

## Hepatitis C in Pakistan: A Review of Available Data

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**Hepatitis C virus (HCV) infection is increasingly recognized as a major health care problem, and is found frequently in Pakistani settings. In this article we reviewed published and unpublished data related to the seroepidemiology of HCV infection in Pakistan. For this article, data from 132 published studies and three unpublished data sets published/presented between the period 1992-2008 were utilized. Data of 1,183,329 individuals were gathered. Blood donors (982,481) and the general population (178,322) constituted the majority of these subjects. The frequency of HCV infection in blood donors and in the general population was 3.0 % (95% CI: 3.0- 3.1) and 4.7 (95% CI: 4.6 -4.8), respectively. The frequency among 6,148 pregnant females was 7.3% (95% CI = 6.7 – 8.0). The frequency in healthy children ranged from 0.4 to 4.1% (95% CI = 1.4 – 2.3). Pakistani HCV serofrequency figures are significantly higher ( $P < 0.0001$ ) compared to those of the corresponding populations in surrounding countries like India, Nepal, Myanmar, Iran and Afghanistan.**

**Keywords:** Hepatitis C Virus, Anti-HCV, Pakistan, Serofrequency

### Introduction

The World Health Organization (WHO) has compared hepatitis C to a “viral time bomb” and estimates that about 180 million people (some 3% of the world’s population) are infected with hepatitis C virus (HCV), 130 million of whom are chronic carriers at risk of developing liver cirrhosis and/or liver cancer. Three to four million persons are newly infected each year, 70% of whom will develop chronic hepatitis. HCV is responsible for 50–76% of all liver cancer cases, and two thirds of all liver transplants in the developed world <sup>(1)</sup>. World Health Statistics 2008 lists cirrhosis of the liver as the 18<sup>th</sup> commonest cause of mortality in the world, and it is estimated that by 2030, liver cancer will become the 13<sup>th</sup> commonest cause <sup>(2)</sup>.

The prevalence of hepatitis varies from country to country, and at times it will also vary among different regions of the same country. The epidemiological estimates by WHO show that the prevalence of hepatitis C is low (< 1%) in Australia, Canada and northern Europe, and about 1% in countries of

medium endemicity, such as the USA and most of Europe. It is high (>2%) in many countries of Africa, Latin America, Central and South-East Asia. In these countries, prevalence figures between 5% and 10% are frequently reported <sup>(1)</sup>.

Collecting and comparing health data from across a country is a way to describe health problems, identify trends and help decision-makers set priorities. The global epidemiology of hepatitis C is well established. However, its epidemiology in Pakistan is ill-defined.

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Most of the data have come from hospital-based studies, because there is a dearth of community-based ones (3-5). Although the National Survey of Hepatitis has concluded, its results have not yet been officially published, except for a few presentations made by researchers at official meetings. This review summarizes the available data on the epidemiology of hepatitis C since the first report of its recognition in 1992.

## HCV-Related Pakistani Data

All available Pakistani data published or unpublished till the writing of this article were collected by a literature search through electronic databases like Pubmed, Pakmedinet, Yahoo and Google *etc.* Unpublished data from any source, if accessible, were also reviewed. Data from 132 published studies and 3 unpublished data sets were gathered and grouped in six categories, based on the type of population studied *i.e.* 1) general population, 2) blood donors, 3) patients with liver diseases, 4) patients with diseases other than hepatic diseases, 5) pregnant women and 6) children. Most of the data (78.5%) pertained to the years 2001-2008. Year by year distribution of this data is given in Table 1.

**Table 1.** Distribution of studies and unpublished data sets by year of publication/data gathering/presentation.

Year	Number	Percent
2005 – 2008	47	34.8
2001 – 2004	59	43.7
1996 - 2000	20	14.8
1995 and earlier.	9	6.7
<b>Total</b>	<b>135</b>	<b>100.0</b>

## General Population

Twenty-five studies (6-30) pertained to the serofrequency of hepatitis C in the general population. Details are given in Table 2. The majority of these studies (92%) were conducted during the period 2000-2008. Two studies were conducted in the nineties (6, 7). The data of 178,322 persons were included in this group. Unfortunately, there was no study from any major city of Balochistan, or from the NWFP provinces. The frequency of HCV infection ranged from 0.4% in Karachi (6) to 33.7% in Jarwar (Sindh) (28). The mean frequency was 4.7% (95% confidence interval [CI]: 4.6 - 4.8).

**Table 2.** Sero-Prevalence of HCV in General Population

Author	Year	Place	Number	Anti HCV (%)	Reference
Agboatwala <i>et al.</i>	1994	Karachi	258	0.4	(6)
Luby	1997	Hafizabad	313	6.5	(7)
Aslam	2001	Lahore	488	16.0	(8)
Aslam	2001	Gujranwala	1,922	23.8	(8)
Ali <i>et al.</i>	2002	Rawalpindi	5,370	3.3	(9)
Khan	2004	Mardan	700	9.0	(10)
Khokhar	2004	Islamabad	47,538	5.3	(11)
Muhammad	2005	Buner	16,400	4.6	(12)
Farooq <i>et al.</i>	2005	Khuzdar	665	3.3	(13)
Hashim <i>et al.</i>	2005	Attock	4,552	4.0	(14)
Ahmad	2006	Swat	41,613	2.2	(15)
Fayyaz <i>et al.</i>	2006	Bahawalpur	2,086	6.3	(16)
Tariq & Janjua	2006	Rawalpindi	15,550	3.7	(17)
Jafri <i>et al.</i>	2006	Karachi	3,533	1.6	(18)
Sherif & Tariq	2006	Rawalpindi	2,558	2.8	(19)
Zaman	2006	Bahawalpur	6,815	4.4	(30)
Ahmad <i>et al.</i>	2007	Faisalabad	300	16.0	(20)
Altaf <i>et al.</i>	2007	Hyderabad	2,835	5.2	(21)
Mirza <i>et al.</i>	2007	Bahawalpur	1821	2.5	(22)
Malik <i>et al.</i>	2008	Pannu Aqil	5,237	4.8	(23)
Hakim <i>et al.</i>	2007	Karachi	4,000	5.2	(24)
Butt & Amin	2008	DI Khan	5,707	1.7	(25)
Khan <i>et al.</i>	2008	Azad Kashmir	245	3.3	(26)
Idrees <i>et al.</i>	2008	Lahore	6,817	14.6	(27)
Abbas <i>et al.</i>	2008	Jarwar (Sindh)	873	33.7	(28)
Alam <i>et al.</i>	2008	Mianwali	697	1.9	(29)
<b>Total</b>			<b>178,322</b>	<b>4.7 (95% CI: 4.6-4.8)</b>	<b>(63)</b>

## Blood Donors

Blood donor data constituted the largest data set. There were 27 studies and 3 unpublished data sets in this group. The total population covered in this group was 982,481 over the period 1996-2008 (Table 3). The studies covered all provinces of Pakistan. The serofrequency of HCV ranged from 0.3% in Multan (31) to 12.5% in Islamabad (32). The mean frequency was 3.0% (95% CI: 3.0- 3.1). Only five studies (29, 32-35) showed a frequency of > 5%.

