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RESEARCH ARTICLE

Prevalence of Hepatitis C Virus (HCV) Across Age and Gender in a Sample Population: A Cross-Sectional Study in Pakistan

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Abstract

Hepatitis C Virus remains a significant public health burden in Pakistan, which has one of the highest HCV prevalence rates globally. This cross-sectional study aimed to assess the prevalence of HCV in a sample population and examine variations by age and gender. The overall HCV prevalence was found to be 15.79%, with a 95% confidence interval (CI) of 8.56% to 27.18%. The highest prevalence was observed in the 21-40 years age group (37.5%), suggesting younger adults are at increased risk due to high-risk behaviors such as intravenous drug use. The 41-60 and 61-80 years age groups showed similar prevalence rates of 14.29% and 12%, respectively, while the 0-20 and 81+ years groups had no positive cases, though wide CIs indicated uncertainty due to small sample sizes. Prevalence was slightly higher in males (17.14%) than in females (13.64%), although this difference was not statistically significant. These findings align with previous studies highlighting the continued burden of HCV in Pakistan, driven by unsafe healthcare practices and limited access to effective treatment. The study underscores the need for targeted interventions, particularly in younger adults and high-risk groups, as well as the expansion of screening and treatment programs. Further research with larger sample sizes is recommended to confirm these trends and improve the precision of prevalence estimates.

Keywords: Hepatitis C Virus | Pakistan | Prevalence | Epidemiology | Public Health

Significance

This study on Hepatitis C Virus in Pakistan highlights a significant public health challenge, with a high overall prevalence of 15.79%. The highest prevalence (37.5%) was found among adults aged 21-40, likely due to high-risk behaviors such as intravenous drug use. Males had a slightly higher prevalence (17.14%) than females (13.64%), though the difference was not statistically significant. The findings underscore the need for targeted interventions, particularly for younger adults, and emphasize the importance of expanding screening and treatment programs. Further research with larger sample sizes is recommended to improve precision in prevalence estimates.

Introduction

Hepatitis C Virus (HCV) remains a significant public health challenge worldwide, affecting an estimated 71 million people globally (1). In Pakistan, HCV is a particularly pressing concern, with the country ranking among those with the highest prevalence rates. According to the World Health Organization (WHO), around 10 million people in Pakistan are living with HCV, making it a critical public health burden (1, 2). The virus is a leading cause of chronic liver diseases, cirrhosis, and hepatocellular carcinoma, all of which contribute to high morbidity and mortality rates in the country (3).

The prevalence of HCV in Pakistan is estimated to be between 4.5% and 8%, which is significantly higher than the global average of 1% (3). Several factors contribute to this elevated prevalence, including unsafe healthcare practices, poor sterilization of medical equipment, and the widespread reuse of syringes. A study by Raja and Janjua (2008) found that healthcare-related exposure, particularly in rural areas, is one of the primary drivers of HCV transmission in Pakistan (5). Furthermore, blood transfusions and invasive procedures without proper sterilization protocols are major risk factors for HCV spread (6).

Pakistan's healthcare infrastructure faces significant challenges in tackling this epidemic. Lack of awareness, inadequate screening programs, and limited access to effective treatment have allowed HCV to spread, particularly among the lower socio-economic classes (7). Consequently, many HCV patients present with advanced liver disease, making treatment more complex and costly (8).

The transmission of HCV occurs primarily through blood-to-blood contact. In Pakistan, this is frequently linked to unsafe medical practices, including the reuse of needles in informal healthcare settings, unscreened blood transfusions, and improper sterilization of medical equipment. Intravenous drug use, although less prevalent than in some other countries, is also a growing concern for HCV transmission. Waheed et al. (2009) highlighted that the prevalence of HCV among intravenous drug users in Pakistan could be as high as 50%, further contributing to the public health burden (9).

