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DEMOGRAPHIC INSIGHTS INTO HEPATITIS-C VIRUS PREVALENCE AMONG INTERNALLY DISPLACED PERSONS (IDPS) AND NATIVE POPULATIONS OF PUNJAB, PAKISTAN

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Abstract

Hepatitis C Virus (HCV) is a blood-borne pathogen responsible for acute and chronic liver infections, which can progress to fibrosis and cirrhosis. With over 185 million individuals infected globally (>3% of the world population), HCV is a significant contributor to global morbidity and mortality. Internally Displaced Persons (IDPs) are particularly vulnerable to communicable diseases such as HCV due to adverse social and environmental conditions. This comparative study evaluated the demographic variables associated with HCV prevalence among IDPs and the native population. One hundred six participants were enrolled, and venous blood samples were analyzed for anti-HCV antibodies using ICT and ELISA methods. Data on HCV-related demographic variables were collected through structured questionnaires. The findings revealed a higher prevalence of HCV among IDPs compared to the native population. Preliminary analysis highlighted associations between HCV prevalence and factors such as illiteracy, low monthly income, inadequate housing, employment status, type of healthcare facility utilized, hospital admissions, and limited access to health education and information. These results underscore the urgent need for targeted preventive measures and improved strategies to mitigate HCV transmission, particularly among vulnerable populations like IDPs.

INTRODUCTION

Hepatitis C Virus (HCV) is a major blood-borne pathogen that presents significant global health challenges due to its ability to cause acute and chronic liver infections. [1]. If left untreated, these

infections can progress to severe liver damage, including fibrosis, cirrhosis, and hepatocellular carcinoma, ultimately leading to considerable morbidity and mortality. [2]. Recent data highlights an alarming increase in HCV prevalence globally, with over 185 million individuals affected and an estimated 3–4 million new cases reported annually [3]. Pakistan, in particular, has emerged as one of the most affected regions worldwide, now accounting for approximately 8.8 million cases, which translates to nearly 44% of all new hepatitis C infections. This surge is attributed mainly to unsafe medical practices, making HCV one of the most pressing public health concerns in the region [4].

The transmission of HCV in Pakistan is primarily linked to various unsafe practices and sociocultural factors. The reuse of syringes and needles without proper sterilization is a prominent cause, as healthcare providers often lack sufficient training in infection prevention protocols [5].[6] Unsafe blood transfusions due to inadequate screening processes for HCV in blood banks further exacerbate the risk of transmission. Intravenous drug use represents another critical factor, with HCV prevalence rates reaching up to 93% among certain groups of drug users who share contaminated needles [7]. Similarly, using unsterilized surgical and dental instruments significantly contributes to HCV spread, particularly in rural areas where medical facilities are poorly equipped. Improper disposal of hospital waste [6], including used syringes, also plays a significant role in the propagation of the virus, as these discarded items are often reused in unhygienic settings [8]. Cultural practices, such as shaving with contaminated tools at barbershops, further heighten the risk of HCV transmission among the general population. These factors underscore the pressing need for robust interventions and awareness campaigns to mitigate HCV spread in Pakistan [9].

Internally Displaced Persons (IDPs) in Pakistan are an especially vulnerable population concerning HCV transmission. IDPs are individuals forced to leave their homes due to conflict, violence, natural disasters, or other emergencies but remain within their country's borders [10]. The living conditions of IDPs are often characterized by overcrowding, poor sanitation, and limited access to healthcare services, which create an ideal environment for the rapid spread of communicable diseases like HCV. Additionally, IDPs frequently face psychosocial stress and economic instability, further exacerbating their susceptibility to health risks. Despite the evident vulnerability of IDPs, epidemiological data focusing on HCV prevalence in this population is scarce [11]. The lack of sufficient data limits understanding how demographic factors contribute to disease transmission, impeding the development of effective prevention and control strategies [12].