## Patients with Liver Diseases

Forty-one studies (36-68) dealing with the frequency of hepatitis C among patients with liver diseases were found, covering 7,765 patients over a period of 27 years from 1992 to 2008 (Table 4, and 5). Liver diseases included cirrhosis, chronic liver disease, chronic active hepatitis and hepatocellular carcinoma.

Fourteen studies (37-50) pertained to cirrhosis patients. The number of individuals included in these studies was 1,902. HCV serofrequency in these individuals ranged from 10.5-79.6%, with

**Table 3.** Sero-prevalence of HCV in Blood Donors.

Author	Year	Place	Number	Anti HCV (%)	Reference
Takepoto <i>et al.</i>	1996	Karachi	16,705	1.2	(103)
Bhatti <i>et al.</i>	1996	Rawalpindi	760	4.8	(104)
Lone <i>et al.</i>	1999	Lahore	186	4.3	(105)
Mujeeb	2000	Karachi	612	0.5	(106)
Tanwani & Ahmad	2000	Islamabad	1,345	12.5	(32)
DBTU	2001 UP	Rawalpindi	20,500	5.0	(99)
PBTS	2001 UP	Lahore	120,000	2.3	(99)
Adridi	2001 UP	Peshawar	19,000	4.0	(99)
Ryas <i>et al.</i>	2001	Rawalpindi	1,885	4.7	(107)
Ahmed <i>et al.</i>	2001	Karachi	1,410	4.4	(108)
Ahmad <i>et al.</i>	2002	Lahore	5,789	4.9	(109)
Khattak <i>et al.</i>	2002	Rawalpindi	103,858	4.0	(110)
Fayyaz <i>et al.</i>	2002	Bahawalpur	345	5.6	(33)
Mumtaz <i>et al.</i>	2002	Rawalpindi	553	6.2	(34)
Rahman <i>et al.</i>	2002	Lahore	166,183	4.4	(111)
Ali <i>et al.</i>	2003	Quetta	1635	1.8	(112)
Akhtar <i>et al.</i>	2004	Karachi	351,309	1.8	(113)
Ahmad <i>et al.</i>	2004	Peshawar	4,000	2.2	(114)
Mahmood <i>et al.</i>	2004	Multan	6,000	0.3	(31)
Sirhindi	2006	Lahore	18,216	4.2	(115)
Aziz	2006	Skardu	850	1.1	(116)
Khan	2006	Bahawalpur	27,938	2.5	(117)
Ujjan <i>et al.</i>	2006	Hyderabad	3,677	6.7	(35)
Mujeeb <i>et al.</i>	2006	Karachi	7,325	3.6	(118)
Chaudhary	2007	Rawalpindi	1,428	2.5	(119)
Alam & Naeem	2007	Gilgit	8,949	1.3	(120)
Ishaq <i>et al.</i>	2007	Thatta	310	1.3	(121)
Bhatti <i>et al.</i>	2007	Karachi	94,177	4.2	(122)
Khattak <i>et al.</i>	2008	Peshawar	1,131	4.1	(123)
Mujeeb & Pearce	2008	Karachi	5,345	7.5	(124)
<b>Total</b>			<b>982,481</b>	<b>3.03 (95% CI: 3.0- 3.1)</b>	

an overall prevalence of 44.9% (95% CI = 42.6 – 47.2). Eleven studies (39, 51-59, 69) covering 3,144 patients with chronic liver disease showed a range of 13.3% to 86.0% HCV serofrequency. The mean frequency was 52.9% (95% CI: 51.1-54.7).

In 10 studies (36, 39, 40, 42, 60-65) The HCV serofrequency in 739 cases of hepatocellular carcinoma was investigated (Table 5), and it ranged from 24% to 67.9%. The mean frequency in this subgroup was 50.6% (95% CI : 46.9–54.3). One thousand nine hundred and eighty patients with acute/chronic hepatitis from 6 studies had 58.2% (95% CI : 55.7–60.4) HCV serofrequency (46, 51, 57, 66-68).

### Patients with Diseases Other than Hepatic Diseases

Sixteen studies focused on HCV serofrequency in patients with various diseases other than liver diseases (Table 6) (10, 70-85). These studies spanned a period of 8 years, from 1999 to 2006, and covered major cities. The mean frequency of HCV infection in patients

with various medical diseases was 20.4% (95% CI : 18.4-22.5), 38% in haematological diseases (95% CI : 33.6-42.5), 7.9% among surgical diseases (95% CI : 6.9 – 9.0), and 1.3% in dental diseases.

### Pregnant Women

Eleven studies (86-96) dealing with the serofrequency of HCV among pregnant women were found (Table 7). These studies spanned a period of 13 years from 1996 to 2008 and covered 6,148 women. The frequency in this group ranged from 3.3% to 29.1%. Overall serofrequency in this group was 7.3% (95% CI = 6.7 – 8.0).

### Children

Data from four studies (18, 86, 97, 98) covering 4,472 healthy children were analyzed (Table 8). HCV serofrequency among children ranged from 0.4% to

Table 4. Sero-Prevalence of HCV in Liver Disease.

Author	Year	Place	Number	Anti HCV (%)	Reference
<b>Cirrhosis</b>					
Malik	1992	Northern Areas	24	13.3	(38)
Malik	1995	Rawalpindi	220	48.0	(39)
Makki	1995	Karachi	67	10.5	(40)
Hussain	1998	Lahore	50	52.0	(14)
Farooqi & Farooqi	1998	Peshawar	410	43.9	(42)
Umar <i>et al.</i>	1999	Rawalpindi	120	58.0	(43)
Mahmood <i>et al.</i>	1999	Karachi	202	37.7	(44)
Liaqat	2000	Karachi	250	43.0	(45)
Shah <i>et al.</i>	2002	Islamabad	108	79.6	(46)
Iqbal	2002	Peshawar	100	41.0	(47)
Khan	2002	Lahore	94	68.0	(56)
Farooqi & Kahan	2002	Swat	55	59.0	(49)
Khurram	2003	Rawalpindi	142	34.1	(50)
Mashud <i>et al.</i>	2004	DI Khan	60	13.3	(125)
<b>Total</b>			<b>1902</b>	<b>44.9 (95% CI = 42.6 – 47.2)</b>	
<b>Chronic Liver Disease</b>					
Malik	1995	Rawalpindi	45	13.3	(39)
Tong <i>et al.</i>	1996	Rawalpindi	105	22.0	(52)
Sultana <i>et al.</i>	2000	Islamabad	108	29.6	(53)
Younas <i>et al.</i>	2001	Lahore	100	65.0	(94)
Tahir <i>et al.</i>	2001	Lahore	104	43.3	(55)
Khan <i>et al.</i>	2001	Islamabad	323	28.7	(56)
Khokhar	2002	Islamabad	354	86.0	(51)
Khan	2003	Hazara	614	40.8	(57)
Shaikh	2003	Larkana	1,074	51.0	(69)
Bakhtiar <i>et al.</i>	2003	Rawalpindi	97	68.1	(58)
Wazir <i>et al.</i>	2003	Hyderabad	510	59.0	(59)
<b>Total</b>			<b>3144</b>	<b>52.9 ( 95% CI : 51.1 – 54.7)</b>	

Table 5. Sero-Prevalence of HCV in Hepato-cellular Carcinoma and Acute/Chronic Hepatitis.

