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BURDEN BEYOND HEALTH AND HEALTH CARE COMPLICATIONS: THE SOCIOECONOMIC IMPACT OF VIRAL HEPATITIS B AND C IN PAKISTAN

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Abstract

Hepatitis B and C pose significant public health challenges in Pakistan, not only due to their medical consequences but also their profound socioeconomic impacts. This study examines how these chronic infections affect employment status, out-of-pocket healthcare expenditures, and the relationship between disease severity and financial burden among patients. This study finds significant effect of viral hepatitis B and C on labor productivity, labor mobility, absenteeism and presentism at work place, family income, mortality and life style in Pakistan. This study also originated significant direct relationship between total per month direct medical cost and indirect medical cost at different disease stage. Higher direct medical costs and indirect medical costs were found with advanced disease and vice versa. In the initial stage of the disease most of the direct medical costs were associated with diagnostic charges and medical services whereas the decompensated cirrhosis stage a large portion of direct medical costs were related to hospital admission and medication. Findings also indicated that individuals with advanced stages of hepatitis are more likely to face unemployment, reduced productivity, and catastrophic healthcare costs, particularly in low income households. The absence of structured support systems exacerbates these challenges, leading to a cycle of poverty and worsening health. The research underscores the urgent need for integrated health and social policies to address the broader consequences of hepatitis B and C in Pakistan

INTRODUCTION

Health is universally recognized as a fundamental driver of economic growth and social welfare. A nation's economic performance is intrinsically linked to the health status of its population, as

healthy individuals contribute more effectively to productivity, innovation, and long-term development. In resource-constrained countries, where decades of investment are required to build human capital, the loss of productive capacity due to illness represents a significant economic setback. Poor health imposes both direct costs—such as reduced work capacity and loss of income—and indirect costs, particularly when the affected individual is a household head or primary income earner. These losses extend beyond households, influencing labor market participation, national output, and economic stability.

Health challenges often disproportionately affect the working-age population, leading to reduced labor market engagement, early retirement, and shortened productive lifespans. Such outcomes exacerbate household vulnerability, particularly in settings where healthcare access is constrained by both economic conditions and systemic health infrastructure limitations. The interplay between health and economic performance is therefore critical: a healthier population not only sustains higher incomes but also reduces preventable medical expenditures through improved disease prevention, timely treatment, and equitable access to quality health services.

Morbidity indicators—such as disease prevalence and incidence—are key determinants of national productivity. A healthy labor force safeguards returns on human capital investments, enhances workforce experience, and minimizes productivity losses due to absenteeism. Consequently, improving population health is not merely a public health objective but a core economic strategy. In the long run, strengthening health systems, particularly in vulnerable regions, can reduce poverty and foster sustained economic growth. This study examines these dynamics within the context of **Hepatitis B and C in Pakistan**, assessing how these health burdens influence labor productivity, household welfare, and broader economic outcomes.

Globally, hepatitis B and C are among the most pressing infectious diseases, affecting an estimated 296 million and 58 million people, respectively, and causing approximately 1.1 million deaths per year. Beyond clinical outcomes, these infections impose substantial economic burdens, High-income countries demonstrate that lost productivity often outweighs direct medical costs. Modeling studies suggest that investing in elimination strategies such as universal screening and subsidized treatment can yield substantial economic returns. (Sajjad and Misbah 2022, Sajjad et all 2024, 2025). Pakistan ranks among the countries with the highest HBV and HCV burdens. Prevalence estimates vary broadly: for the general population, HBV hovers near 2.4%, while HCV ranges from 2.1% to 3%, with much higher rates in high-risk groups. In Punjab, screening coverage remains insufficient only a fraction of the population has been tested and treatment uptake is limited. Empirical studies in Pakistan, including those by Umar et al. (2019) and Qureshi et al. (2022), highlight significant productivity losses associated with HBV/HCV. However, most research remains clinically focused, with limited integration of labor market data, economic cost modelling, and policy simulation. This gap restricts policymakers from fully understanding the return on investment of hepatitis elimination programs

Statement of the Problem

Hepatitis B and C remain significant public health concerns in Pakistan, with prevalence rates among the highest in the region. These chronic viral infections impose a considerable burden on affected individuals, households, and the national economy. Beyond their direct health implications, hepatitis B and C reduce labor productivity, increase absenteeism, and, in severe cases, force early withdrawal from the labor market. Such losses are particularly damaging in Pakistan's socio-economic context, where a large proportion of the workforce is engaged in informal employment, lacks adequate health insurance, and relies on daily income for subsistence. The economic consequences extend beyond individual productivity losses to encompass increased healthcare expenditures, depletion of household savings, and the liquidation of productive assets to finance treatment. These effects compound the cycle of poverty and reduce the country's capacity to sustain economic growth. Despite the well-

documented clinical impact of hepatitis B and C, there is limited empirical evidence quantifying their broader socioeconomic and labor market effects in Pakistan. This knowledge gap hinders the design of effective policies that could mitigate the disease's economic toll while improving public health outcomes.