The prevalence of HCV among IDPs and its associated risk factors are often higher compared to native populations due to their unique living conditions. Overcrowded camps, insufficient health education, limited access to clean medical facilities, and the absence of proper hygiene practices contribute to the rapid spread of HCV within these communities [13]. Furthermore, IDPs often rely on informal or under-resourced healthcare providers, increasing their exposure to unsafe medical practices, including unsterilized injections and improper surgical procedures [14]. This situation is further compounded by a lack of awareness about HCV transmission and prevention, leaving IDPs particularly vulnerable to the disease. The psychosocial stress associated with displacement also affects the overall health and well-being of IDPs, making them less likely to seek timely medical intervention [15].

Given the high burden of HCV in Pakistan and the elevated risks faced by IDPs, it is critical to explore the socio-demographic factors associated with HCV transmission in these populations. Understanding these factors is essential for signing effective public health interventions that can mitigate the spread of HCV, particularly in vulnerable and underserved groups [16]. This study addresses these gaps by investigating the socio-demographic characteristics and HCV prevalence among IDPs in Pakistan and comparing these findings to those of native populations. By identifying key risk factors, this research provides valuable insights for policymakers and healthcare providers to develop targeted prevention and control strategies. Additionally, the findings of this study will contribute to the broader understanding of HCV transmission dynamics in displaced populations, offering a foundation for future research and intervention efforts. In

conclusion, addressing the challenges posed by HCV in vulnerable populations like IDPs is essential for reducing the overall disease burden and achieving global health goals.

2. Materials and Methods

2.1 Sampling area and sampling criteria

A comparative study was planned to assess the prevalence of HCV among IPDs and native residents of Lahore, Pakistan. In this study, among enrolled participants, IDPs were classified as those who indigenously migrated from FATA (Federally Administered Tribal Area) to Lahore due to social, fiscal, and geographical reasons. 106 participants (53 from each native and IDP) were enrolled from May 2017 to February 2018. A randomized sampling rule was followed as per the method of earlier researchers by Fatima, et al. [17]. All enrolled participants of the study signed informed consent. A questionnaire having socio and demographic values was designed and distributed among enrolled participants as per the method by Shafiq, et al. [18]. Participants were informed about the goals and outcomes of the study.

2.3 Inclusion and exclusion criteria.

Healthy individuals from both populations without any previous HCV medical history, including males and females over 15 years, were enrolled in the study. Individuals having less than 15 years of experience were omitted.

2.4 Blood Sampling

About 5cc venous blood was extracted from enrolled participants. The blood was transferred to a Gel Vacutainer containing a gel that separates serum from the cells. All the samples were kept at room temperature to allow the blood to clot as per the method by earlier researchers [19-21]. Serum from collected samples was separated following centrifugation at 5000 rpm for 10 min at room temperature (25 °C). Serum samples were stored at -20° C until further use.

2.4.1 Detection of HCV antibodies using ICA and ELISA

Immunochromatographic assay (ICA) and Enzyme-linked Immunosorbent Assay (ELISA) were performed for HCV antibody conformation [22]. Samples with two distant colored lines appearing in both control and test zones were considered HCV. Only one colored line appearance was indicated in the control zone, and no line in the test zone showed a negative HCV. All samples were cross-assayed for ELISA to avoid any false positive results. The absorbance was read at 450nm with a Biotek ELISA plate reader. The ELISA results were interpreted as cut off value: 1.0; Positive: >5; Negative: <1

2.5 Data Analysis

Data obtained from the individuals through questionnaires were entered in Microsoft excel and SPSS statistics (Ver 20).