Author	Year	Place	Number	Anti HCV (%)	Reference
<b>Hepato cellular Carcinoma</b>					
Makki	1991	Karachi	25	24.0	(40)
Malik	1995	Rawalpindi	64	25.0	(39)
Mujeeb <i>et al.</i>	1997	Karachi	54	33.0	(60)
Farooqi & Farooqi	2000	Peshawar	56	67.9	(42)
Mumtaz <i>et al.</i>	2001	Rawalpindi	44	54.0	(61)
Khokhar <i>et al.</i>	2003	Islamabad	67	67.0	(72)
Siddiqui	2005	Karachi	100	43.0	(36)
Bilal	2006	Faisalabad	100	66.4	(74)
Almani <i>et al.</i>	2008	Hyderabad	100	52.0	(64)
Abbas <i>et al.</i>	2008	Karachi	129	51.2	(65)
<b>Total</b>			<b>739</b>	<b>50.6 (95% CI =46.9 – 54.3)</b>	
<b>Acute /Chronic Hepatitis</b>					
Haider <i>et al.</i>	1994	Lahore	94	6.4	(79)
Umer	1999	Rawalpindi	710	70.0	(67)
Almani <i>et al.</i>	2002	Jamshoro	100	9.0	(112)
Khokhar	2002	Islamabad	354	86.0	(51)
Shah <i>et al.</i>	2002	Islamabad	108	79.6	(115)
Khan <i>et al.</i>	2003	Abbotabad	614	40.8	(57)
<b>Total</b>			<b>1980</b>	<b>58.2 (95% CI =55.9 – 60.4)</b>	

**Table 6.** Seroprevalence among patients of diseases other than Liver Disease.

Author	Year	Place	Disease	Number	Anti HCV (%)	Reference
<b>Medical Diseases</b>						
Khan	2004	Mardan	General	700	9.0	(10)
Mumtaz & Aftab	2005	Rawalpindi	General	264	28.6	(70)
Gul & Iqbal	2003	Lahore	Renal Failure	50	68.0	(71)
Khokar <i>et al.</i>	2005	Islamabad	Renal Failure	97	23.7	(72)
Qazi <i>et al.</i>	2004	Bahawalpur	Diabetes 2	250	27.6	(73)
Bilwani <i>et al.</i>	2004	Karachi	Lymphoprolifative	143	29.2	(89)
<b>Total</b>				<b>1504</b>	<b>20.4 (95% CI = 18.4-22.5)</b>	
<b>Haematological Diseases</b>						
Moatter <i>et al.</i>	1999	Karachi	$\beta$ -Thalassemia	100	35.0	(106)
Muhammad J	2003	Peshawar (Thalassemia)	$\beta$ -Thalassemia	80	36.2	(126)
Younus <i>et al.</i>	2004	Islamabad	$\beta$ -Thalassemia	75	42.0	(94)
Burki <i>et al.</i>	2005	Islamabad	$\beta$ -Thalassemia	180	41.7	(74)
Hussain	2001	Peshawar	Haemophillia	40	25.0	(14)
<b>Total</b>				<b>475</b>	<b>38 (95% CI = 33.6-42.5)</b>	
<b>Psychological Diseases</b>						
Shah & Dar	2004	Islamabad	Depression	135	22.9	(80)
<b>Surgical Diseases</b>						
Hussain & Fatima	2005	Karachi	Surgical Diseases	750	16.2	(81)
Talpur <i>et al.</i>	2006	Nawabshah	Surgical Diseases	180	11.9	(82)
Khan <i>et al.</i>	2007	Abbottabad	Orthopaedic Diseases	1630	3.1	(83)
Daudpota & Soomro	2008	Jacobabad	Surgical Diseases	150	14.0	(84)
<b>Total</b>				<b>2710</b>	<b>7.9 (95% CI = 6.9-9.0)</b>	
<b>Dental Diseases</b>						
Khitab <i>et al.</i>	2005	Peshawar	Dental Diseases Diseases	1,498	1.3	(85)

**Table 7.** Seroprevalence among Pregnant women.

Author	Year	Place	Number	Anti HCV (%)	Reference
<b>Pregnant Women</b>					
Khan	1996	Lahore	417	9.3	(56)
Parker	1999	Lahore	417	4.0	(90)
Zafar <i>et al.</i>	2001	Lahore	300	6.0	(88)
Bilal	2002	Peshawar	352	5.1	(74)
Rizvi	2002	Karachi	120	6.6	(80)
Fayyaz	2004	Lahore	100	7.0	(91)
Khokar <i>et al.</i>	2004	Islamabad	503	4.8	(92)
Jaffery	2005	Islamabad	947	3.3	(93)
Yousafani <i>et al.</i>	2006	Hyderabad	103	29.1	(94)
Hakeem <i>et al.</i>	2006	RY Khan	450	18.2	(41)
Batool <i>et al.</i>	2008	Lahore	2,439	7.3	(99)
<b>Total</b>			<b>6,148</b>	<b>7.3 (95% CI = 6.7 – 8.0)</b>	

36.25%. The mean frequency was 1.8% (95% CI = 4.6 – 7.5). One study from Lahore in 1996 reported a 4.1% perinatal transmission of HCV in children of HCV- positive mothers. The serofrequency of HCV in thalassemics, and hemophiliacs was 35-42% (75-78) and 25% (79), respectively.

## Discussion

Many researchers have tried to derive a national

or regional figure for HCV serofrequency based on the available data (99-101). In 2005, Umar M and Khaar HTB (99), from Rawalpindi, collected data from various studies and reported a 9.8% frequency in 79,192 individuals. In 2006, Hafeez (99), from Islamabad, collected data from 98 studies and produced an estimate of 5.3%. Raja and Janjua (101), from Essex (UK), analyzed studies available on Medline from 1970 to 2005, and observed that the prevalence of HCV infection ranges from 0.4% in children, to 1.2% in healthy blood donors. Ali *et al.*

**Table 8.** Seroprevalence among Healthy Children.

Author	Year	Place	Number	Anti HCV (%)	Reference
Jafri <i>et al.</i>	2006	Karachi	3,533	1.6	(18)
Akram	1995	Karachi	230	0.40	(97)
Khan	1996	Lahore	538	4.09	(86)
Hyder	2001	Lahore	171	0.58	(98)
<b>Total</b>			<b>4472</b>	<b>1.8 (95% CI = 1.4 – 2.3)</b>	

reviewed data from 139 studies from 1994 to 2007 and concluded that the weighted average for hepatitis C antibody positivity was 3.0% (range 0.3-31.9%). Rates in the high-risk subgroups were far higher <sup>(100)</sup>.