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Another critical factor contributing to HCV prevalence in Pakistan is the traditional practice of visiting unregulated healthcare providers, including barbers and quacks, for minor surgical procedures and injections. This practice exposes individuals to non-sterile medical equipment, significantly increasing their risk of acquiring HCV. Studies such as Akhtar et al. (2013) have documented the role of these informal healthcare settings in the transmission of HCV in both rural and urban Pakistan (10).

Globally, HCV affects individuals of all ages, but certain demographic groups are at higher risk. In Pakistan, age and gender disparities in HCV prevalence are notable. Research indicates that the prevalence of HCV increases with age, particularly among individuals over the age of 40 (11). However, women, especially those of reproductive age, are also vulnerable due to the risks associated with childbirth and unsafe blood transfusions during medical procedures. These findings suggest the need for gender-specific screening and prevention programs (12).

Despite the heavy burden of HCV in Pakistan, there have been some advancements in diagnosis and treatment. The introduction of direct-acting antivirals (DAAs) has revolutionized HCV treatment, offering cure rates of over 90% with shorter treatment durations and fewer side effects. However, access to these treatments remains limited, particularly in rural areas and among socioeconomically disadvantaged populations (13). Liver Foundation Pakistan (2020) has emphasized the need for broader access to DAAs, as well as the implementation of national screening programs to identify and treat individuals at risk for HCV (14). Screening programs in Pakistan are still in their infancy, and the coverage of high-risk groups remains inadequate. The Pakistan Medical Research Council (PMRC) has called for more extensive HCV screening efforts, particularly targeting populations such as intravenous drug users, healthcare workers, and individuals with a history of blood transfusions (15). Studies like Janjua et al. (2016) have underscored the importance of early detection and treatment to prevent the progression of liver disease and reduce HCV-related mortality (16).

This study aims to address the knowledge gap regarding the prevalence of HCV in various age and gender groups in a specific population sample. By examining the overall prevalence of HCV, as well as differences in prevalence based on age and gender, this study seeks to provide valuable insights into the demographic factors that influence HCV transmission in Pakistan. The findings can contribute to the design of targeted interventions, such as age- and gender-specific screening programs, that are necessary to reduce the burden of HCV in the country.

Given the substantial burden of HCV in Pakistan, particularly in high-risk groups, understanding the prevalence of the virus across different demographics is crucial for public health efforts. This study aims to provide a comprehensive analysis of HCV prevalence in a sample population, with the goal of informing future screening and prevention strategies to reduce the spread of this virus.

Methods

Study Population

The study included 57 individuals who underwent HCV screening as part of routine medical assessments. Participants were grouped into five age categories (0-20, 21-40, 41-60, 61-80, and 81+ years) to analyze HCV prevalence across different life stages. The sample was also divided by gender to explore potential differences between males and females. Inclusion criteria includes; Individuals tested for HCV using an approved diagnostic test; Patients with complete demographic and screening data. While the exclusion criteria include; Patients with incomplete records; Individuals not tested for HCV or with unavailable test results.

Data Collection

The primary outcome was HCV status (positive or negative), determined via serological testing methods like the Enzyme-Linked Immunosorbent Assay (ELISA). Age and gender data were extracted from patient records, and all data were anonymized to ensure confidentiality and compliance with ethical standards. The sample size was based on available data at study initiation and, while limited, was sufficient to provide preliminary insights into HCV prevalence.

Data Analysis

HCV prevalence was calculated for the entire population and stratified by age group and gender. For each prevalence estimate, 95% confidence intervals (CI) were computed to assess precision. Prevalence was defined as the proportion of individuals testing positive for HCV out of the total tested in each group.

Age Group and Gender Analysis

Participants were categorized into five age groups (0-20, 21-40, 41-60, 61-80, and 81+ years) to identify age-specific trends in HCV prevalence. The sample was also split into male and female groups to explore gender-based differences in infection rates. Prevalence and 95% CIs were calculated for both age and gender groups.

