Prevalence and Associated Risk Factors Analysis of Hepatitis B & C Infections in the Low Socioeconomic Communities; A Cross-Sectional Study from Pakistan

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Abstract

Background: Pakistan is bearing the second highest global burden of hepatitis C and B virus, infecting 3-4 % of its overall 22 million population. These infections remain unchecked in most of the cases and such incidences become a continuous source of infection to the healthy population. Maximum efforts for screening, prevalence and surveillance of these viral infections is needed to stem the devastating impact on the underprivileged communities living in the outskirt of major cities.

Methods: This study was designed to determine the prevalence of hepatitis B & C and the corresponding risk factors among the low socioeconomic communities of Islamabad. Participants (aged 10-70 years) were recruited from six localities inhabited with people living in underprivileged conditions. Relationship between hepatitis B/C incidence, demographics and risk factors was measured using Pearson's Chi-square test, univariate and multivariate regression analysis. A total of 1004 individuals were enrolled in this study.

Results: Out of 1004 individuals, almost 4% were found positive for hepatitis C and 1% for hepatitis B after screening with PCR. Pearson's Chi-square test showed a strong relationship of hepatitis B/C infection with marital status (p= 0.000), hepatitis B vaccination status (p= 0.000), blood or blood product recipient (p= 0.000), having a tattoo, family income (p= 0.026) and participant age (p= 0.000). Multivariable analysis showed hepatitis B vaccination odds ratio (OR) =5.309 (95% confidence interval [CI] 2.812-10.025), population exposed to therapeutic injections four-times/past 6 months OR=4.328 (95% CI 1.319-13.617) dental visit four-time/past six months OR=11.9 (95% CI 3.350-40.098) people having exposure to HCV patients ≥6 times/past six months OR=3.095 (95% CI 1.577-6.074) and age of the participants OR=1.049 (95% CI 1.026-1.072) were independently associated with hepatitis C infection.

Conclusions: These findings show that the risk of hepatitis B/C is multifactorial. However, on multivariate analysis, no association was found between hepatitis C incidence and blood donation, blood recipient, nose/ear piercing, barber visit, tattooing, drug abuse, marital status, family income and education status.

1. Introduction

According to WHO estimation, every 1 in 3 people in the world have been infected with either hepatitis B or C. This accounts for about 3.9% (291.9 million) infections due to hepatitis B virus (HBV) and around 2.5% (177.5 million) infections due to hepatitis C virus (HCV)[1, 2]. Every year, 1.4 million people die due to viral hepatitis, of whom 90% of deaths are due to hepatitis B or C [3, 4]. Pakistan is bearing 2nd highest burden of global hepatitis C prevalence with 7.44% population carrying HCV [5]. Around 1.98% of the Pakistani population is having HBV antigen in their blood [6]. The population with chronic HBV or HCV infection is at high risk of developing liver cirrhosis, leading to hepatocellular carcinoma and metabolic disorders and in severe case, it can lead to a life-threatening situation [7].

Several risk factors such as ear/body piercing, intravenous drug abuse, tattoo, blood transfusion, needle stick injury, reuse of syringes, barber visits and dental checkups are reported to be associated with hepatitis B or C infection [8]. Moreover low socioeconomic status and lack of awareness about disease transmission routes also contribute significantly towards the increase in disease incidence [9]. To achieve the WHO target of eliminating 80% of hepatitis C incidence by 2030, each year about 36 million screenings need to be done and 660,000 cases need to be treated annually. Moreover, it would be ensured that 90% of diagnosed cases get treatment [10].

Therefore, findings of the current study proposed to screen the general population of Pakistan at a large scale and ensure the HBV/HCV positive cases get proper treatment. In addition to that, we aim to qualify high-risk factors posing serious threats to a specific population. Furthermore, this study intends to increase the knowledge about disease transmission in the general population, so that new cases could be prevented.

2. Methods

Study design, site and population

This cross-sectional study was conducted in Islamabad, the capital territory of Pakistan. The study population consisted of people belonging to lower socioeconomic status and was less educated in terms of formal education. Six regions consisting of such population were selected at random which included Police line H-11, IGFG church area F-7, G7/1, Iqbal Town, Abpara police station and Sohan near Faizabad. This study was conducted by setting up free awareness and screening camps from August 2018 to April 2019.