The data analyzed in this article shows HCV positivity (95% CI: 4.6 – 4.8) among 178,322 healthy individuals and 3.03% positivity (95% CI: 3.00 – 3.06) among 982,481 healthy blood donors. This figure is significantly lower (P < 0.0001) than the figure of 9.8% quoted by Umar M and Khaar HTB <sup>(99)</sup>. However, our estimates are significantly higher (P < 0.00001) than the 3% figure quoted by Ali *et al.* <sup>(100)</sup> for healthy individuals. Our estimates are closer to the figure of 5.3% given by Hafeez <sup>(99)</sup>. According to several studies, HCV genotype 3 is the most frequent genotype found in Pakistan (Table 9).

Most of the available Pakistani data on HCV pertains to blood donors, probably because for reasons of convenience and access to a large sample size, and may not truly represent the general population <sup>(100)</sup>. If high-risk blood donors are screened out (those with jaundice, injection drug users etc), the frequency in the general population may be underestimated. If professional blood donors (who are often injection-

drug users who sell their blood to make money) are included, the figures may be overestimated.

The number of subjects studied, other than healthy blood donors, appears very small, and also there is a lack of representation from across the country <sup>(101)</sup>. The frequency of HCV positivity in Pakistan is significantly higher (P < 0.0001) when compared to the corresponding populations in the surrounding countries (Table 10).

We noted a highly variable serofrequency in different studies of similar populations, even within the same province. One of the reasons for such variability in the results has been explained by Ali *et al.* <sup>(100)</sup>. The authors observed that unlike highly contagious diseases like measles that have a more predictable seroprevalence, blood-borne illnesses like hepatitis and HIV are transmitted sporadically or in microepidemics. According to them these microepidemics may account for wide variations in prevalence within a nation, a province, or even a community, and methodological differences in sampling strategies may also contribute to differences in seroprevalence within similar regions or populations <sup>(100)</sup>.

**Table 9.** Frequency of Genotypes\*

Author	Year	Place	Number (Typable)	Genotype (%)							Reference
				1	2	3	4	5	6	Mixed	
Azhar	2003	Bahawalpur	105	6.0	4.8	69.6	2.4	-	0.8	-	(122)
Ansari	2002	Karachi	255	12.0	2.3	77.6	2.3	0.4	2.7	2.3	(127)
Khokhar	2002	Islamabad	148	-	-	64.1	-	-	-	-	(125)
Zuberi	2002	Karachi	215	8.4	-	79.5	-	-	-	8.8	(88)
Nasir	2001	Rawalpindi	39	5.1	2.6	59.9	5.2	12.8	15.4	-	(128)
Mumtaz	2005	Karachi	725	7.9	1.2	87.8	5.0	-	0.8	-	(129)
<b>Total</b>			<b>1,487</b>	<b>7.7</b>	<b>1.6</b>	<b>80.5</b>	<b>3.1</b>	<b>0.9</b>	<b>1.3</b>	<b>1.7</b>	

\*Due to missing data in some studies, percentages do not add to 100.

**Table 10.** Comparison of HCV Frequency with surrounding countries.

Country	Year	Population	Number	Prevalence (%)	Reference
Myanmar	2006	Healthy Adults	362	2.5	(130)
India	2003	Blood Donors	28,956	0.66	(126)
Nepal	2004	Healthy Adults	103	1.0	(131)
Iran	2006	Healthy Adults	1721	0.87	(132)
Afghanistan	2006	Healthy Women	4452	0.31	(133)
Pakistan	2009	Healthy Adults	178,322	4.7	This review

According to the “Burden of Disease Study” carried out by Hyder and Morrow in 2001, chronic liver diseases are the 5<sup>th</sup> commonest cause of premature mortality in Pakistan and the 11<sup>th</sup> commonest cause of disabilities (102). Although between 75-85% of infections move on to chronic hepatitis C, the progress may be slow. Hence most people who are infected do not experience symptoms and are unaware of their infection. They are not able to benefit from available treatment that may clear them of the virus. They may also unknowingly spread the virus to others. Currently, there is no vaccine to prevent HCV infection. Effective but costly treatment is available. The high frequency and its contribution to premature mortality and disability call for massive awareness campaigns to combat the menace of this infectious disease.

## Conclusions

The frequency of hepatitis C infection in Pakistan is high (4.7%), varying from 0.4% - 33.7%, indicating pockets of infections. The frequency is significantly higher than in surrounding countries. The contribution of this high frequency to premature mortality and disability calls for massive awareness campaigns.