Statistical Methods

Prevalence rates and their 95% CIs were calculated using the Wilson score method, which provides more accurate estimates for small sample sizes. Comparisons of HCV prevalence were made across age groups and between genders to identify significant variations.

Results

The overall prevalence of Hepatitis C Virus (HCV) in the study population of 57 individuals was found to be 15.79%. A total of 9 individuals tested positive for HCV, while the remaining 48 tested negative. The 95% confidence interval (CI) for the overall prevalence ranged from 8.56% to 27.18%, indicating a moderate level of HCV prevalence within the population, though the relatively wide confidence interval suggests some uncertainty due to the sample size.

HCV prevalence varied significantly across different age groups, as summarized in Table 1. The highest prevalence was observed in the 21-40 years age group, where 37.5% of individuals tested positive for HCV, with a 95% CI ranging from 14.78% to 69.95%. This age group also had a larger sample size (8 individuals) compared to some of the other age groups, contributing to a more reliable estimate despite the wide confidence interval.

The 41-60 years and 61-80 years age groups exhibited similar HCV prevalence rates of 14.29% (95% CI: 5.01% to 33.55%) and 12% (95% CI: 4.18% to 29.75%), respectively. The similarity in prevalence rates across these two middle-aged and elderly groups suggests that HCV infections are consistently present in these populations, likely due to long-term chronic infections.

Age Group	Total Patients	Positive Cases	Prevalence (%)	95% CI
0-20	2	0	0%	[0.00%, 60.87%]
21-40	8	3	37.5%	[14.78%, 69.95%]
41-60	21	3	14.29%	[5.01%, 33.55%]
61-80	25	3	12%	[4.18%, 29.75%]
81+	1	0	0%	[0.00%, 97.50%]

Table 1: HCV Prevalence and Confidence Intervals by Age Group

The 0-20 years and 81+ years age groups had no positive cases, with a prevalence of 0% in both groups. However, the wide confidence intervals—[0.00%, 60.87%] for the 0-20 age group and [0.00%, 97.50%] for the 81+ group—indicate a high degree of uncertainty due to the small sample sizes in these groups (2 individuals in the 0-20 group and 1 individual in the 81+ group).

The wide confidence intervals in the younger (0-20 years) and oldest (81+ years) age groups suggest that these results should be interpreted with caution. The absence of positive cases in these groups could be due to their limited sample sizes rather than a true absence of HCV infections. Larger studies are necessary to better understand HCV prevalence in these age groups.

The gender analysis showed a slightly higher HCV prevalence among males compared to females. Out of the 35 male patients, 6 tested positive, resulting in a prevalence of 17.14% (95% CI: 8.13% to 32.57%). Among the 22 female patients, 3 tested positive, leading to a prevalence of 13.64% (95% CI: 4.76% to 33.04%).

Gender	Total Patients	Positive Cases	Prevalence (%)	95% CI
Male	35	6	17.14%	[8.13%, 32.57%]
Female	22	3	13.64%	[4.76%, 33.04%]

Table 2: HCV Prevalence and Confidence Intervals by Gender

While males exhibited a higher prevalence of HCV (17.14%) compared to females (13.64%), the overlap in confidence intervals suggests that this difference may not be statistically significant. This finding aligns with some previous studies that report slightly higher rates of HCV infection in males due to increased exposure to certain risk factors, such as occupational hazards or intravenous drug use. However, the overlapping confidence intervals indicate that the true difference between male and female prevalence rates may be minimal.

Descriptive Analysis

The findings from this study suggest that HCV is moderately prevalent in the studied population, with an overall prevalence of 15.79%. The highest prevalence is seen in the 21-40 years age group, a finding consistent with other studies that attribute higher HCV rates in younger adults to risk behaviors such as intravenous drug use, unsafe medical practices, and occupational exposures.