Significance of the Study

This study holds significant value for policymakers, public health professionals, and development economists by bridging the gap between clinical understanding of hepatitis B and C and their broader socioeconomic implications. In Pakistan, where healthcare resources are limited and the informal labor market dominates, the economic repercussions of chronic illnesses are often underestimated in policy formulation. By providing empirical evidence on the labor market effects, productivity losses, and household economic strain caused by hepatitis B and C, this research contributes to a more comprehensive understanding of the disease burden.The findings will support the design of targeted health interventions that go beyond treatment to address the economic vulnerabilities of affected households. Moreover, the study's results will offer guidance for integrating health policies with economic and labor market strategies, ensuring that prevention and control programs are aligned with poverty reduction and sustainable growth objectives. For researchers, this work fills a critical literature gap by applying econometric analysis to quantify the relationship between infectious disease prevalence and labor market outcomes in a developing country context. Ultimately, the study aims to inform both national strategies and international development initiatives aimed at reducing the dual health and economic impact of hepatitis B and C.

Research Design.

The study adopts a quantitative, cross-sectional design using primary data collected from hepatitis B and C patients across Pakistan. Descriptive statistics are used to summarize demographic, socioeconomic, and health-related characteristics, while econometric models—Ordinary Least Squares (OLS) and Logistic Regression—are employed to estimate the impact of hepatitis B and C on selected labor market outcomes.

Study Area and Population

The target population comprises diagnosed hepatitis B and C patients from 77 districts across all provinces and administrative regions of Pakistan, including Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan, Azad Jammu & Kashmir (AJK), and Gilgit-Baltistan (GB). The geographic spread ensures representation from both urban and rural areas, capturing variations in socioeconomic conditions and healthcare access.

Sample Size and Sampling Technique

The sample consists of 8,388 respondents, with 5,005 males (59.7%) and 3,383 females (40.3%). A multi-stage sampling technique was used: Stage 1 – Selection of districts with high hepatitis prevalence based on provincial health department data. Stage 2 – Random selection of healthcare facilities (public hospitals, private clinics, and diagnostic centers). Stage 3 – Systematic random sampling of patients meeting the inclusion criteria (clinically confirmed diagnosis of hepatitis B or C, aged 18–65 years).

Data Collection Tools and Procedures

Data were collected through a structured questionnaire comprising the following sections: Demographic information (age, gender, education, marital status), Socioeconomic characteristics (occupation, income level, household size), Health-related information (type of hepatitis, disease stage, duration since diagnosis, treatment status), Economic costs (direct medical costs, non-medical costs, and indirect costs due to productivity losses).

Demographic analysis of the data and socioeconomic analysis of data

Demographic analysis of the data

This part of study consists of two sub sections. The first sub section analyzes the demographic characteristics whereas the second section discusses the socioeconomic status of the respondents.

Table 1. Gender wise classification of data

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	3383	40.3	40.3	40.3
	Male	5005	59.7	59.7	100.0
	Total	8388	100.0	100.0	

The gender-wise distribution of hepatitis B and C patients in this study reveals a higher prevalence among males (59.7%) compared to females (40.3%). This disparity may be attributed to several interrelated factors, including occupational exposure, where men in Pakistan are more frequently engaged in labor-intensive or high-risk professions such as construction, transport, and agriculture, which can increase the likelihood of contact with contaminated blood or instruments. Cultural and social dynamics may also play a role, as men generally have higher mobility, leading to greater exposure to unsafe medical practices, barber shops, or unregulated dental care, all of which are recognized transmission routes. Additionally, disparities in healthcare-seeking behavior may mean that men are more likely to be diagnosed and recorded in clinical settings, while women—particularly in rural areas—may have less access to testing facilities, leading to underreporting. These findings suggest that targeted prevention and awareness strategies should consider gender-specific occupational and behavioral risk factors to effectively reduce the hepatitis burden.