## References

- World Health Organization. Hepatitis C. Available at: [www.who.int/vaccine\\_research/viral\\_cancers](http://www.who.int/vaccine_research/viral_cancers). Retrieved on 16.4.2009.
- World Health Statistics. Geneva: World Health Organization. 2008.
- Alavian SM, Fallahian F, Bagheri Lankarani K. Comparison of seroepidemiology and transmission modes of viral hepatitis B in Iran and Pakistan. *Hepat Mon*. 2007;7(4):233-8.
- Khan H. Threat of hepatitis B & C: who will take the action. *Gomal J Med Sci*. 2005;3(1):1.
- Sultan F, Mehmood T, Mahmood MT. Infectious pathogens in volunteer and replacement blood donors in Pakistan: a ten-year experience. *Int J Infect Dis*. 2007;11(5):407-12.
- Agboatwalla M, Isomura S, Miyake K, Yamashita T, Morishita T, Akram DS. Hepatitis A, B and C seroprevalence in Pakistan. *Indian J Pediatr*. 1994;61(5):545-9.
- Luby SP, Qamruddin K, Shah AA, et al. The relationship between therapeutic injections and high prevalence of hepatitis C infection in Hafizabad, Pakistan. *Epidemiol Infect*. 1997;119(3):349-56.
- Aslam M, Aslam J. Seroprevalence of the antibody to hepatitis C in select groups in the Punjab region of Pakistan. *J Clin Gastroenterol*. 2001;33(5):407-11.
- Ali N, Khattak J, Anwar M, et al. Prevalence of hepatitis B surface antigen and hepatitis C antibodies in young healthy adults. *Pak J Pathol*. 2002;13(4):3-6.
- Khan MSA, Khalid M, Ayub N, Javed M. Seroprevalence and risk factors of hepatitis C virus (HCV) in Mardan, N.W.F.P. *Rawal Med J*. 2004;29(2):57-60.
- Khokhar N, Gill ML, Malik GJ. General seroprevalence of hepatitis C and hepatitis B virus infections in population. *J Coll Physicians Surg Pak*. 2004;14(9):534-6.
- Muhammad N, Jan MA. Frequency of hepatitis “C” in Buner, NWFP. *J Coll Physicians Surg Pak*. 2005;15(1):11-4.
- Farooq MA, Iqbal MA, Tariq WZ, Hussain AB, Ghani I. Prevalence of hepatitis B and C in healthy cohort. *Pak J Pathol*. 2005;16(2):42-6.
- Hashim R, Hussain AB, Rehman K. Seroprevalence of Hepatitis C virus antibodies among healthy young men in Pakistan. *Pak J Med Res*. 2005;44(4):140-2.
- Ahmad A. Frequency of HBV surface antigen and anti-HCV in healthy voluntary blood donors in Swat district. *J Postgrad Med Inst*. 2006;20(2):187-90.
- Fayyaz M, Qazi MA, Ishaq M, Chaudhary GM, Bukhari MH. Frequency of hepatitis B and C seropositivity in prisoners. *Biomedica*. 2006;22(1):55-8.
- Mirza IA, Mirza SH, Irfan S, Siddiqi R, Tariq WZ, Janjua AN. Seroprevalence of hepatitis B and C in young adults seeking recruitment in armed forces. *Pak Armed Forces Med J*. 2006;56(2):192-7.
- Jafri W, Jafri N, Yakoob J, et al. Hepatitis B and C: prevalence and risk factors associated with seropositivity among children in Karachi, Pakistan. *BMC Infect Dis*. 2006;6:101.
- Sherif TB, Tariq WZ. Seroprevalence of hepatitis B and C in healthy adult male recruits. *Pak J Pathol*. 2006;17(4):147-50.
- Ahmad N, Asgher M, Shafique M, Qureshi JA. An evidence of high prevalence of Hepatitis C virus in Faisalabad, Pakistan. *Saudi Med J*. 2007;28(3):390-5.
- Altaf C, Akhtar S, Qadir A, Malik KZ, Ahmed P, Tariq WZ. Frequency of hepatitis B and C among healthy adult males from Central Sindh. *Pak J Pathol*. 2007;18(4):113-5.
- Mirza IA, Kazmi SM, Janjua AN. Frequency of hepatitis B surface antigen and anti-HCV in young adults-experience in Southern Punjab. *J Coll Physicians Surg Pak*. 2007;17(2):114-5.
- Malik N, Butt T, Mansoor N, Khan TG, Akbar MS, Aslam M. Percentage of hepatitis B and C among young adult males from interior Sindh. *Pak Armed Forces Med J*. 2008;58(3):260-6.
- Hakim ST, Kazmi SU, Bagasra O. Seroprevalence of hepatitis B and C genotypes among young apparently healthy females of Karachi-Pakistan. *Libyan J Med*. 2008;3(2):66-70.
- Butt T, Amin MS. Seroprevalence of hepatitis B and C infections among young adult males in Pakistan. *East Mediterr Health J*. 2008;14(4):791-7.
- Khan S, Rai MA, Khan A, Farooqui A, Kazmi SU, Ali SH. Prevalence of HCV and HIV infections in 2005-Earthquake-affected areas of Pakistan. *BMC Infect Dis*. 2008;8:147.
- Idrees M, Lal A, Naseem M, Khalid M. High prevalence of hepatitis C virus infection in the largest province of Pakistan. *J Dig Dis*. 2008;9(2):95-103.
- Abbas Z, Jeswani NL, Kakepoto GN, Islam M, Mehdi K, Jafri W. Prevalence and mode of spread of hepatitis B and C in rural Sindh, Pakistan. *Trop Gastroenterol*. 2008;29(4):210-6.
- Alam M, Tariq WUZ, Saleem J, Akram S. Ethnic and geographical distribution of HBsAg and anti-HCV in recruits belonging to Mianwali. *Pak J Pathol*. 2008;19(1):3-5.
- Zaman R. Prevalence of Hepatitis B and Hepatitis C Viruses in Human Urban Population of Bahawalpur District, Pakistan. *J Med Sci*. 2006;6:367-73.
- Mahmood MA, Khawar S, Anjum AH, et al. Prevalence of hepatitis B, C and HIV infection in blood donors of Multan region. *Ann King Edward Med Coll*. 2004;10(4):459-61.
- Tanwani AK, Ahmed N. Prevalence of hepatitis B surface antigen and hepatitis C antibodies in laboratory based data