Moreover, the prevalence rates in the 41-60 and 61-80 age groups indicate that HCV persists into middle and older adulthood, potentially due to chronic infections acquired earlier in life. This is consistent with global trends, as noted by studies like Raja and Janjua (2008), which highlight that many individuals in these age groups may have contracted the virus decades earlier, before modern medical screening practices became widespread (5).

The absence of positive cases in the youngest and oldest age groups may be due to the small sample sizes rather than an actual absence of HCV infections. The wide confidence intervals in these groups suggest that more extensive studies are needed to confirm or refute these findings.

The limitation of this study is the relatively small sample size, particularly in the youngest (0-20 years) and oldest (81+ years) age groups, leading to wide confidence intervals and reducing the precision of the prevalence estimates. This limitation affects the ability to generalize the results to the broader population. Additionally, the cross-sectional design of the study does not allow for the determination of causality or the exploration of temporal trends in HCV infection rates.

Discussion

Globally, infectious diseases, including Hepatitis B and C, remain a significant public health burden (18-21), and the recent COVID-19 pandemic (22-29) has further exacerbated the socioeconomic challenges in Pakistan. In this context, the overall prevalence of Hepatitis C Virus (HCV) in the studied population was found to be 15.79%, with a 95% confidence interval (CI) of 8.56% to 27.18%. This prevalence rate is notably higher than the global average of 1% and aligns with several regional studies from Pakistan, which have reported similar or even higher rates of HCV infection. For example, a study by Qureshi et al. (2009) found an overall HCV prevalence of 16.5% in a rural population of Punjab, Pakistan. This comparison underscores the persistent burden of HCV in the country and highlights the urgent need for enhanced public health interventions (30).

One of the reasons for the relatively high prevalence in Pakistan is the widespread practice of using unsterilized medical instruments and improper healthcare practices. A systematic review by Umar et al. (2010) identified unsafe medical injections, blood transfusions, and inadequate sterilization of surgical instruments as key contributors to the high HCV prevalence in Pakistan (31). More recent studies, such as Butt et al. (2019), have continued to highlight the same risk factors, suggesting that despite increasing awareness, unsafe healthcare practices remain a significant challenge. This study's findings underscore the continued importance of improving healthcare safety standards, especially in rural and underserved areas (32).

The analysis of HCV prevalence by age group revealed important trends, with the highest prevalence observed in the 21-40 years age group (37.5%). This finding is consistent with other studies that show younger adults are more likely to contract HCV due to certain high-risk behaviors such as intravenous drug use and unsafe medical practices. Raja and Janjua (2008) also found that individuals in this age range had a significantly higher prevalence of HCV, particularly in urban areas where intravenous drug use is more prevalent (5). These behaviors are a critical factor driving the spread of HCV among younger adults and emphasize the need for targeted public health campaigns focused on reducing risky behaviors in this demographic.

However, the prevalence decreases in the older age groups (14.29% in 41-60 years and 12% in 61-80 years). This could be due to several factors, including reduced exposure to risky behaviors like intravenous drug use, which is less common in older adults. It could also reflect the fact that many older individuals who contracted HCV earlier in life may have already progressed to more advanced stages of liver disease or have succumbed to HCV-related complications, leading to lower prevalence rates in this group. The Global Burden of Disease Study (2016) suggested that HCV-related liver disease is a leading cause of death among older populations, which may partially explain the lower prevalence in older age groups in the current study (33).

Furthermore, the complete absence of HCV cases in the 0-20 years and 81+ age groups, though potentially linked to the small sample size in these groups, suggests a need for more extensive studies in these age brackets. This result aligns with the findings of Hamid et al. (2004), who observed low HCV prevalence among children and very elderly individuals, potentially due to limited exposure to medical interventions in these age groups (34). However, studies like Gower et al. (2014) have indicated that vertical transmission (from mother to child) and unsafe medical practices during childhood are rising concerns in some parts of Pakistan, suggesting that future studies should investigate this further (35).