Table 2. Age wise classification of viral hepatitis B and C patients in Pakistan

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-18 Years	305	3.6	3.6	3.6
	19-32 Years	2898	34.5	34.5	38.2
	33-46 Years	2721	32.4	32.4	70.6
	47-60 Years	1511	18.0	18.0	88.6
	>60 Years	953	11.4	11.4	100.0
	Total	8388	100.0	100.0	

Table 2.1. Mean age with standard deviation

	N	Minimum	Maximum	Mean	Median	Std. Deviation
Age of the Patient	8388	5	70	39.99	40.00	2.061
Valid N (list wise)	8388					

The age distribution indicates that hepatitis B and C predominantly affect individuals in their economically productive years, with nearly 85% of patients between 19 and 60 years of age. This has significant socioeconomic implications, as infection during prime working years can reduce labor productivity, increase absenteeism, and place a financial burden on both households and the broader economy. The relatively low prevalence among those aged 5–18 years suggests that childhood infection rates are limited, possibly reflecting improvements in vaccination coverage for hepatitis B in recent decades. However, the presence of cases in younger age groups may point to gaps in preventive programs, perinatal transmission, or unsafe medical practices. The mean and median ages both around 40 years reflect a mid-life disease concentration, indicating that prevention and treatment programs should prioritize screening and intervention in working-age populations to mitigate both health and economic consequences.

Table 4.4. Geographical region of the patients

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Punjab	4210	50.2	50.2	50.2
	Sindh	865	10.3	10.3	60.5
	GB	77	1.0	1.0	61.6
	KPK	2482	29.6	29.6	90.1
	Baluchistan	480	5.7	5.7	95.9
	Azad Kashmir	149	1.8	1.8	97.6
	Islamabad capital territory	125	1.4	1.4	100.0
	Total	8388	100.0	100.0	

Table 4.4.1 Cast/race/ethnicity of the patient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Punjabi	2495	29.7	29.7	29.7
	Pashtun	2500	29.8	29.8	59.5
	Sindhi	1316	15.7	15.7	75.2
	Saraiki	1200	14.3	14.3	89.5
	Muhajir	201	2.4	2.4	91.9
	Hindko	450	5.3	5.3	97.2
	Chitrali	77	1.0	1.0	98.2
	Kashmiri	149	1.8	1.8	100.0
	Total	8388	100.0	100.0	

The data reveal that **half of all hepatitis cases (50.2%) originate from Punjab**, followed by Khyber Pakhtunkhwa (29.6%) and Sindh (10.3%). The high representation from Punjab may partly reflect its status as Pakistan's most populous province, but may also indicate a concentration of healthcare facilities that draw patients from other regions. This is supported by the ethnic distribution, which shows that 44% of patients identify as Punjabi or Saraiki (Southern Punjab), while others, such as Pashtuns and Hindko speakers from KPK, likely traveled to Punjab for treatment. Similarly, the difference between geographical and ethnic proportions in KPK (29.6% geographically vs. 35.1% ethnically) suggests interprovincial mobility for healthcare access.

From a public health perspective, these findings highlight **unequal access to hepatitis care across provinces**, with Punjab emerging as a key treatment hub. Ethnically, the disease burden appears most significant among Pashtuns (29.8%) and Punjabis (29.7%), followed by Sindhis (15.7%) and Saraikis (14.3%). Such clustering may be influenced by regional healthcare disparities, cultural practices, and variations in exposure to unsafe medical procedures. The geographic–ethnic overlap underscores the need for **region-specific interventions** that consider both local transmission patterns and patient mobility for treatment.

Table: 4.5. Education and awareness of the respondent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	2644	31.5	31.5	31.5
	Primary	1788	21.3	21.3	52.8
	High school	2355	28.1	28.1	80.9
	Collage/university	1601	19.1	19.1	100.0
	Total	8388	100.0	100.0	

The data indicate that a substantial proportion of hepatitis patients have low educational attainment, with over half (52.8%) having either no formal education or only primary-level education. This trend suggests a potential link between lower education levels and higher hepatitis prevalence, likely mediated by reduced health literacy, limited awareness of transmission risks, and inadequate access to preventive healthcare. Conversely, only 19.1% of patients had a college or university degree, reflecting lower representation of highly educated individuals among those infected. This may be due to greater awareness of safe medical practices, better access to quality healthcare, and healthier lifestyle behaviors in more educated populations. These findings emphasize the importance of targeted health education and awareness programs in low-literacy communities to reduce the transmission of hepatitis B and C.