- at Islamabad. *J Surg.* 2000;**19**(20):25-9.
33. Fayyaz KM, Ali S, Khan AA, *et al.* Hepatitis B carriers; diagnosis among volunteer blood donor students at Quaid-i-Azam Medical College Bahawalpur. *Prof Med J.* 2002;**9**(3):186-90.
  34. Mumtaz S, Rehman MU, Muzaffar M, Ul Hassan M, Iqbal W. Frequency of seropositive blood donors for hepatitis B, C and HIV viruses in railway hospital Rawalpindi. *Pak J Med Res.* 2002;**41**(2):51-3.
  35. Ujjan ID, Memon RA, Butt AR, *et al.* Seroprevalence of HBsAg and anti-HCV in healthy blood donors. *Pak J Gastroenterol.* 2006;**20**(1):75-7.
  36. Siddiqui A, Abbas Z, Hassan M, *et al.* Hepatocellular Carcinoma in Pakistan : Shift of etiology towards hepatitis. *J Postgrad Med Inst.* 2005;**18**:265.
  37. Khokhar N, Niazi SA. Chronic liver disease related mortality pattern in Northern Pakistan. *J Coll Physicians Surg Pak.* 2003;**13**(9):495-7.
  38. Malik IA, Ahmad N, Luqman M, *et al.* Hepatitis C as a cause of chronic liver disease in northern Pakistan. *J Pak Med Assoc.* 1992;**42**(3):67-8.
  39. Malik IA, Ahmad N, Butt S, Tariq WUZ, Muzaffar M, Bakhtiar N. Role of HBV and HCV in etiology of HCC in northern Pakistan. *J Coll Physicians Surg Pak.* 1995;**5**:26-8.
  40. Makki KU, Shaikh I, Memon AS, Qureshi AF. Hepatitis C and chronic liver disease. *Biomedica.* 1995;**11**(1):33-5.
  41. Hussain I, Nasrullah M, Shah AA. Prevalence of hepatitis B and C viral infections in liver cirrhosis in Pakistan. *Pak J Gastroenterol.* 1998;**12**(1-2):7-11.
  42. Farooqi JI, Farooq RJ. Relative frequency of hepatitis B and C virus infection in cases of hepatocellular carcinoma in NWFP. *J Coll Physicians Surg Pak.* 2000;**10**(6):217-9.
  43. Umar M, Bushra HT, Younis N, Bashir N. Clinical spectrum of chronic liver disease due to HBV, HCV and dual infection—a comparative study. *Pak J Gastroenterol.* 1999;**13**(1-2):1-3.
  44. Mahmood A, Karamat KA, Mubarak A, Rehman ZU. Prevalence of hepatitis C virus antibodies in cases of chronic hepatitis and cirrhosis at PNS Shifa, Karachi. *Pak Armed Forces Med J.* 1999;**49**(1):15-7.
  45. Liaquat A, Humara M, Mashoor AS. Hepatitis C in chronic liver disease. *Pak J Med Sci.* 2000;**16**(3):146-51.
  46. Shah FU, Salih M, Malik IA, Hussain I. Increasing prevalence of chronic hepatitis and associated risk factors. *Pak J Med Res.* 2002;**41**(2):46-50.
  47. Iqbal S, Ruknuddin. Liver Cirrhosis in North-West Frontier province of Pakistan. *J Coll Physicians Surg Pak.* 2002;**12**(5):289-91.
  48. Khan AA, Rehman K, Haider Z, Shafiqat F. Seromarkers of Hepatitis B and C in patients with Cirrhosis. *J Coll Physicians Surg Pak.* 2002;**12**(2):105-7.
  49. Farooqi JI, Khan PM. Viral aetiology of Liver Cirrhosis patients in Swat. *Pak J Gastroenterol.* 2002;**16**(2):39-42.
  50. Mashud I, Khan H, Khattak AM. Relative frequency of hepatitis B and C viruses in patients with hepatic cirrhosis at DHQ Teaching Hospital D. I. Khan. *J Ayub Med Coll Abbottabad.* 2004;**16**(1):32-4.
  51. Khokhar N. Spectrum of chronic liver disease in a tertiary care hospital. *J Pak Med Assoc.* 2002;**52**(2):56-8.
  52. Tong CY, Khan R, Beeching NJ, *et al.* The occurrence of hepatitis B and C viruses in Pakistani patients with chronic liver disease and hepatocellular carcinoma. *Epidemiol Infect.* 1996;**117**(2):327-32.
  53. Sultana N, Qazilbash AA, Bari A. Prevalence of anti-hepatitis C antibodies in patients with liver disease. *Pak Armed Forces Med J.* 2000;**50**(1):9-13.
  54. Younas BB, Khan GM, Akhtar P, Chaudhry A. Audit of Patients of Chronic Liver Disease. *Ann King Edward Med Coll.* 2001;**7**(1):52-4.
  55. Tahir M, Aslam M, Hafeez R, Aman S. Anti-HCV Positivity in Anicteric Individuals with Raised Serum Transaminases. *Ann King Edward Med Coll.* 2001;**7**(4):281-3.
  56. Khan H, Khan N, Niazi R, Adam T, Yaqoob A. Seroprevalence of hepatitis C in Pakistanis visiting and admitted at the Pakistan Institute of Medical Sciences Islamabad. *J Surg.* 2001;**21-22**:22-6.
  57. Khan TS, Rizvi F, Rashid A. Hepatitis C seropositivity among chronic liver disease patients in Hazara, Pakistan. *J Ayub Med Coll Abbottabad.* 2003;**15**(2):53-5.
  58. Bukhtiar N, Hussain T, Iqbal M, Malik AM, Qureshi AH, Hussain A. Hepatitis B and C single and co-infection in chronic liver disease and their effect on the disease pattern. *J Pak Med Assoc.* 2003;**53**(4):136-40.
  59. Wazir MS, Majid AS, Solangi GA, Hakin A. Prevalence of Hepatitis C in chronic liver disease. Pakistan Society of Gastroenterology and GI Endoscopy - 19<sup>th</sup> Annual Congress; 28<sup>th</sup> Feb-2<sup>nd</sup> Mar; Lahore. 2003. Abstract 19.
  60. Abdul Mujeeb S, Jamal Q, Khanani R, Iqbal N, Kaher S. Prevalence of hepatitis B surface antigen and HCV antibodies in hepatocellular carcinoma cases in Karachi, Pakistan. *Trop Doct.* 1997;**27**(1):45-6.
  61. Mumtaz MS, Iqbal R, Umar M, *et al.* Sero-Prevalence of Hepatitis B and C Viruses in Hepatocellular Carcinoma. *J Rawal Med Coll.* 2001;**5**(2):78-80.
  62. Khokhar N, Aijazi I, Gill ML. Spectrum of hepatocellular carcinoma at Shifa International Hospital, Islamabad. *J Ayub Med Coll Abbottabad.* 2003;**15**(4):1-4.
  63. Bilal A, Qureshi FS, Omar Z, Khalid G. Frequency of Hepatitis B and C Virus in patients with decompensated cirrhosis of liver in Faisalabad. *Pak J Gastroenterol.* 2006;**20**(1):43-8.
  64. Almani SA, Memon AS, Memon AI, Shah I, Rahpoto Q, Solangi R. Cirrhosis of liver: Etiological factors, complications and prognosis. *J Liaquat Uni Med Health Sci.* 2008;**7**(2):61-6.
  65. Abbas Z, Siddiqui AU, Luck NH, *et al.* Prognostic factors of survival in patients with non-resectable hepatocellular carcinoma: hepatitis C versus miscellaneous etiology. *J Pak Med Assoc.* 2008;**58**(11):602-7.
  66. Haider Z, Khan AA, Rehman K, *et al.* Sero-diagnosis for viral hepatitis in 93 patients admitted with acute hepatitis in three different teaching hospitals in Lahore. *J Pak Med Assoc.* 1994;**44**(8):182-4.
  67. Umar M, Bushra HT, Shuaib A, Anwar A, Shah NH. Spectrum of chronic liver disease due to hepatitis C virus infection. *J Coll Physicians Surg Pak.* 2000;**10**(10):380-3.
  68. Almani SA, Memon AS, Qureshi AF, Memon NM. Hepatitis viral status in Sindh. *Prof Med J.* 2002;**9**(1):36-43.
  69. Shaikh MA, Shaikh WM, Solangi GA, Abro H. Frequency and transmission mode of hepatitis C virus in northern Sindh. *J Coll Physicians Surg Pak.* 2003;**13**(12):691-3.
  70. Mumtaz S, Aftab I. Seromarkers of hepatitis B and C (onserved in symptomatic cases of teaching hospital of IIMC (Railway Hospital) Rawalpindi. *Ann Pak Inst Med Sci.* 2005;**1**(4):242-4.
  71. Gul A, Iqbal F. Prevalence of hepatitis C in patients on maintenance hemodialysis. *J Coll Physicians Surg Pak.* 2003;**13**(1):15-8.
  72. Khokhar N, Alam AY, Naz F, Mahmud SN. Risk factors for hepatitis C virus infection in patients on long-term hemodialysis. *J Coll Physicians Surg Pak.* 2005;**15**(6):326-8.
  73. Qazi MA, Fayyaz M, Muhyuddin HCG, *et al.* Frequency of hepatitis C infection in diabetes mellitus. *Ann King Edward Med Coll.* 2005;**11**(4):549-51.