Sample size

The sample size was calculated using an online tool (https://www.surveysystem.com/sscalc.htm). Choosing a 95% confidence level and confidence interval of 3, the sample size for this study in Islamabad with the population of 1,095,000 people was calculated as 1066 individuals.

Inclusion and exclusion criteria

Participants having less than 10 years of age and greater than 70 years of age were excluded from the study. Only participants from 10 years to 70 years of age included in the study. Participants having total family income greater than 90,000 PKR were excluded from the study. Only male and female gender were included in the study and participant belonging to the third gender were excluded.

Study instrument and variables

To obtain demographics and information about exposure to risk factors, using previously reported literature[11], a structured questionnaire was developed in the Urdu language. Demographics included age, gender, education, total family income/month, family members living in the same house and marital status. Information about exposure to risk factors such as tattoo, history of drug abuse, history of blood donation or receiving and having a hepatitis B/C positive family member was recorded as yes or no. History of nose/ear piercing was recorded as none, one time, two times and three or more. Response to barber visit, exposure to injection, exposure to hepatitis B/C positive patient and dental checkup were recorded as none, one time, two times, three times, four times and six or more times per last six months.

The questionnaires were distributed among the camp participants. Those participants who could not read and write recorded their response by dictating it to camp volunteers. We got n = 1040 questionnaires back, out of which n = 33 was incomplete and hence excluded from the study. Those cases n = 3 which were positive for HCV antibodies but did not have detectable HCV RNA were also excluded from the study. Hence total n = 1004 cases were included in the current study.

Screening of HCV antibodies and HBV antigens

One-step rapid test kits (HEALGEN) were used for the detection of anti HCV antibodies and hepatitis B virus surface antigen (HBsAg) using whole blood. Positive samples were run in duplicate and sample showing a positive result for the second time were reported as positive samples.

Confirmation of positive samples

Serum of people reported positive with one step rapid test kit was subjected to qualitative PCR using SaCycler-96 (Sacace-Italy) for the confirmation of HBV DNA and HCV RNA.

Data Analysis

The data of the current study was analyzed using SPSS 22. The demographics and exposure to risk factors are presented as frequencies and percentages. Comparison of the study variables was assessed by using Pearson's Chi-square test. For potential risk factors, by using univariate binomial logistic regression, crude odds ratios (OR) and 95% confidence intervals were determined to take HCV status as a dependent variable. All variables showing p-value < 0.05 in univariate binomial logistic regression were subjected to multivariable binomial logistic regression analysis. This model further assessed for the presence of multicollinearity and interaction between independent variables. Hosmer–Lemeshow goodness-of-fit test was used to examine the model fit.

3. Results

In total n = 1004 samples were collected from six different areas of Islamabad and area-wise distribution of these samples is given in Fig. 1.

Out of the total, n = 727 (73%) population was having ≤ 10 years of education. A significant relationship was observed between education status and gender ($\chi2 = 22.93$, $p = 0.000$). Similarly, there was a significant relation present in gender and history of drug abuse ($\chi2 = 15.09$, $p = 0.000$) given that 39/42 (93%) drug abusers were male. Moreover, a significant relationship was observed between gender and nose/ear piercing ($\chi2 = 690.19$, $p = 0.000$) given that 20/315 (6%) participants having at least one nose or ear piercing were male. In addition to that gender and presence of tattoo also have a significant relationship ($\chi2 = 5.42$, $p = 0.013$) as 14/15 (93%) participants having tattoo were male. The detailed breakdown of the questionnaire is given in Table. 1.

Pearson's Chi-square test was calculated among the status of hepatitis and other study variables. This test shows a strong relationship between hepatitis B or C infection and marital status, hepatitis B vaccination status, blood or blood product recipient, having a tattoo, total family income and age of the participant. However, there was no significant association was observed between the status of hepatitis and nose/ear piercing, education status, barber visit, blood donation and drug abuse. Significant relationship of the status of hepatitis and other study variables are given in Table 2.

