilization of dental facilities that may result in increased usage of unsterilized tools. Conversely, body piercing, which is often conducted in informal or non-clinical settings, was more common among rural participants (76.8%) than urban participants (28.8%), showing a stark disparity ($p < 0.001$).

Tattooing was significantly higher among urban participants 63.2% compared to the rural ones 43.2%, at a p-value of 0.025. Risk factors include drug injection via the injected substance, contact with blood and needles; these too are significantly high among the urban dwellers 60% while only 44% reported among the rural participants. Contact with blood and needles was also marginally higher among the urban respondents (61.6%) compared to the rural respondents (59.2%). On the other hand, practices such as razor sharing and syringe sharing, which are critical transmission modes, were much higher in the rural setting (56% and 47.2%, respectively) compared to the urban settings (16.8% and 16%, respectively), with highly significant p-values (<0.001). These results highlight the necessity of public health interventions among rural populations to minimize such risk behaviors. Other interesting comparisons include organ transplantation, which was reported by 20.8% of the urban participants versus 13.6% of the rural participants, and history of cuts, more prevalent in the urban participants (76.8%) compared with the rural participants (68%), both p-values being <0.001.

This table highlights the various risk profiles between rural and urban populations, which indicates that public health strategies should be designed with these disparities in mind. Table 5 outlines these differences and underscores the need for specific interventions to be applied to particular risk factors in each setting.

Table 4.5: Percentage Comparison of Risk Factors of Hepatitis B and C In Urban/Rural areas.

		Rural	Urban	P-Value
Variable	**Category**	**N** (%)	**N** (%)	
Family history of hepatitis	No	67 (53.6)	79 (63.2)	<0.001

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	Yes	58 (46.4)	46 (36.8)	
Kidney dialysis	No	71 (56.8)	65 (52)	<0.001
	Yes	54 (43.2)	60 (48)	
Dental surgery	No	66 (52.8)	54 (43.2)	<0.001
	Yes	59 (47.2)	71 (56.8)	
Body piercing	No	96 (76.8)	36 (28.8)	<0.001
	Yes	29 (23.2)	89 (71.2)	
Tattooing	No	71 (56.8)	46 (36.8)	0.025
	Yes	54 (43.2)	79 (63.2)	
Have injected drugs	No	70 (56.0)	50 (40)	<0.001
	Yes	55 (44.0)	75 (60)	
More than one marriage	No	96 (76.8)	83 (66.4)	<0.001
	Yes	29 (23.2)	42 (33.6)	
Contact with blood and needle	No	51 (40.8)	48 (38.4)	<0.001
	Yes	74 959.2)	77 (61.6)	
Barber shaves	No	83 (66.4)	79 (63.2)	<0.001
	Yes	42 (33.6)	46 (36.8)	
Sharing razor	No	55 (44.0)	104 (83.2)	<0.001
	Yes	70 (56.0)	21 (16.8)	
Sharing syringes	No	66 (52.8)	105 (84.0)	<0.001
	Yes	59 (47.2)	20 (16.0)	

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Have organ transplant	No	108 (86.4)	99 (79.2)	<0.001
	Yes	17 (13.6)	26 (20.8)	
History of cuts	No	40 (32.0)	29 (23.2)	<0.001
	Yes	85 (68.0)	96 (76.8)	

The following Table 6 illustrates Pearson correlation analysis used to describe association between socio-demographic and lifestyle factors and the presence of hepatitis B and C. In table 6, the association varies in terms of strength and multiple factors that appear to be correlated with hepatitis infection at p 0.01 and 0.05 significance levels. Among the factors mentioned earlier, organ transplant displayed the highest correlation ($r = 0.774$, $p < 0.01$), suggesting that this is the strongest factor associated with hepatitis. This might have been due to the virus spread through bad screening of blood or organs. A history of cuts also showed a high correlation value of $r = 0.598$, $p < 0.01$, pointing out the transmission of hepatitis through nonsterile practices and accidental exposures.

More than one marriage is another strongly correlated factor ($r = 0.698$, $p < 0.01$), possibly linked to increased exposure to the virus through multiple partners or shared living arrangements in certain cultural contexts. Contact with blood and needles ($r = 0.583$, $p < 0.01$) and dental surgery ($r = 0.533$, $p < 0.01$) are also significant contributors, highlighting the importance of proper sterilization and safe practices in clinical and non-clinical settings. Moderate correlations are found with factors like barber shaves ($r = 0.458$, $p < 0.01$), sharing syringes ($r = 0.462$, $p < 0.01$), and sharing razors ($r = 0.398$, $p < 0.01$), indicating the risk of transmission through common grooming practices and shared personal items. Body piercing ($r = 0.350$, $p < 0.01$) and injected drug use ($r = 0.329$, $p < 0.01$) further emphasize the need for awareness campaigns on safer practices in informal and high-risk environments.