74. Bilwani F, Zaidi Y, Kakepoto GN, Adil SN, Khurshid M. Prevalence of hepatitis C virus in lymphoproliferative disorders. *J Pak Med Assoc.* 2004;**54**(4):202-6.
75. Moatter T, Adil S, Haroon S, Azeemuddin S, Hassan F, Khurshid M. Prevalence of hepatitis G virus in Pakistani children with transfusion dependent beta- thalassemia major. *Indian J Pathol Microbiol.* 1999;**42**(4):475-82.
76. Mohammad J, Hussain M, Khan MA. Frequency of hepatitis B and hepatitis C infection in thalassemic children. *Pak Pediatr J.* 2003;**27**(4):161-4.
77. Younas M, Hassan K, Ikram N, Naseem L, Zaheer HA, Khan MF. Hepatitis C virus seropositivity in repeatedly transfused thalassemia major patients. *Int J Pathol.* 2004;**2**(1):20-3.
78. Burki MFK, Hassan M, Hussain H, Nisar YB, Krishan J. Prevalence of anti-hepatitis C antibodies in multiply transfused beta thalassemia major patients. *Ann Pak Inst Med Sci.* 2005;**1**(3):150-3.
79. Hussain M, Khan MA, Mohammad J, Jan A. Frequency of Hepatitis B and C in Hemophiliac Children. *Pak Pediatr J.* 2003;**27**(4):157-60.
80. Shah F, Dar SI. Prevalence of Hepatitis C in depressed population. *Pak J Med Res.* 2004;**43**:200-2.
81. Hussain SMA, Fatima T. Incidence of hepatitis B and C in surgical patients. *Ann Abbasi Shaheed Hosp Karachi Med Dent Coll.* 2000;**5**:188-91.
82. Talpur AA, Ansari AG, Awan MS, Ghumro AA. Prevalence of hepatitis B and C in surgical patients. *Pak J Sur.* 2006;**22**(3):150-3.
83. Khan MS, Jamil M, Jan S, Zardad S, Sultan S, Sahibzada AS. Prevalence of hepatitis 'B' and 'C' in orthopaedics patients at Ayub Teaching Hospital Abbottabad. *J Ayub Med Coll Abbottabad.* 2007;**19**(4):82-4.
84. Daudpota AQ, Soomro AW. Seroprevalence of hepatitis B and C in surgical patients. *Pak J Med Sci.* 2008;**24**(3):483-4.
85. Khatib U, Khan AS, Shah SA, Haq N. Hepatitis in dental practice-a study conducted on 1498 patients. *Pak Oral Dent J.* 2005;**25**(1):25-9.
86. Khan HI. A study of seroprevalence of hepatitis B and C in mothers and children in Lahore. *Pak Pediatr J.* 1996;**20**(4):163-6.
87. Parker S, Khan H, Cubitt W. Detection of antibodies to hepatitis C virus in dried blood spot samples from mothers and their offspring in Lahore, Pakistan. *Am Soc Microbiol;* 1999. p. 2061-3.
88. Zafar MAF, Mohsin A, Hussain I, Shah AA. Prevalence of hepatitis C among pregnant women. *J Surg Pakistan.* 2001;**6**(2):32-3.
89. Bilal N, Akhter S, Baber M. Spectrum of HCV positive cases in a Gynae Unit. *J Postgrad Med Inst.* 2002;**16**(1):68-71.
90. Rizvi TJ, Fatima H. Frequency of hepatitis C in obstetric cases. *J Coll Physicians Surg Pak.* 2003;**13**(12):688-90.
91. Fayyaz H, Latif Y, Sohail R, Zaman F. Screening for hepatitis C in gynecological population. *Ann King Edward Med Coll.* 2004;**10**(3):287-8.
92. Khokhar N, Raja KS, Javaid S. Seroprevalence of hepatitis C virus infection and its risk factors in pregnant women. *J Pak Med Assoc.* 2004;**54**(3):135.
93. Jaffery T, Tariq N, Ayub R, Yawar A. Frequency of hepatitis C in pregnancy and pregnancy outcome. *J Coll Physicians Surg Pak.* 2005;**15**(11):716-9.
94. Yousfani S, Mumtaz F, Memon A, Memon MA, Sikandar R. Ante-natal screening for hepatitis B and C virus carrier state at a university hospital. *J Liaquat Univ Med Health Sci.* 2006;**5**(1):24-7.
95. Hakeem K, Khan S, Abdullah M, Rehman A, Hashmi I. Prevalence of HBsAg and Anti HCV in pregnant ladies attending antenatal clinic at Shaikh Zayed Medical Complex, Rahim Yar Khan. *Esculapio J Services Inst Med Sci* 2006;**2**(3):6-8.
96. Batool A, Bano KA, Khan MI, Hussain R. Antenatal screening of women for hepatitis B and C in an out-patient department. *J Dow Univ Health Sci* 2008;**2**(1):32-5.
97. Akram DS, Isomara S, Agboatwala M. The prevalence of antibodies to hepatitis A, B and C virus in children of Karachi. *J Coll Physicians Surg Pak.* 1995;**5**:17-8.
98. Hyder SN, Hussain W, Aslam M, Maqbool S. Seroprevalence of anti-HCV in asymptomatic children. *Pak J Pathol.* 2001;**12**(3):89-93.
99. Umar M, Khaar HUB. Hepatitis C in Pakistan. Rawalpindi. 2006. [unpublished data].
100. Ali SA, Donahue RM, Qureshi H, Vermund SH. Hepatitis B and hepatitis C in Pakistan: prevalence and risk factors. *Int J Infect Dis.* 2009;**13**(1):9-19.
101. Shah NH, Shabbir G. A Review of published literature on Hepatitis B and C Virus Prevalence in Pakistan. *J Coll Physicians Surg Pak.* 2002;**12**(6):368-71.
102. Hyder AA, Morrow RH. Applying burden of disease methods in developing countries: a case study from Pakistan. *Am J Public Health.* 2000;**90**(8):1235-40.
103. Kakepoto GN, Bhally HS, Khaliq G, et al. Epidemiology of blood-borne viruses: a study of healthy blood donors in Southern Pakistan. *Southeast Asian J Trop Med Public Health.* 1996;**27**(4):703-6.
104. Bhatti FA, Shaheen N, Tariq WZ, Amin M, Saleem M. Epidemiology of hepatitis C virus in blood donors in northern Pakistan. *Pak Armed Forces Med J.* 1996;**46**(2):91-2.
105. Lone DS, Aman S, Aslam M. Prevalence of Hepatitis C Virus antibody in Blood Donors of Lahore. *Biomedica.* 1999;**15**:103-7.
106. Mujeeb SA, Aamir K, Mehmood K. Seroprevalence of HBV, HCV and HIV infections among college going first time voluntary blood donors. *J Pak Med Assoc.* 2006;**56**(1 Suppl 1):S24-5.
107. Ryas M, Hussain T, Bhatti FA, Ahmed F, Tariq WZ, Khattak MF. Epidemiology of Hepatitis C virus infection in blood donors in Northern Pakistan. *J Rawal Med Coll.* 2001;**5**(2):56-9.
108. Ahmed MU, Aziz MU. Anti hepatitis C antibodies study in professional and volunteer blood donors. *Ann Abbasi Shaheed Hosp Karachi Med Dent Coll* 2001;**6**:278-9.
109. Ahmad S, Gull J, Bano KA, Aftab M, Kokhar MS. Prevalence of anti Hepatitis C antibodies in healthy blood donors at Services Hospital Lahore. *Pak Postgrad Med J.* 2002;**13**(1):18-20.
110. Khattak MF, Salamat N, Bhatti FA, Qureshi TZ. Seroprevalence of hepatitis B, C and HIV in blood donors in northern Pakistan. *J Pak Med Assoc.* 2002;**52**(9):398-402.
111. Rahman M, Akhtar G, Lodhi Y. Seroprevalence of Hepatitis-C antibodies in blood donors. *Pak J Med Sci.* 2002;**18**(3):193-6.
112. Ali N, Nadeem M, Qamar A, Qureshi AH, Ejaz A. Frequency of Hepatitis C virus antibodies in blood donors in Combined Military Hospital, Quetta. *Pak J Med Sci.* 2003;**19**(1):41-4.
113. Akhtar S, Younus M, Adil S, Jafri SH, Hassan F. Hepatitis C virus infection in asymptomatic male volunteer blood donors in Karachi, Pakistan. *J Viral Hepat.* 2004;**11**(6):527-35.
114. Ahmad J, Taj AS, Rahim A, Shah A, Rehman M. Frequency of Hepatitis B and Hepatitis C in healthy blood donors of NWFP: a single center experience. *J Postgrad Med Inst.* 2004;**18**(3):343-52.
115. Sirhindi GA, Khan AA, Alam SS, et al. Frequency of Hepatitis B, C and Human Immunodeficiency virus in blood donors at Shaikh Zayed Hospital, Lahore. *Proceeding Shaikh Zayed Postgrad Med Inst.* 2005;**19**(1):33-6.