Table 1
Demographic characteristics and exposure to risk factors of the study population

Variable	Value	n	%
Area			
	Police line, H-11	340	33.9
	Iqbal Town	195	19.4
	Abpara Police Station	123	12.3
	F-7	104	10.4
	G-7/1	128	12.7
	Sohan,Faizabad	114	11.4
Total family income/ Month			
	≤ 10000	10	1.0
	11–20 k	316	31.5
	21–30 k	194	19.3
	31–40 k	140	13.9
	41–50 k	198	19.7
	51–60 k	76	7.6
	> 60000	70	7.0
Gender			
	Male	651	64.8
	Female	353	35.2
Marital Status			
	Unmarried	308	30.7
	Married	696	69.3
Education			
	primary or less	353	35.2
	middle	117	11.7
	Matric	257	25.6
	Intermediate	135	13.4
	Bachelors	102	10.2
	Masters	40	4.0
Family Members			
	two	13	1.3
	three	40	4.0
	four	106	10.6
	five	169	16.8
	six	232	23.1
	≥ seven	443	44.1
Hep B vaccination status			
	not vaccinated	824	82.1
	vaccinated	180	17.9
Hepatitis B/C positive family member			
	Present	52	5.17

Variable	Value	n	%
	Absent	952	94.8
Nose ear piercing			
	None	689	68.6
	One time	213	21.2
	two times	72	7.2
	≥ three times	30	3.0
Tattoo			
	Absent	989	98.5
	Present	15	1.5
Drug abuser			
	no	962	95.8
	yes	42	4.2
Blood recipient			
	No	979	97.5
	Yes	25	2.5
Blood donor			
	No	869	86.6
	Yes	135	13.4
Injection exposure/ Last six months			
	one time	4	.4
	two times	8	.8
	three times	9	.9
	four times	5	.5
	≥ six times	153	15.2
Dental checkup/ Last six months			
	none	704	70.1
	one time	192	19.1
	two times	65	6.5
	three times	19	1.9
	four times	13	1.3
	≥ six times	11	1.1
Barber visit/ Last six months			
	none	410	40.8
	one time	64	6.4
	two times	45	4.5
	three times	35	3.5
	four times	23	2.3
	≥ six times	427	42.5
Exposure to hepatitis B/C patient / Last six months			
	none	825	82.2
	one time	4	.4
	two times	8	.8

Variable	Value	n	%
	three times	9	.9
	four times	5	.5
	≥ six times	153	15.2
Status of hepatitis B/C			
	both negative	956	95.2
	C positive	41	4.1
	B positive	7	.7
Information about routes of hepatitis B/C transmission			
	Nose/ear piercing	295	29.3
	Blood	466	46.4
	Sexual contact	233	23.2
	Use of personal item	711	70.8
	Touching and handshake	102	10.1
	Sharing utensils with hepatitis patient	327	32.6
	Water	556	55.4
	Barber	677	67.4
	Mother to child	121	12.1
	Breathing in the air near hepatitis patient	52	5.2
	Dentist	166	15.5
	Eating specific food	609	60.7

Univariate binomial logistic regression test was performed to assess the risk factors for hepatitis C. Five variables having *p* value less than 0.05 overall or at least one of their categories were subjected to multivariable analysis. This analysis shows hepatitis B vaccination $p = 0.000$ odd ratio (OR) = 5.309 (95% confidence interval [CI] 2.812–10.025) as a strong predictor for hepatitis C infection. Compared with those without injection exposure population exposed to four-time to injection in the past 6 months were most likely to have HCV infection $p = 0.015$ OR = 4.328 (95% CI 1.319–13.617). Similarly, the population is more prone towards HCV infection who have visited a dentist four times in past six months $p = 0.000$ OR = 11.9 (95% CI 3.350-40.098) than those who have not visited a dentist at all. Moreover, people having frequent exposure to HCV patients ≥ 6 times during past six months were more susceptible towards HCV infection $p = .001$OR = 3.095 (95% CI 1.577–6.074) in comparison to those who have not exposed to HCV patients. Age of the participants proved to be a strong predictor of HCV infection $p = .000$ OR = 1.049 (95% CI 1.026–1.072). For multilinguistic binomial logistic regression analysis $\chi 2 = 73.635$, $p = .000$ and Hosmer–Lemeshow goodness-of-fit test was recorded as $p = 0.6$. Table 3 shows a detailed analysis of risk factors for hepatitis C infection.