3. Results

3.1 Frequency Analysis of IDPs and Native Population

This comparative study was conducted to enlighten the high burden of communicable diseases like HCV and the associated risk factors that aid HCV's spread and high presence. All the individuals were interviewed via questionnaire and screened for anti-HCV. Our study showed that the presence of HCV-positive cases was 22.6% (12 cases) and 11.3% (6 cases) in the IDPs and native population, respectively **Table I**. A comparatively higher percentage of HCV-positive cases was reported in our study in IDPs than in the natives. ELISA and CIA results

Table I: Total Frequency and Percentage of IDPs and Native Population

HCV Status	IDPs		Natives Population	
	No of Individuals	Percentage	No of Individuals	Percentage
Negative	41	77.4%	47	88.7%
Positive	12	22.6%	6	11.3%
Total	53	100%	53	100%

3.2 Analysis of Socioeconomic and Health Disparities Between Internally Displaced Persons (IDPs) and Native Populations

The study revealed significant disparities in educational attainment between IDPs and the native population, with education levels categorized as illiteracy (no formal schooling or inability to read/write), basic literacy, primary, secondary, matric (high school), and graduation. Among IDPs, illiteracy rates were markedly higher (67.9%) compared to natives (50.9%) (**Figure 1A**). Conversely, natives exhibited more excellent representation in higher educational tiers: basic literacy (17.0% IDPs vs. 15.1% natives), primary education (5.7% vs. 13.2%), secondary education (5.7% vs. 13.2%), matriculation (1.9% vs. 3.8%), and graduation (1.9% vs. 1.9%). These disparities highlight systemic barriers to education for IDPs, likely exacerbated by displacement-related disruptions and socioeconomic constraints. Notably, among Hepatitis C virus (HCV)-positive cases, 75% of IDPs and 83.3% of natives were illiterate (**Figure 1B**), underscoring a correlation between low education and health vulnerability.

Marital status distributions further emphasized socioeconomic differences. Most IDPs (69.8%) were married, compared to 83.0% of natives (**Figure 1C**). Strikingly, all HCV-positive natives were married, whereas only 75% of HCV-positive IDPs were married, suggesting potential destabilization of family structures due to displacement. Income disparities were equally pronounced: 84.9% of IDPs earned less than 5,000 PKR/month (below the poverty line), compared to 64.2% of natives (**Figure 1D**). While 30.2% of natives earned over 10,000 PKR/month, only 5.7% of IDPs fell into this bracket. HCV prevalence was disproportionately high among low-income groups, with 92% of HCV-positive IDPs and 66% of HCV-positive natives earning less than 5,000 PKR/month (**Figure 1E**), aligning with global trends linking poverty to healthcare access barriers.

Housing conditions, a proxy for socioeconomic stability, also differed significantly. While 49.1% of IDPs lived in concrete houses—potentially reflecting humanitarian aid efforts—15.1% still resided in mud houses, compared to only 3.4% of natives (**Figure 1F**). Natives predominantly occupied durable housing (96.2% brick/concrete), which may contribute to better health outcomes.

These findings highlight the compounded disadvantages faced by IDPs, including lower education, income, and suboptimal housing, which likely exacerbate health inequities. Illiteracy and poverty may limit health literacy and preventive care access, perpetuating disease transmission. In contrast, the native population's higher socioeconomic status appears to buffer against such risks. The data underscore the urgent need for targeted interventions, such as educational programs, vocational training, and healthcare outreach, to address IDPs' vulnerabilities.