The following factors show weaker but still significant associations: tattooing ($r = 0.156$, $p < 0.05$) and a family history of hepatitis ($r = 0.122$, not significant at the 0.01 level). These factors point to a smaller but non-negligible role in the epidemiology of hepatitis.

Association of socio-demographic and lifestyle factors

Table 7 shows the odds ratios (ORs) for different risk factors of hepatitis B and C, along with their 95% confidence intervals (CIs). These are the measures of the risk of developing hepatitis B or C by the presence of specific risk factors and therefore provide insight into their relative contribution to disease transmission. The most important risk factor noted is more than one marriage, with an OR of 39.846 (95% CI: 13.189–120.384). This is a very high odds ratio and would indicate a very strong association possibly through increased exposure to viral transmission by shared intimate contacts or living environments in specific sociocultural settings.

Table 4.6: Association of socio-demographic and lifestyle factors with hepatitis B and C.

Variable	Pearson correlation
Family history of hepatitis	0.122
Kidney dialysis	.455**

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Dental surgery	0.533**
Body piercing	.350**
Tattooing	.156*
Have injected drugs	0.329**
More than one marriage	0.698**
Contact with blood and needle	0.583**
Barber shaves	0.458**
Sharing razor	0.398**
Sharing syringes	0.462**
Have organ transplant	0.774**
History of cuts	0.598**

**. Correlation is significant at the 0.01 level

Likewise, history of cuts (OR = 24.000, 95% CI: 7.966–72.312) and exposure to blood and needles (OR = 15.136, 95% CI: 6.229–36.783) are major risk factors of hepatitis. In this regard, safety measures are very crucial that include proper care of wounds and sterilized use of needles so that disease spread can be minimized.

Other factors such as dental surgery (OR = 11.905, 95% CI: 4.945–28.661) and barber shaves (OR = 8.815, 95% CI: 3.596–21.609) also are significantly high, indicating that risks of nonsterilized practices in both clinical and nonclinical grooming settings are risky. A second prominent cause is kidney dialysis (OR = 7.286, 95% CI: 3.278–16.193), probably due to protracted exposure to blood-related equipment.

The risk of associated hepatitis from drug injection is likewise substantially increased: OR = 4.255, 95% CI: 1.923–9.414: unsafe injection contributes to viral acquisition. The likelihood of sharing a razor is another risk factor because of the blood contact: OR = 1.429, 95% CI: 1.225– 1.665 and sharing syringe: OR = 1.513, 95% CI: 1.260–1.816. Interestingly, the odds ratios are lower for body piercing (OR = 0.625, 95% CI: 0.535–0.730) and tattooing (OR = 0.617, 95% CI: 0.536–0.710), suggesting a protective effect or reduced relative risk compared to other factors.

This may indicate better sterilization practices in these areas.

Whereas the odds ratio is remarkably low at 0.083 for organ transplant (95% CI: 0.045–0.156), indicating almost nil direct association within this data. Yet, it could be quite variable based on the regional and procedural differences regarding the practice of organ transplantation. This analysis sheds great light on the hierarchy of risk factors and suggests that certain types, such as multiple marriages, cuts, and blood contact, are especially potent. It pinpoints crucial points for public health interventions in sterilization practices, public campaigns, and focused education to counter risks of hepatitis B and C most effectively.

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Table 4.7: Odds ratio for risk factor against Hepatitis B and C.

Risk Factors	OR	CI (95%)	
		Lower	Upper
Family history of hepatitis	1.659	.798	3.452
Kidney dialysis	7.286	3.278	16.193
Dental surgery	11.905	4.945	28.661
Body piercing	.625	.535	.730
Tattooing	.617	.536	.710
Have injected drugs	4.255	1.923	9.414
More than one marriage	39.846	13.189	120.384
Contact with blood and needle	15.136	6.229	36.783
Barber shaves	8.815	3.596	21.609
Sharing razor	1.429	1.225	1.665
Sharing syringes	1.513	1.260	1.816
Have organ transplant	.083	.045	.156
History of cuts	24.000	7.966	72.312

DISSCUSSION

This study provides crucial insights into the prevalence and risk factors associated with the presence of hepatitis B virus (HBV) and hepatitis C virus (HCV) in both urban and rural settings of Lahore, Pakistan. The differences found in demographic composition, disease prevalence, and patterns of risk behaviors between these two populations confirm that the HBV and HCV transmission processes are multifaceted and depend on socio-cultural factors, healthcare accessibility, and other related factors. This discussion critically interprets the findings within the context of previous literature and then draws out the implications for public health interventions.