Table 2
Pearson's Chi-square test among study variables

		Negative for both	Hepatitis C positive	Hepatitis B Positive	χ2	*p* value
Status of hepatitis B vaccination	Vaccinated	159	21	0	33.505	0.000**
	Not Vaccinated	797	20	7		
Blood or Blood Product recipient	Recipient	20	3	2	24.16	0.000**
	Not recipient	936	38	5		
Marital Status	Married	649	41	6	19.955	0.000**
	Not married	307	0	1		
Tattoo	Absent	942	41	6	8.41	0.015*
	present	14	0	1		
Total family income/month	≤ 10000	10	0	0	23.16	0.026*
	11–20 k	305	10	1		
	21–30 k	182	10	2		
	31–40 k	135	3	2		
	41–50	190	6	2		
	51–60	66	10	0		
	> 60 k	68	2	0		
Age	10–15	110	0	0	60.11	0.000**
	16–20	73	0	0		
	21–25	132	0	3		
	26–30	83	1	0		
	31–35	98	5	0		
	36–40	84	6	0		
	41–45	81	1	2		
	46–50	128	11	1		
	51–55	88	4	1		
	56–60	48	8	0		
	61–65	15	3	0		
	66–70	16	2	0		

χ2 = Pearson's Chi-square, * = $p < 0.05$, **= p

Table 3
Univariate and Multivariate binomial logistic regression of risk factors for hepatitis C

	Univariate analysis						Multivariate analysis					
Predictors					95% C.I.						95% C.I.	
	B	S.E.	Sig.	OR	Lower	Upper	B	S.E.	Sig.	OR	Lower	Upper
Vaccination for hepatitis B	1.787	0.364	0.000**	5.970	2.927	12.178	1.669	0.324	0.000**	5.309	2.812	10.025
Dental Checkup/last 6 months			0.337						0.002**			
one time	-0.322	0.534	0.547	0.725	0.255	2.065	-0.361	0.495	0.467	0.697	0.264	1.841
two times	0.128	0.609	0.834	1.136	0.344	3.748	0.536	0.553	0.332	1.710	0.578	5.059
three times	0.171	0.872	0.845	1.186	0.215	6.558	1.121	0.774	0.147	3.068	0.673	13.980
four times	1.663	0.748	0.026*	5.274	1.216	22.869	2.450	0.633	0.000**	11.590	3.350	40.098
≥ six times	-18.582	11104.333	0.999	0.000	0.000		-17.942	12118.636	0.999	0.000	0.000	
Injection Exposure/last 6 months			0.165						0.134			
one time	0.637	0.522	0.222	1.892	0.681	5.258	0.206	0.467	0.659	1.229	0.492	3.066
two times	-0.016	0.681	0.982	0.985	0.259	3.739	0.006	0.572	0.992	1.006	0.328	3.087
three times	-0.194	0.682	0.776	0.824	0.216	3.136	-0.065	0.642	0.919	0.937	0.266	3.300
four times	1.649	0.674	0.014*	5.202	1.388	19.502	1.444	0.596	0.015*	4.238	1.319	13.617
≥ six times	0.542	0.507	0.285	1.719	0.636	4.648	0.787	0.451	0.081	2.198	0.908	5.316
Hepatitis B,C Patient Exposure/6months			0.334						0.037*			
one time	-17.224	19840.962	0.999	0.000	0.000		-17.778	20096.485	0.999	0.000	0.000	
two times	2.312	1.130	0.041*	10.090	1.101	92.466	1.479	1.087	0.174	4.390	0.521	36.993
three times	-17.669	12849.654	0.999	0.000	0.000		-17.778	13397.657	0.999	0.000	0.000	
four times	-18.510	17064.818	0.999	0.000	0.000		-17.778	17974.843	0.999	0.000	0.000	
≥ six times	0.553	0.408	0.176	1.738	0.781	3.866	1.130	0.344	0.001**	3.095	1.577	6.074
Age	0.048	0.012	0.000**	1.049	1.025	1.074	0.047	0.011	0.000**	1.049	1.026	1.072
* = $p < 0.05$, **= $p <$												

4. Discussion

Hepatitis c is a global health problem and a major cause of liver transplant around the globe [12] while hepatitis B is still a life-threatening disease in developing countries associated with high morbidity and mortality rate [13]. Thus, it is very important to find the risk factors associated with disease transmission, vaccination status, early diagnosis and treatment [14].