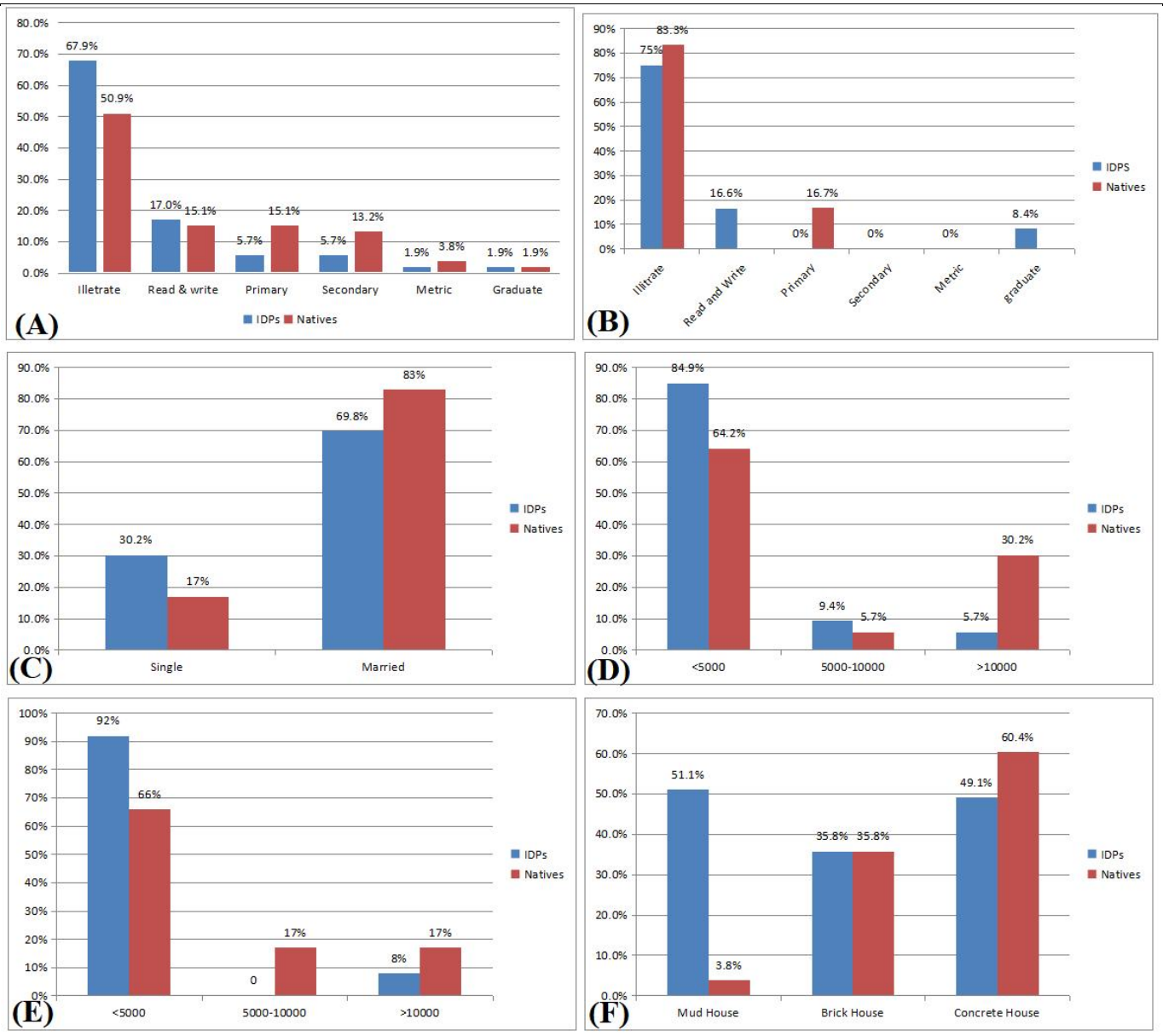

Figure 1: ***Figure 1(A)*** illustrates the educational attainment disparities between IDPs and natives, comparing illiteracy, basic literacy, primary, secondary, matriculation, and graduation rates. ***Figure 1(B)*** highlights illiteracy prevalence among HCV-positive cases in both populations. ***Figure 1(C)*** contrasts marital status distributions, showing higher marriage rates among natives compared to IDPs. ***Figure 1(D)*** details monthly income brackets, emphasizing the economic marginalization of IDPs, while ***Figure 1(E)*** focuses on income disparities among HCV-positive individuals. ***Figure 1(F)*** compares housing conditions, revealing differences in mud, brick, and concrete housing prevalence between IDPs and natives.