Table 4.6. Health care institutions attended by the patients

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Public sector	1395	16.6	16.6	16.6
	Private sector	6819	81.3	81.3	97.9
	Homeopathic and Ayurveda	37	.4	.4	98.4
	Quacks/ peers/ spiritual healers	48	.6	.6	98.9
	Trust hospitals /organizations	89	1.1	1.1	100.0
	Total	8388	100.0	100.0	

The overwhelming majority of patients (81.3%) sought care from the private healthcare sector, with only 16.6% using public-sector facilities. This finding reflects Pakistan's healthcare landscape, where private providers deliver a substantial proportion of medical services, often due to perceptions of better quality, shorter waiting times, and greater accessibility. However, heavy reliance on the private sector raises concerns about treatment affordability and equity, particularly for low-income households. The minimal use of alternative medicine (1.0% combined for homeopathic, Ayurvedic, and spiritual healers) suggests that most patients seek biomedical treatment, although such small proportions still represent potential public health risks if these providers do not follow safe medical practices. The low utilization of trust-run hospitals (1.1%) may indicate either limited availability or low awareness of these charitable options

Table 4.7.1. Employment status of the patient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full time employee	708	8.4	8.4	8.4
	Part time employee <30 hr/week	127	1.5	1.5	10.0
	Self-employee	3380	40.3	40.3	50.3
	Dependent / Un-employed	4116	49.1	49.1	99.3
	Retired	57	.7	.7	100.0
	Total	8388	100.0	100.0	

The majority of patients were either unemployed or dependent (49.1%) or self-employed (40.3%), with only 8.4% holding full-time jobs and 1.5% engaged in part-time employment. This distribution suggests a low formal labor market participation among hepatitis B and C patients, potentially reflecting the debilitating effects of chronic illness on sustained employment. The high proportion of self-employment may also indicate labor market exclusion, where individuals resort to informal work due to health constraints or limited job opportunities. The small proportion of retirees (0.7%) aligns with the relatively young-to-middle age profile observed in the sample, implying that premature labor force withdrawal is not primarily age-related but may be disease-induced. These findings underscore the economic vulnerability of patients, highlighting the dual challenge of managing health costs while facing restricted earning capacity, which has implications for social protection policies and workplace health interventions.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sexual weakness	50	.6	.6	.6
	None	6043	72.0	72.0	72.6
	Diabetes	1477	17.6	17.6	90.2
	Genetic disorder	290	3.5	3.5	93.7
	Anemia	22	.3	.3	94.0
	H.pylori	27	.3	.3	94.3
	Depression	411	4.9	4.9	99.2
	Skin infection	18	.2	.2	99.4
	Fatigue	50	.6	.6	100.0
	Total	8388	100.0	100.0	

The data indicate that while the majority of hepatitis B and C patients (72.0%) reported no additional health complications, a substantial minority experienced comorbid conditions that could exacerbate disease burden and impair quality of life. Notably, the high prevalence of diabetes (17.6%) underscores the metabolic health risks often associated with chronic liver disease, possibly due to shared risk factors or liver-related insulin resistance. Depression, present in 4.9% of patients, reflects the psychosocial toll of long-term illness and highlights the need for integrated mental health support in hepatitis care. Although less prevalent, conditions such as genetic disorders, sexual weakness, anemia, and H. pylori infection may contribute to clinical complexity and require targeted interventions.

Total number of infected family members

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4452	53.1	53.1	53.1
	2	2976	35.5	35.5	88.6
	3	804	9.6	9.6	98.1
	4	125	1.5	1.5	99.6
	5	21	.3	.3	99.9
	6	10	.1	.1	100.0
	Total	8388	100.0	100.0	

Table 4.8.5. Statistics (mean and standard deviation)

		Total number of family members	Number of infected family members
N	Valid	8388	8388
	Missing	0	0
Mean		9.88	1.60
Std. Error of Mean		.008	.008
Std. Deviation		.758	.773
Minimum		1	0
Maximum		5	7

Table 4.8.3 and 4.8.4 presented the total number of infected family members of all the respondents while their mean and standard deviations are highlighted in table 4.8.5. The descriptive statistics indicated that on average the total family members of hepatitis B and C infected person were 9.88 with standard deviation of 0.758 and the mean of infected family members are estimated 1.6 with standard deviation of 0.773.

Furthermore, 53.6% of the respondents reported 8 to 10 persons in their family followed by 25.6% and 16.8% of the patients recorded 5 to 7 and 11 to 13 persons in their family. 46.9% of the hepatitis B and C patients stated that their family has more than 1 hepatitis patients. The estimated 35.5% patients reported 2 patients in the family followed by 9.6%, 1.5%, 0.3% and 0.1% reported 3, 4, 5 and 6 viral hepatitis B or C patients in their family.