To measure the incidence rate and assessing the risk factors associated with hepatitis B/C infection, the current study was conducted. The Present study reports 4% HCV prevalence and 1% HBV prevalence in less educated population with the lower socioeconomic status of the federal capital Islamabad. Satti et al and Khokhar et al reported a similar result regarding HCV prevalence [15, 16]. This study reports a quite low prevalence of hepatitis B than overall national HBV prevalence (2.5%) as reported by Mehmood et al.[6]. Due to less exposure to risk factors, the current study population may have a relatively low prevalence of HBV than the overall prevalence in Pakistan. This study reports a relatively high prevalence of hepatitis C in male (5%) than female (3%). This study is in line with the study of Arshad, Arshad et al who reported 4.5% prevalence in male and 2% in female [17]. ul Huda et al and Akhtar et al Higher also reported higher HCV prevalence in male than female ul Huda, Jameel [18], [19]. High prevalence in male is attributed to social mobility and freedom, exposing male to risk factors more than female. In current study, strong gender biases were observed in nose ear piercing ($\chi2 = 690.19$, $p = 0.000$), tattooing ($\chi2 = 5.42$, $p = 0.013$) and history of drug abuse ($\chi2 = 15.09$, $p = 0.000$). Related observations were previously reported by Yee et al. They reported 64.8% male and 23.3% female were found to be drug abuser, 20.5% male and 91.7% female underwent body/ear piercing, 20.5% male and11.7% were having tattoo [20]. Such discrepancies in the two studies are due to cultural norms and social trends as both studies are conducted in two different regions.

In terms of Pearson's Chi-square test, the present study reports a significant association of hepatitis B/C infection with marital status and low socioeconomic status both having $p = .000$. Results closer to the current study were previously reported by Akhtar et al [21] given that HCV infection and marital status had $p = .007$ and socioeconomic status $p = .000$. These findings were also supported by Qureshi et al [22]. The married population is more vulnerable to risk factors such as sexual transmission and low socioeconomic status is associated with a high risk of exposure, less awareness about transmission routes and more liable to quack visit and unhealthy practices such as sharing of personal items.

This study reports a high association between hepatitis B/C infection and recipients of blood or blood products $p = .000$ which is in accordance with the results of Ejiofor et al, Adeyemi et al and Chakrabarty et al [23–25]. This association attributes to negligence or poor practices including the use of screening devices with low sensitivity in blood banks. Moreover, we observed a strong association between hepatitis B, C infection and tattooing in Chi-Square $p = .015$ but having tattoo was not proven to be a strong predictor of hepatitis C infection in univariate analysis. Thome & Homeberg, Jafri et al and Carney et al reported similar result $p < .001$ [13] but the only difference is that in there study having a tattoo is a strong predictor for HCV and HBV infection [26–28]. Most of the literature is equivocal regarding tattooing and hepatitis B/C infection. It is due to variability in the study population. Moreover, in the current study overall prevalence of population with a tattoo was quite low. Chi square analysis shows significant association of hepatitis B, C infection $p = .000$ with age Ziaee et al and Gacche & Al-Mohani reported likewise results $p = .015$ and $p < .001$ respectively [29, 30]. This association depicts that with age, exposure to risk factor increases resulting in more infections in elderly age than in young age.

Multivariate logistic regression computed hepatitis B vaccination as a strong predictor (0R = 5.309, 95% C1 2.812–10.025) for hepatitis C infection. Al Humayed reported having not vaccinated against hepatitis B is independently associated with seropositivity of hepatitis B. (0R = 6.852, 95% C1 1.614–9.092) [31]. This could be since patients with hepatitis C may have been exposed to both HBV and HCV, but hepatitis B vaccination helped him from developing HBV infection. Another reason could be that upon their physician's advice, patients after diagnosis with hepatitis C may have got themselves vaccinated against hepatitis B. Schillie et al supported these assumptions [32]. The current study reports exposure to a syringe as a potential risk factor of developing hepatitis C infection (OR = 4.238, 95% CI 1.319–13.617) which is in accordance with the findings of Pereira et al (OR = 1.67, 95% CI 1.09–2.56) [33]. In Pakistan reuse of syringes is a common practice especially people visiting quacks or clinics working in the low socioeconomic locality. Such practices are the reason for the association of exposure to therapeutic injections and hepatitis. We report dental checkup as a strong predictor of HCV infection (OR = 11.59, 95% CI 3.35–40.098) which is aligning with the reporting of Pracoyo et al (OR = 2.26, 95% CI 0.98–5.2) [34]. This could be resulted due to the use of unsterilized dental equipment. The present study reports exposure to a hepatitis C patient could lead to HCV infection (OR = 3.095, 95% CI 1.577–6.074). This finding supports the intrafamilial transmission of HCV in Pakistan since most of the participants were exposed to HCV patients in their homes. These findings are comparable with Omar et al (OR = 4.3, 95% CI 1.3–14.5) [35]. Such transmission is possible due to the sharing of personal items such as nail cutter, toothbrush and razors since such practices are common in our study population given that low socioeconomic status. In multivariate model current study implicates age as a strong predictor of hepatitis C infection (OR = 1.049, 95% CI 1.026–1.072) which agrees with the finding of Xu et al (OR = 2.78, 95% CI 2.35–3.95) [36].