An interesting demographic disparity can be found between rural and urban populations through the age distribution patterns. The rural participants were more youthful, with a mean age of 38.31 years, whereas the mean age of the urban cohort was 45.06 years. This is in accordance with previous studies that showed that younger demographics prevail in rural areas due to the general trend of migration to cities, which is mainly driven by better employment

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opportunities and access to services. Urban populations had a higher proportion of people in the older age groups (46–75 years), which may partly explain the observed lower HCV prevalence in urban settings, as older individuals might have had greater exposure to preventive health campaigns or vaccinations. Research conducted in South Asia supports the correlation between age and HBV/HCV prevalence. Younger cohorts are found to be more susceptible to transmission risk factors, especially in settings where healthcare infrastructure is inadequate (Wait et al., 2016).

Gender distribution further strengthens the socio-cultural disparities. Within the rural cohorts, females overrepresented 61.6% that was statistically highly significant compared with males. Possibly, this trend could be contributed by societal gender norms where societal roles of females are more compatible with health education and screening service delivery than is the case in males, who dominate agriculture and generally labor-intensive occupations may not be adequately available or desirous. In contrast, gender distribution in the urban population was relatively balanced and reflected changing social norms and better health awareness among the urbanized population. This pattern is similar to other South Asian studies where gender-based differences in health-seeking behavior and participation in screenings were reported (Bhattarai et al., 2018).

The prevalence among rural participants (17.6%) was appreciably greater than in their urban counterparts at 12.8%, but no cases of HBV were identified in the two groups. The lack of HBV can be interpreted in the context of the successful launch of immunization programs in Pakistan over the late 1990s. However, the persistence of HCV- especially in rural settings- suggests areas that need improvement with regard to service delivery and interventions. Studies have been able to prove that rural communities experience significant barriers that affect their health, including less awareness, lesser diagnostic facilities, and socio-economic factors (Ahmed et al., 2021; Omote et al., 2020). More than this, higher prevalence among rural populations could also be associated with traditional medical practices such as using reused needles and syringes, which have been documented to be a risk factor in low resource settings (Scheibe et al., 2019).

The significant differences in risk factor profiles between urban and rural populations provide insight into the behavioral and systemic contributors to HBV and HCV transmission. Rural participants were more likely to engage in the risky practices of razor sharing (56%) and syringe sharing (47.2%), key transmission routes for HCV. These behaviors are typically associated with cultural practices and low awareness of infection control. Conversely, urban respondents reported a greater frequency of dental surgeries (56.8%) and tattooing (63.2%), possibly reflecting increased utilization, but also an increased risk of exposure to unsterilized instruments within unregulated facilities. These studies indicate unsterilized instruments as a significant source of HCV exposure in both urban healthcare and cosmetic environments (Stroffolini&Stroffolini, 2024; Zahid et al., 2023).

Family history of hepatitis was another highly significant risk factor as reported by 46.4% of rural participants compared with 36.8% of their urban counterparts. This finding supports the concept that infectious diseases do cluster in families and that a family history, especially in extended families in the rural setting where they live more closely together, tends to increase transmission. This finding is consistent with studies indicating that intra-household transmission is a significant driver of hepatitis spread in resource-constrained settings, and the higher prevalence of HCV in rural populations with a family history supports this (Morgan, 2024; Olakunde et al., 2021).

Higher risk factors noted included kidney dialysis and drug injection, though higher in prevalence in the urban population. Dialysis facilities in most urban settings tend to have a better infrastructure in healthcare, thus often more likely to have centers; however, in these, inadequate infection control can increase the risk of transmission. Similarly, (the higher rate of drug injection among participants in cities parallels the trend of rising substance abuse epidemics around the globe that is increasingly recognized as an important cause of HCV epidemics (Ghias et al., 2010; Valdiserri et al., 2014).

The absence of HBV in the cohorts further confirms that the immunization efforts have had a significant impact. It would seem that inclusion of the HBV vaccine into EPI meant Pakistan is likely on the right

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track with regard to management of its HBV prevalence. On the other hand, HCV is still present and it needs individualized interventions, including public education, improved screening practices, and access to treatment. Several neighboring countries have shown that comprehensive approaches to HCV elimination, incorporating large-scale screening with subsidized antiviral treatment and community education, are efficacious (Jamali et al., 2024).

The differences between the levels of urban and rural populations on tattooing and body piercing are an expression of variations in culture and socio-economics. The percentages were considerably higher on the practice of tattooing, which was 63.2% among the urban subjects. Still, non-sterile conditions at the shops where tattoos are obtained remain a large pool of high potential for HCV transmission. This is even reflected in several outbreak-related studies linked to this activity (Naeem et al., 2012). On the other hand, body piercing was more common in rural settings at 76.8%, and mainly performed in informal settings without adherence to infection control protocols. This calls for regulation and education targeting these high-risk practices (Seerat et al., 2020).