Table 4.8.6. Death of a family member associated to Hepatitis B or C

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	6886	82.1	82.1	82.1
	1	1398	16.7	16.7	98.8
	2	82	1.0	1.0	99.7
	3	11	.1	.1	99.9
	4	11	.1	.1	100.0
	Total	8388	100.0	100.0	

Table 4.8.7. Death of a Family member with mean and standard deviation

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Death of a family member	8388	0	4	.20	.448	.200
Valid N (listwise)	8388					

The mortality associated with viral hepatitis B and C reported by the respondents has been presented in table 4.8.6. The statistics in the above table explore significant association of mortality and viral hepatitis B and C. Thus, the mean value of deaths is 0.20 and standard deviation 0.448 with minimum of zero deaths and maximum of 4 death caused by viral hepatitis B and C. In current study 1398 families reported 1 causality in their family related to either hepatitis B or C accounting to 16.7% of the total population included in the study while 82 families reported 2 deaths (1%) and 11 each family reported 3(0.13%) and 4 (0.13%) death caused by hepatitis B and C in their family.

Table 4.26 ANOVA current infection, estimated direct medical cost and estimated indirect cost at different stage of the disease

		Sum of Squares	df	Mean Square	F
Current Infection	Between Groups	71.516	3	23.839	145.117
	Within Groups	1377.252	8384	.164	
	Total	1448.768	8387		
Estimate Indirect Medical Cost per Month	Between Groups	14.561	3	4.854	35.796
	Within Groups	1136.821	8384	.136	
	Total	1151.382	8387		
Estimated Direct Medical Cost per Month	Between Groups	49.318	3	16.439	84.063
	Within Groups	1639.584	8384	.196	
	Total	1688.902	8387		

Multiple Comparisons						
Dependent Variable	(I) Staging of Liver Disease	(J) Staging of Liver Disease	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
						Lower Bound
Current Infection	Non-cirrhotic	compensated cirrhosis	-.132*	.010	.000	-.15
		decompensated cirrhosis	-.267*	.013	.000	-.29
		other complications	-.126	.073	.086	-.27
	compensated cirrhosis	Non-cirrhotic	.132*	.010	.000	.11
		decompensated cirrhosis	-.134*	.012	.000	-.16
		other complications	.007	.073	.928	-.14
	decompensated cirrhosis	Non-cirrhotic	.267*	.013	.000	.24
		compensated cirrhosis	.134*	.012	.000	.11
		other complications	.141	.073	.055	.00
	other complications	Non-cirrhotic	.126	.073	.086	-.02
		compensated cirrhosis	-.007	.073	.928	-.15
		decompensated cirrhosis	-.141	.073	.055	-.28
Estimate Indirect Medical Cost per Month	Non-cirrhotic	compensated cirrhosis	-.002	.009	.854	-.02

		decompensated cirrhosis	-.023	.012	.050	-.05
		other complications	.666*	.067	.000	.54
	compensated cirrhosis	Non-cirrhotic	.002	.009	.854	-.02
		decompensated cirrhosis	-.021*	.011	.046	-.04
		other complications	.668*	.066	.000	.54
	decompensated cirrhosis	Non-cirrhotic	.023	.012	.050	.00
		compensated cirrhosis	.021*	.011	.046	.00
		other complications	.689*	.067	.000	.56
	other complications	Non-cirrhotic	-.666*	.067	.000	-.80
		compensated cirrhosis	-.668*	.066	.000	-.80
		decompensated cirrhosis	-.689*	.067	.000	-.82
Estimated Direct Medical Cost per Month	Non-cirrhotic	compensated cirrhosis	.167*	.011	.000	.14
		decompensated cirrhosis	.144*	.014	.000	.12
		other complications	.499*	.080	.000	.34

	compensated cirrhosis	Non-cirrhotic	-.167*	.011	.000	-.19
		decompensated cirrhosis	-.023	.013	.072	-.05
		other complications	.333*	.080	.000	.18
	decompensated cirrhosis	Non-cirrhotic	-.144*	.014	.000	-.17
		compensated cirrhosis	.023	.013	.072	.00
		other complications	.355*	.080	.000	.20
	other complications	Non-cirrhotic	-.499*	.080	.000	-.66
		compensated cirrhosis	-.333*	.080	.000	-.49
		decompensated cirrhosis	-.355*	.080	.000	-.51

*. The mean difference is significant at the 0.05 level.