3.3 Housing Conditions Among HCV-Positive IDPs and Native Populations

Our study observed significant differences in housing conditions between HCV-positive Internally Displaced Persons (IDPs) and the HCV-positive native population. Notably, only 17% of HCV-positive IDPs lived in mud houses, whereas none (0%) of the HCV-positive natives resided in such dwellings (**Figure 2A**). This suggests that while mud housing remains a characteristic of IDP settlements,

native populations have primarily transitioned to more permanent housing structures.

The study also examined living space conditions, revealing that 83% of IDPs shared their living rooms with more than three individuals. Regarding bedroom-sharing, 5.7% of IDPs shared with three persons, 9.4% with two, 1.9% with one, and 0% had a private bedroom. In contrast, among the native population, 54.7% shared their living rooms with more than three individuals, while 20.8%, 11.3%, 11.3%, and 1.9% shared their bedrooms with three, two, one, and none, respectively (**Figure 2B**). This indicates that overcrowding is more prevalent among IDPs than among natives.

Focusing specifically on HCV-positive individuals, 84% of IDPs and 68% of natives shared their living rooms with more than three people (**Figure 2C**). These findings highlight that HCV-positive individuals, especially in IDP communities, are more likely to experience overcrowded living conditions, which could contribute to disease transmission and other health-related challenges.

3.3.1 Employment Status of IDPs and Native Populations

Employment patterns varied significantly between IDPs and native populations. In the overall population, the employment rate among IDPs was 20.8%, while 79.2% remained unemployed. Among the natives, 1.9% did not disclose their employment status, while 54.7% were unemployed and 43.4% were employed (**Figure 2D**). These statistics indicate a higher unemployment rate among IDPs, reflecting the economic instability they face due to displacement.

When analyzing employment status among HCV-positive individuals, a contrasting pattern emerged. Employment was observed in 92% of HCV-positive IDPs and 50% of HCV-positive natives, while 8% of HCV-positive IDPs and 50% of HCV-positive natives were unemployed (**Figure 2E**). This suggests that despite overall high unemployment among IDPs, HCV-positive individuals within this group tend to be more engaged in employment compared to their native counterparts.

3.3.2 Health Services Utilized by IDPs and Native Populations

The study also examined the types of healthcare facilities utilized by IDPs and natives for routine medical check-ups. Among IDPs, 1.9% visited a pharmacist, 5.7% consulted registered medical practitioners, 9.4% sought treatment at government dispensaries, 7.5% visited private hospitals, 43.4% relied on government hospitals, 15.1% consulted herbal practitioners, 13.2% sought help from traditional healers, and 3.8% utilized other healthcare options.

Among the native population, the healthcare-seeking pattern was slightly different. 5.7% visited a pharmacist, 17% consulted registered medical practitioners, 1.9% sought care at government dispensaries, 11.3% visited private hospitals, 32.1% relied on government hospitals, 3.8% sought advice from herbal consultants, 26.4% preferred traditional healers, and 1.9% used other healthcare services (**Figure 2F**). These findings indicate that while both groups predominantly rely on government hospitals, a significantly higher percentage of natives (26.4%) consult traditional healers than IDPs (13.2%). This highlights potential differences in healthcare accessibility, affordability, and cultural beliefs influencing treatment choices.

3.4 Type of Health Services Utilization by HCV-Positive Individuals in IDPs and Natives

HCV-positive individuals were assessed based on the type of healthcare facility they utilized during their illness. Among the Internally Displaced Persons (IDPs), approximately 52% reported availing services from government hospitals compared to only 17% of the native population. In contrast, visits to private hospitals were reported by about 16% of HCV-positive IDPs, whereas 33% of HCV-positive natives sought care in these facilities**.**