In contrast, rural populations had a significantly higher prevalence of sharing razors and syringes, underscoring issues with healthcare infrastructures and knowledge of safe practice. Public health interventions, like education programs in communities and the use of disposable razors and syringes, would help decrease these risks. Urban populations will also benefit if the regulation and monitoring of health and cosmetic centers are strengthened, which will adhere to sterilization protocols.

The findings of this study come in line with global trends that show socio-economic and healthcare disparities add to the prevalence of HBV and HCV. It shows the need for contextspecific interventions targeted towards risk profiles unique to rural and urban populations. For rural areas, the attention should be on improving health care accessibility, increasing awareness about safe practices, and shifting cultural norms promoting the act of transmission. For the urban population, strict regulation of health and cosmetic services and focused campaigns against risky behaviors like injection drug use are essential (Raza et al., 2022).

CONCLUSION

It provides an overview of the epidemiology and risk factors related to hepatitis B virus (HBV) and hepatitis C virus (HCV) among residents of urban and rural populations in Lahore, Pakistan. The results clearly indicate differences in demographic trends, exposure to risks, and the prevalence rates between two populations. The prevalence of HCV was higher in rural participants, at 17.6% compared to that in urban participants, which was 12.8%. HBV was surprisingly lacking in both groups, which could be an indicator of successful vaccination programs or lower rates of transmission among members of the communities. Key risk factors, such as sharing razors and reuse of syringes, were significantly more prevalent in rural areas whereas in urban populations, greater exposure of risks such as dental surgeries, tattoos, and injection of drugs was seen. These results underscore the critical need for targeted public health interventions tailored to the unique risk profiles of each setting.

Future interventions will focus on extending immunization coverage, especially in rural areas, and conducting health education programs to raise awareness regarding safe practices, such as no sharing of razor blades and syringes. It is also necessary to raise the sterilization levels of medical and dental equipment at urban health institutions. Testing and treatment centers need to be easily accessible in rural and urban regions for early diagnosis and management of hepatitis infections. Further explorations in research can be focused on genetic predispositions, environmental factors, and the effectiveness of existing preventive strategies. The issues mentioned above can be addressed with a multifaceted approach to reducing the burdens of hepatitis in Pakistan in achieving the greater goal of global hepatitis elimination by 2030.

LIMITATIONS

- **Sample Size Constraints:** Limited sample size may affect generalizability across the entire Lahore district.

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• **Cross-sectional Design:** Only captures data at a single time point — no causality or trend over time can be inferred.

• **Self-Reporting Bias:** If data relies on participant self-reports or symptoms, underreporting or misclassification may occur.

• **Limited Diagnostic Reach:** If serological testing wasn't used for all participants, accuracy of Hepatitis status may be compromised.

- **Sociocultural Barriers:** Stigma or lack of awareness in rural areas may affect willingness to participate or answer truthfully.

RECOMMENDATIONS

1. **Expand Screening Programs:** Conduct regular and free Hepatitis B and C screening, especially in underserved rural areas where access to diagnostics is limited.

2. **Launch Public Awareness Campaigns:** Educate the population on modes of transmission, prevention strategies, and the importance of early detection, especially targeting low-literacy communities.

3. **Strengthen Vaccination Coverage:** Promote and expand the Hepatitis B vaccination program in both urban and rural sectors, particularly targeting high-risk groups.

4. **Improve Health Infrastructure in Rural Areas:** Enhance rural healthcare services by equipping local clinics with diagnostic facilities and trained personnel for hepatitis management.

5. **Integrate Hepatitis Services into Primary Healthcare:** Incorporate hepatitis prevention, testing, and counseling into routine healthcare visits to increase reach and reduce stigma.

SUMMARY

Hepatitis B (HBV) and Hepatitis C (HCV) are serious viral infections affecting the liver and are major contributors to chronic liver disease and liver cancer worldwide. In Pakistan, recent estimates suggest that approximately 2.5–3% of the population is infected with HBV and 4.9–6% with HCV, marking the country as one of the most heavily burdened globally. This study, titled "Frequency of Hepatitis B and C amongst the General Population of Rural and Urban Areas of Lahore, Pakistan", was a descriptive cross-sectional survey conducted over six months at the Microbiology Laboratory of Arif Memorial Hospital. A total of 250 participants—125 from an urban hospital (National Hospital, Lahore) and 125 from a rural hospital (Arif Memorial Teaching Hospital)—were screened using rapid immunochromatographic test kits and confirmed by fourth-generation ELISA. Findings revealed no cases of HBV in either group, likely due to effective vaccination programs or lower exposure risks. However, HCV was more prevalent in rural areas (17.6%) compared to urban areas (12.8%), with associated risk factors including body piercing, tattooing, injectable drug use, and unsterilized medical practices being significantly more common in rural populations. These results highlight the urgent need for targeted public health interventions in rural areas to control and prevent hepatitis transmission.

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