The difference of cost associated with different stage of the current infection were analyzed in table 4.26 of the current study. The table explored the statistically significant differences among the staging of disease group, direct medical cost, indirect medical cost and current infection with different groups and examined multiple comparison of each group. The results showed statistically significant difference in the mean value of the current infection at different stage of the disease with F statistic value of 145.117 and significance of 0.000 which fall in the critical region of 0.05%. The mean difference in direct cost and indirect cost was also determined significant as the F statistic of direct cost showed value of 35.756 with mean square difference of 4.854 and significance 0.000 while the indirect cost mean difference value, F statistic value and significance were estimated 16.436, 84.06 and 0.00, respectively. The second part of this table explored the mean difference associated with different stage of the disease of the current disease. The F statistic and significance value of compensated cirrhosis, decompensated cirrhosis were found statistically significant different from non-cirrhotic patients at current infection group

with significance value of 0.010 and 0.013 which is less than 5% level of significance so there exists significant difference whereas the difference of other complications were found statistically in significant with significance level of 0.073 it concluded that no significant difference of other complications with non-cirrhotic hepatitis patients group. The mean difference of non-cirrhotic, compensated cirrhotic, decompensated cirrhotic and other complication groups were also found statistically significant different in the estimated direct medical cost per month group whereas, in group of compensated cirrhotic no statistically significant difference was found with other complications. The table also showed statistically significant difference in estimated indirect cost per month in all three group of non-cirrhotic, compensated cirrhotic and decompensated cirrhotic while in group of other complications the again no statistical significant difference was found.

Table 4.27. Independent test results of visa rejection, rusticated from job, job rejection, selling assets, absenteeism from work during job and health care institution.

Group Statistics					
	Current Infection	N	Mean	Std. Deviation	Std. Error Mean
Visa Rejection Due to Hepatitis	HBV	1853	1.83	.374	.009
	HCV	6535	1.86	.349	.004
Rusticated or Terminated	HBV	1853	2.00	.033	.001
	HCV	6535	1.98	.129	.002
Rejection from Job	HBV	1853	1.94	.229	.005
	HCV	6535	1.93	.250	.003
Selling Assets for Treatment	HBV	1853	1.86	.343	.008
	HCV	6535	1.81	.395	.005
Absenteeism during treatment	HBV	1853	1.98	.275	.006
	HCV	6535	1.90	.359	.004
Health care Institution	HBV	1853	1.95	.277	.006
	HCV	6535	1.86	.574	.007

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Visa Rejection Due to Hepatitis	Equal variances assumed	31.035	.000	-2.841	8386	.005	-.027	.009	-.045	-.008
	Equal variances not assumed			-2.732	2828.460	.006	-.027	.010	-.046	-.007
Rusticated or Terminated	Equal variances assumed	112.555	.000	5.223	8386	.000	.016	.003	.010	.022
	Equal variances not assumed			8.926	8330.201	.000	.016	.002	.012	.019
Rejection from Job	Equal variances assumed	13.049	.000	1.792	8386	.073	.012	.006	-.001	.024
	Equal variances not assumed			1.882	3212.975	.060	.012	.006	.000	.024
Selling Assets for Treatment	Equal variances assumed	143.280	.000	5.667	8386	.000	.057	.010	.038	.077
	Equal variances not assumed			6.128	3370.397	.000	.057	.009	.039	.076
Absenteeism during treatment	Equal variances assumed	245.338	.000	8.037	8386	.000	.072	.009	.055	.090
	Equal variances not assumed			9.309	3824.889	.000	.072	.008	.057	.088
Health care Institution	Equal variances assumed	382.000	.000	6.025	8386	.000	.083	.014	.056	.110
	Equal variances not assumed			8.652	6403.826	.000	.083	.010	.064	.102

Table 4.27 showed the results of independent test applied for the statistically significant difference in the mean value of independent variables. The results of Levene's test which is used to confirm the assumption of equal variance among all in the independent sample t-test. The F values with significance level of the visa Rejection 31.35(0.000), Rusticated from job 115.55(0.000), job rejection

13.09(0.000), selling assets 143.28(0.000), absenteeism from work during job 245.33(0.000) and health care institution 382.00(0.000) explored significant statistical difference in the mean values of the stated groups. The significance level of 0.00 in all the above- mentioned group indicated the rejection of null hypothesis of equal mean.

Table 4.28. Chi square test for the association of viral hepatitis with other demographic and economic indicators.