116. Aziz MS. Prevalence of anti hepatitis C antibodies and hepatitis B surface antigen in healthy blood donors in Baltistan. *Pak Armed Forces Med J.* 2006;**56**(2):189–91.
117. Khan MA, Chaudhary GMD, Fayyaz M, Qazi MA, Ahmed G. Hepatitis B, C & HIV; seroprevalence of infection in blood donors. *Prof Med J.* 2006;**13**(4):632-6.
118. Abdul Mujeeb S, Nanan D, Sabir S, Altaf A, Kadir M. Hepatitis B and C infection in first-time blood donors in Karachi--a possible subgroup for sentinel surveillance. *East Mediterr Health J.* 2006;**12**(6):735-41.
119. Chaudhary IA, Samiullah, Khan SS, Masood R, Sardar MA, Mallhi AA. Seroprevalence of hepatitis B and C among the healthy blood donors at Fauji Foundation Hospital, Rawalpindi. *Pak J Med Sci.* 2007;**23**(1):64-7.
120. Alam M, Naeem MA. Frequency of hepatitis B surface antigen and anti-hepatitis C antibodies in apparently healthy blood donors in northern areas. *Pak J Pathol.* 2007;**18**(1):11-4.
121. Ishaq M, Ali SS, Karim N, Umrani NI, Hassan N. Frequency of hepatitis B and C virus among the healthy volunteer blood donors at Taulka Hospital Sujjawal, District Thatta, Sindh. *Ann Abbasi Shaheed Hosp Karachi Med Dent Coll.* 2007;**12**(2):97-101.
122. Bhatti FA, Ullah Z, Salamat N, Ayub M, Ghani E. Anti-hepatitis B core antigen testing, viral markers, and occult hepatitis B virus infection in Pakistani blood donors: implications for transfusion practice. *Transfusion.* 2007;**47**(1):74-9.
123. Khattak MN, Akhtar S, Mahmud S, Roshan TM. Factors influencing Hepatitis C virus sero-prevalence among blood donors in north west Pakistan. *J Public Health Policy.* 2008;**29**(2):207-25.
124. Mujeeb SA, Pearce MS. Temporal trends in hepatitis B and C infection in family blood donors from interior Sindh, Pakistan. *BMC Infect Dis.* 2008;**8**:43.
125. Khokhar N, Asif N, Khokhar O. Hepatitis C virus Serotypes in chronic liver disease. *Pak J Med Sci* 2002;**18**(2):156-9.
126. Mukhopadhyaya A. Hepatitis C in India. *J Biosci.* 2008;**33**(4):465-73.
127. Ansari N, Ahmed A, Esmail J, Mujeeb SA. HCV serotypes in Karachi: a Liaquat National Hospital experience. *J Pak Med Assoc.* 2002;**52**(5):219-20.
128. Nasir J, Alam B, Shafi MS. Prevalence of Genotypes in HCV positive patients in Rawalpindi, Islamabad. 17th International Congress of Gastroenterology and GI Endoscopy; March 23-25; Islamabad. 2001.
129. Mumtaz K, Hamid SS, Moatter T, Abid S, Shah HA, Jafri W. Distribution of hepatitis C virus genotypes and its response to treatment in Pakistani patients. *Saudi Med J.* 2008;**29**(11):1671-3.
130. Kyi KP, Aye M, Oo KM, Htun MM. Prevalence of Hepatitis C in Healthy Population and Patients with Liver Ailments in Myanmar. 2002;**6**:1-5.
131. Chiba H, Takezaki T, Neupani D, *et al.* An epidemiological study of HBV, HCV and HTLV-I in Sherpas of Nepal. *Asian Pac J Cancer Prev.* 2004;**5**(4):370-3.
132. Sy T, Jamal MM. Epidemiology of hepatitis C virus (HCV) infection. *Int J Med Sci.* 2006;**3**(2):41-6.
133. Todd CS, Ahmadzai M, Atiqzai F, *et al.* Seroprevalence and correlates of HIV, syphilis, and hepatitis B and C virus among intrapartum patients in Kabul, Afghanistan. *BMC Infect Dis.* 2008;**8**:119.