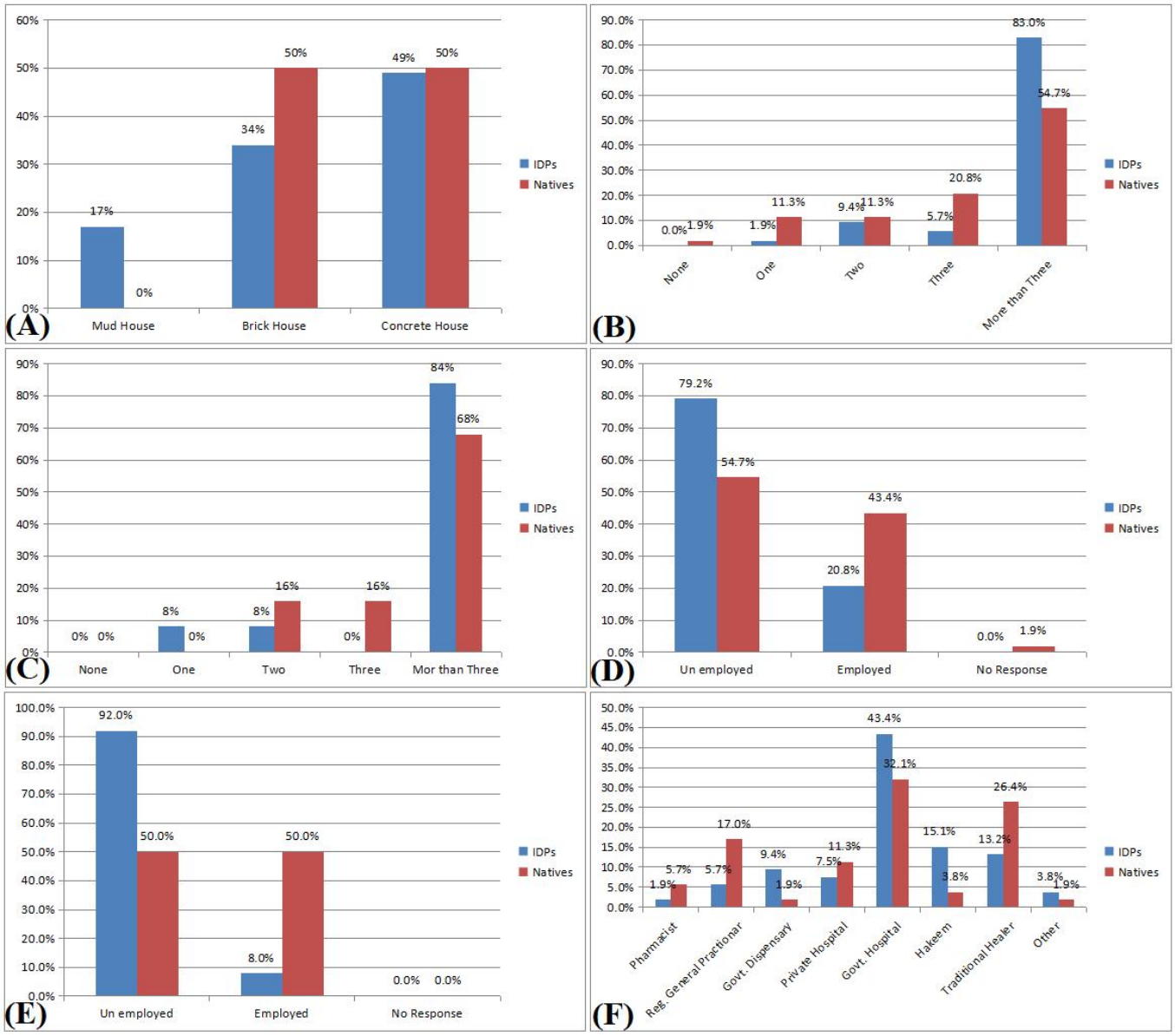

Figure 2: 2A; Housing Type among HCV-Positive Populations. 2B: Household Crowding in IDPs and Native Populations. **2C:** Living Room Sharing among HCV-Positive Individuals. **2D:** Employment Status of Overall IDP and Native Populations. **2E**: Employment Status among HCV-Positive Individuals. **2F:** Utilization of Health Services by IDPs and Native Populations

In addition, other sources of care differed between the groups: among natives, 17% consulted pharmacists, and 33% consulted herbal practitioners, while among IDPs, 8% sought services from registered medical practitioners, 16% consulted traditional healers, and 8% accessed other healthcare providers (**Figure 3A**).