Variable description	Pearson Chi-Square statistic	Pearson Chi-Square p value (significance)	Phi (significance)	Cramer's V (significance)
Gender	47.706	0.000	0.000	0.00
Source of exposure	334.535	0.000	0.000	0.00
Geographical region	15.300	0.018	0.018	0.018
Cast/ race	21/088	0.007	0.007	0.007
Profession	496.857	0.000	0.000	0.000
Employment status	147.925	0.000	0.000	0.000
Education and awareness	120.568	0.000	0.000	0.000
Monthly income	101.940	0.000	0.000	0.000
Time duration of treatment	369.417	0.000	0.000	0.000
Co-infection with other viruses	374.923	0.000	0.000	0.000
Visa rejection	8.068	0.005	0.005	0.005
Rustication / termination of job	27.194	0.000	0.000	0.000
Job rejection	3.309	0.073	0.073	0.073
Selling of assets	31.995	0.000	0.000	0.000
Other complications	641.414	0.000	0.000	0.000

Table 4.28 explored the statistical finding of Pearson Chi-Square statistic and analyzed the statistical relationship of hepatitis B and C with demographic and socioeconomic indicators. The magnitude and P value of Pearson Chi-Square and the P-values of Phi and Cramer's V indicate statistically highly significant association of viral hepatitis B and C with demographic variables age, gender, geographical region, caste/race, source of exposure and education and awareness. Since the P-value of age (0.00), gender (0.00), geographical region (0.018), caste/race (0.017), source of exposure (0.000) and education and awareness (0.00) is less than critical value of 0.05% so we concluded significant of hepatitis B and C with age, gender, geographical region, caste/race, source of exposure and education and awareness. Similarly, the magnitude and P value Pearson Chi-Square and the P-values of Phi and Cramer's V also explored significant association of viral hepatitis B and C with patient's profession, employment status, monthly income, co-infection with other virus, visa rejection, job termination, sale of assets and other complications. The Pearson Chi-Square P-value of profession (0.00), employment status (0.00), monthly income (0.00), co-infection with other virus (0.00), visa rejection (0.005), job termination (0.00), sale of assets (0.00) and other complications (0.00) were less than the significance level of 5% which indicate a strong relationship of hepatitis B and C patient's profession, employment status, monthly income, co-infection with other virus, job termination, sale of assets and other complications while visa rejection with P-value of 0.07 fall in the critical region of 5% which indicate a slight insignificant relationship between hepatitis B and C with visa rejection.

Table 4.29. Chi square test for the association of viral hepatitis with direct and indirect health care cost

Variable description	Pearson Chi-Square statistic	Pearson Chi-Square p value (significance)	Phi (significance)	Cramer's V (significance)
Estimated direct medical cost	99.718	0.000	0.000	0.000
Estimated direct medical cost	335.612	0.000	0.000	0.000

The relationship among viral hepatitis B and C, direct healthcare costs and indirect care health care costs were explained in table 4.29. The Pearson Chi-Square statistic of estimated direct medical cost 99.718 with P value 0.00 and indirect medical costs 335.612 with P-value 0.00 explored statistically significant relationship of hepatitis B and C with direct medical cost and indirect medical costs. As the P-value fall in the critical region of 5%, this study concluded significant statistical association of viral hepatitis B and C with direct medical cost and indirect medical cost in Pakistan.

Table 4.30. Chi square test for the association of direct medical cost with health care and economic indicators

Variable description	Pearson Chi-Square statistic	Pearson Chi-Square p value (significance)	Phi (significance)	Cramer's V (significance)
Treatment history	1916.470	0.000	0.000	0.000
Health care institution	919.673	0.000	0.000	0.000
Time duration	1846.156	0.000	0.000	0.000
Other complication	718.758	0.000	0.000	0.000
Co-infection with other viruses	77.834	0.000	0.000	0.000
Monthly income	1064.245	0.000	0.000	0.000
Employment status	694.100	0.000	0.000	0.000
Stage of the disease	2773.986	0.000	0.000	0.000

The relationship of direct medical cost of viral hepatitis B and C with treatment history, health care institution, other complication of hepatitis B and C patients, co-infection with other virus, monthly income, employment status and stage of the disease were analyzed in table 4.30. The magnitude and P-value of Pearson Chi-Square statistic for treatment history 1916.470 (0.000), health care institution 919.673 (0.000), time duration of treatment 1846.156 (0.000), other complication of hepatitis B and C patients 718.758 (0.000), co-infection with other virus77.834 (0.000), monthly income1064.245 (0.000), employment status 694.100 (0.000) and stage of the disease 2773.986 (0.000) explored statistically significant relation with hepatitis B and C. As the P-value Pearson Chi-Square statistic, Phi and Cramer's V fall in the critical region of 5% level of significance, the above findings concluded significant association of direct health care cost of viral hepatitis B and C with treatment history, health care institution, time duration, other complication of hepatitis B and C patients, co-infection with other virus, monthly income, employment status and stage of the disease.