The gender analysis revealed a slightly higher prevalence of HCV among males (17.14%) compared to females (13.64%), but the overlapping confidence intervals indicate that this difference is not statistically significant. Several previous studies have reported similar trends, with males having a marginally higher prevalence of HCV. For instance, Ali et al. (2011) found that the prevalence of HCV was higher among males due to factors such as higher exposure to risky behaviors like intravenous drug use and occupational hazards in certain industries (e.g., healthcare, barbers, and manual laborers) (36). Male dominance in certain high-risk activities, particularly in the younger age groups, could explain the elevated rates of HCV in this demographic.

In a global context, HCV prevalence in Pakistan remains significantly higher than in many other regions. For example, a study by Mohd Hanafiah et al. (2013) found that the prevalence of HCV in the United States and Western Europe is typically below 2% (37). However, high-prevalence countries like Egypt, with an estimated HCV prevalence of 10% to 14%, also face challenges similar to those in Pakistan, such as unsafe healthcare practices and a lack of widespread screening programs. In Egypt, the widespread use of poorly sterilized medical equipment during mass treatment campaigns in the 1960s and 1970s led to a national HCV epidemic, much like Pakistan's ongoing battle with unsafe medical practices (38). Efforts to combat HCV in other high-prevalence countries, such as Egypt's National Treatment Program, which provides free access to direct-acting antivirals (DAAs), have shown promise in reducing HCV prevalence over time. In contrast, Pakistan has only recently started to scale up access to DAAs (39). The lack of a coordinated national response, limited access to treatment, and financial constraints continue to hinder efforts to control HCV in Pakistan, as documented in the World Health Organization (2017) global hepatitis report (40).

Advancements in HCV treatment have the potential to drastically reduce the prevalence and burden of the disease in Pakistan. The introduction of DAAs, which offer cure rates exceeding 90%, has transformed HCV treatment globally. However, in Pakistan, access to these life-saving medications remains limited, especially in rural areas. Malik et al. (2020) reported that while DAAs are now available in Pakistan, high costs and lack of awareness prevent many patients from seeking treatment (41). This is particularly concerning for populations in rural and underserved regions, where healthcare infrastructure is weak, and access to affordable medication is severely limited. Additionally, the lack of comprehensive national screening programs exacerbates the HCV burden. According to Janjua et al. (2016), only a fraction of the population has been screened for HCV, meaning a large number of infected individuals remain undiagnosed and untreated (42). Implementing wide-reaching screening programs, particularly in high-risk groups such as intravenous drug users, healthcare workers, and individuals receiving frequent medical care, is crucial for curbing the spread of HCV in Pakistan (42).

This study highlights the need for future research with larger sample sizes and more detailed demographic data. While the findings provide valuable insights into HCV prevalence in this particular sample, the wide confidence intervals in certain age groups, such as 0-20 and 81+, suggest that further investigation is necessary. Larger studies are needed to obtain more precise estimates of HCV prevalence and to explore the specific risk factors associated with HCV infection in Pakistan.

Additionally, future research should focus on understanding the socio-economic determinants of HCV infection. Studies like Butt et al. (2019) have shown that individuals from lower socio-economic backgrounds are at higher risk of contracting HCV due to limited access to healthcare, lack of awareness, and unsafe medical practices (43). Identifying these at-risk populations and tailoring public health interventions to meet their needs is essential for controlling the spread of HCV.

Conclusion

The findings of this study are consistent with the existing body of literature on HCV prevalence in Pakistan, emphasizing the continued public health burden posed by this virus. The high prevalence among young adults, particularly those aged 21-40 years, highlights the need for targeted prevention efforts focused on high-risk behaviors. Additionally, the relatively high prevalence of HCV in males suggests the need for gender-specific interventions, though both males and females remain at significant risk. Finally, improving access to DAAs and expanding national screening programs are critical steps in reducing the burden of HCV in Pakistan. Addressing these challenges will require a concerted effort from healthcare providers, policymakers, and the broader community.

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