3.4.1 Admission to Health Care Facilities

Our analysis of hospital admission patterns over the past six months revealed distinct differences between the two groups. Among all IDPs, 15.1% reported a previous hospital admission, 81.1% stated they had not been admitted, and 3.8% did not respond to the question regarding admission status. In contrast, the native population demonstrated much lower hospital utilization, with only 1.9% reporting previous admissions while a vast majority, 98.1%, had not been admitted. Focusing specifically on HCV-positive individuals, only 8% of IDPs reported prior

hospital admission, underscoring a potential discrepancy in healthcare-seeking behavior between the groups (**Figures 3B and 3C**).

3.4.3 Effective Sources of Health-Related Information

The study further evaluated the channels through which respondents obtained health-related information. Among native individuals, 26.4% relied on television, 7.5% received information from family members, 5.7% from friends, and 36.9% from health workers. In comparison, among IDPs, 13.2% used television, 18.9% depended on family members, 7.5% turned to friends, 20.8% relied on health workers, and 3.8% cited newspapers as sources of information. Notably, a substantial proportion reported having no access to proper health information, with 20.8% of natives and 35.8% of IDPs lacking such sources (**Figure 3D**). When focusing exclusively on HCV-positive individuals, the disparity was even more pronounced: 43% of HCV-positive IDPs had no proper health information sources compared to 17% of HCV-positive natives**.**

Among the remaining HCV-positive IDPs, 33% reported obtaining information from family members, while 8% each relied on friends, health workers, or newspapers; meanwhile, HCV-positive natives most commonly received information via television (33%), with 17% and 33% citing friends and health workers, respectively (**Figure 3E**). These findings highlight significant differences in both healthcare access and the sources of health-related information between IDPs and natives, particularly among those affected by HCV.

4. Discussion

The present comparative studies were designed to evaluate the presence of Hepatitis C in the IDPs and natives residing in central Punjab, Pakistan. Using a questionnaire, some socio-demographic factors were asked from the populations, and the association of those factors was analyzed, which may be a contributory factor for the presence of Hepatitis C. This study focused on IDPs, as this population is very sensitive and highly neglected. Medical camps were arranged with the help of a highly professional medical team, including doctors, nurses, paramedical staff, and data entry persons. The frequency of HCV in the native population was compared to that of IDPs, which was around 1:2, indicating that the prevalence of HCV in the IDPs was higher than that of the native or general population. This finding is supported by the literature where displaced people or immigrants have higher rates of HCV than the general population [23].

In our study, HCV frequency in the IDPs was 22.6%. Of the limited literature available on IDPs, a similar kind of study on IDPs from Swat during the war against terrorism showed some contrasting results to our studies. One study reported that the prevalence rate of Hepatitis C in the IDPs was 8.8% [24]. The difference in the ranges might be due to the sample sizes of both studies or the living standards of both populations. However, some studies on homeless people (who are a bit similar to the IDPs) showed that the prevalence of HCV was around 21.4%, which is identical to our studies [25]. Some other studies on the general population showed that the prevalence rate of HCV is around 4.5%-8% [19] and 6.8% [20], respectively, although similar to each other but less than the rate of native Populations in our studies. The higher frequency of HCV in our native population might be due to high genetic diversity, characterized by regional variations in genotype frequency and massive difference in sample size.