Table 4.31. Chi square test for the association of indirect medical cost with health care and economic indicators

Variable description	Pearson Chi-Square statistic	Pearson Chi-Square p value (significance)	Phi (significance)	Cramer's V (significance)
Treatment history	698.580	0.000	0.000	0.000
Health care institution	698.580	0.000	0.000	0.000
Time duration	1169.050	0.000	0.000	0.000
Other complication	1351.361	0.000	0.000	0.000

Co-infection with other viruses	143.518	0.000	0.000	0.000
Monthly income	1467.393	0.000	0.000	0.000
Employment status	462.348	0.000	0.000	0.000
Absenteeism	492.754	0.000	0.000	0.000
Staging of liver disease	1401.616	0.000	0.000	0.000
Visa rejection/labor mobility	89.754	0.000	0.000	0.000
Job rejection	183.165	0.000	0.000	0.000
Rustication / termination of job	250.441	0.000	0.000	0.000
Selling of assets	125.948	0.000	0.000	0.000

The association of indirect medical cost hepatitis B and C with socioeconomic indicators was highlighted in table 4.31 of this study by Pearson Chi-Square statistic approach. The P-value of Pearson Chi-Square statistic explored the direct association of indirect medical cost hepatitis B and C with socioeconomic indicators. The Pearson Chi-Square statistic with their respective P-value of treatment history 698.580 (0.000), health care institution 698.580 (0.000), time duration 1169.050 (0.000), other complication with hepatitis 1351.361 (0.000), Co-infection with other viruses 143.518 (0.000), monthly income 1467.393 (0.000), employment status 462.348 (0.000), absenteeism 492.754 (0.000), staging of liver disease 1401.616 (0.000), visa rejection/labor mobility 89.754 (0.000), job rejection 183.165 (0.000), rustication/termination of job 250.441(0.000) and selling of assets 125.948(0.000) fall in the critical region of 5% level of significance so the above table established statistically significant relationship of indirect medical cost of hepatitis B and C with treatment history, health care institution, time duration, other complication with hepatitis, co-infection with other viruses, monthly income, employment status , absenteeism, staging of liver disease, visa rejection/labor mobility, Job rejection, rustication / termination of job and selling of assets.

Conclusion: Hepatitis B and C pose significant public health challenges in Pakistan, not only due to their medical consequences but also their profound socioeconomic impacts. This study examines how these chronic infections affect employment status, healthcare expenditures, and the relationship between disease severity and financial burden among patients. This study finds significant effect of viral hepatitis B and C on labor productivity, labor mobility, absenteeism and presentism at work place, family income, mortality and life style in Pakistan. study find significant effect of viral hepatitis B and C on labor productivity, labor mobility, absenteeism and presentism at work place, family income, mortality and life style in Pakistan. This study also originated significant direct relationship between total per month direct medical cost and indirect medical cost at different disease stage. Higher direct medical costs and indirect medical costs were found with advanced disease and vice versa. This study also originated significant direct relationship between total per month direct medical cost and indirect medical cost at different disease stage. Higher direct medical costs and indirect medical costs were found with advanced disease and vice versa. In the initial stage of the disease most of the direct medical costs were associated with diagnostic charges and medical services The mean difference of non-cirrhotic, compensated cirrhotic, decompensated cirrhotic and other complication groups were also found statistically significant different in the estimated direct medical cost per

month group whereas, in group of compensated cirrhotic no statistically significant difference was found with other complications, whereas the decompensated cirrhosis stage a large portion of direct medical costs were related to hospital admission and medication. Findings also indicated that individuals with advanced stages of hepatitis are more likely to face unemployment, reduced productivity, and catastrophic healthcare costs, particularly in low income households. This study also concluded statistically significant relationship of indirect medical cost of hepatitis B and C with treatment history, health care institution, time duration, other complication with hepatitis, co-infection with other viruses, monthly income, employment status , absenteeism, staging of liver disease, visa rejection/labor mobility, Job rejection, rustication / termination of job and selling of assets. The absence of structured support systems exacerbates these challenges, leading to a cycle of poverty and worsening health. The research underscores the urgent need for integrated health and social policies to address the broader consequences of hepatitis B and C in Pakistan.

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