5. Conclusions

In this study, the hepatitis C prevalence was found to be 4% while hepatitis B was about 1%. It is thought that people belonging to low socioeconomic status are more prone to develop these infections given that less access to better health care facilities. This study reports that people belonging to the low socioeconomic class in the region of Islamabad have less prevalence of hepatitis C and B give that low exposure rate to risk factors. Exposure to dental clinics, therapeutic injections and hepatitis B/C patients along with age were found to be the strong predictor of hepatitis C. Overall the study population was not aware of the mode of transmission of hepatitis B/C. A targeted screening and vaccination approach could help to reduce the incidence rate and educating the public about transmission routes will further help to control the spread of such infections.

6. Abbreviations

Abbreviation	Stands for
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HBsAg	hepatitis B virus surface antigen
OR	Odds ratio
PCR	Polymerase chain reaction
CI	confidence interval

7. Declarations

-Ethics approval and consent to participate

The proforma used was approved by the IRB committee at ASAB, NUST. Participants were well informed about the research work and the information to be published later.

-Studies involving animals must include a statement on ethics approval.
Not applicable

-Consent to publication
Participants were well informed about the research work and the information to be published later.

- Availability of data and material
The data available is already shared in this manuscript. We don't have any other data to share.

- Competing interests
Not applicable

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- Authors' contributions
This work was designed, conducted, and written by AN and FA. NA, ZS, AA, and FS helped in virus sequence analysis via various web tools and evaluated the manuscript. SN, SJK and TA helped in statistical analysis and final editing of the manuscript.

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Figures

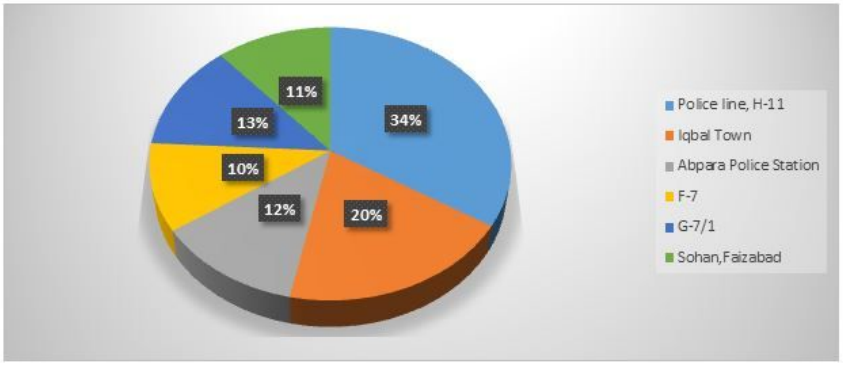

Figure 1

Area wise distribution of samples collected from different locations in Islamabad.

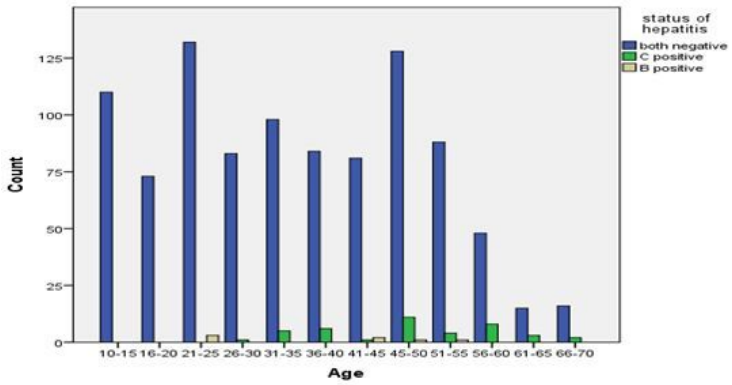

Figure 2

Age-wise comparison of hepatitis B and C positive cases