Among different factors for analysis of the association of socio-demographic factors with the prevalence of HCV, the education level of both the populations was asked through a questionnaire in which it was observed that

education level of both populations was low, i.e. illiteracy rate of IDPs and native population were 67.9% and 50.9% respectively. It was also observed in our study that all HCV-positive cases had illiteracy rates of around 75% and 83% for IDPs and native population, respectively. So, a low literacy rate might be a contributory factor for the presence of Hepatitis C. Similar results were reported in a study from Central Yemen in 2012 which showed that the prevalence of Hepatitis C was more in the illiterate peoples [26]. In another study in San Francisco in 2013 it was observed that formal HCV education speed up HCV therapy and increase virologic response rate [27]. Moreover, WHO secondary and tertiary prevention about HCV reported that education and counselling is a way of prevention for HCV.

Our results also revealed that lower monthly income might also play a role in high prevalence of HCV. In our study 89.9% of the IDPs, 64.2% of the native population had a monthly income of <5000 PKR, while and an average of 79% of all HCV positive cases in both populations had a monthly income of <5000 PKR. Similar trends of increasing HCV prevalence is observed in a study from Yemen which have concluded that HCV prevalence increases with the decrease in the monthly income [26]. Marital status of both populations showed association with prevalence of HCV. However, a study conducted from Canada in 2016 showed that there is no association of HCV with marital status. This variation might be because more than 76% of our study populations were married.

Literature supports that poor housing conditions have no association with increased prevalence of HCV [28]. We also observed in our study, that poor housing condition does not affect the presence of HCV in both the populations. However, we noticed that more HCV positive cases were reported among residents of concrete houses, which ultimately means that HCV may be associated with living in concrete houses [28]. Sharing living rooms with more than one person, unemployment, availing of inadequate health services and facilities like that in government hospitals was also considered as significant risk factor with increased presence of HCV per our study. However, these findings could not be correlated with other studies as no literature is available on this subject. Hence this study will provide a premier finding after statistical analysis. In addition, if unemployed HCV-positive individuals are analyzed separately, no association is observed with the increased presence of HCV. Similarly, seeking inappropriate Health services or in government hospitals is a contributing factor in case of IDPs but not for Native Population [29]. This ultimately means that unemployment is not the only contributing factor that makes an IDP more prone to get HCV than a native person. A considerable portion of the individuals in both populations (mainly in IDPs) did not seek any medical consultation in case of mild illnesses, which is risk factor for the high frequency of HCV in IDPs. Self-medication or no proper medical consultation has also been reported as a significant risk factor for HCV. Moreover, the initial signs and symptoms of HCV are similar to those of general illness, which may play a key role in HCV spread. Most of our study population had private reasons for no medical consultation. According to different studies, we also observed that previous hospital admission and access to health information are strongly associated with HCV frequency. For instance, in 2008, a study from Spain reported that last hospital admission and health-related education were strongly associated with HCV prevalence [30, 31]. HCV can be reduced by increasing health awareness and health education. In our study population, it can be done quickly by augmenting the activity of health workers in the neglected areas of IDPs.

Conclusion

This study underscores the alarming disparity in Hepatitis C Virus (HCV) prevalence, with Internally Displaced Persons (IDPs) exhibiting approximately twice the infection rate compared to the native population. It also highlights the significant burden of HCV within the general population. Our findings suggest that specific socio-demographic factors, including illiteracy, low income, inadequate healthcare facilities, substandard housing, overcrowding, prior hospitalizations, and limited access to health education, significantly contribute to the heightened vulnerability of IDPs to HCV. Addressing these socio-demographic challenges is paramount, and targeted interventions aimed at improving healthcare access, housing conditions, and health education among IDPs should be prioritized. Moreover, this study lays the groundwork for future research, including viral load quantification, genotyping assays, and in-depth statistical analysis to elucidate further the association between socio-demographic factors and HCV prevalence in IDPs. These efforts are critical for shaping effective prevention and mitigation strategies, ultimately reducing the burden of HCV in vulnerable populations.

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Conflict of Interest: None

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