

Seroprevalence of Hepatitis C Virus in Iraqi Population

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Abstract

Background: Hepatitis C is a major public health problem worldwide. In Eastern Mediterranean Region, two third of liver cirrhosis and HCC were attributed to HCV infections.

Aim of the Study: To determine the seroepidemiology of hepatitis C viral infections in Samara community.

Settings: Samara General Hospital and primary health care centers in Samara District.

Study Design: The study design of two parts, the first one is a retrospective study and the second part is a Descriptive Case Control Study.

Study Population: The study conducted in Samara General Hospital and primary health care centers in Samara District. Records of subjects with hepatitis C during three years (2011, 2012 and 2013) were included in the study. Their age range from 1 to 59 years, with a mean age of 26.7 ± 4.9 years. The total number of tested serum samples was 16165, of them 5683 for 2011, 5809 for 2012 and 4673 for 2013. Of the total 9648 (60%) are male and 6517 (40%) are female.

Results: The overall Anti-HCV Ab Seroprevalence was 0.54% (87/16165) and the highest Seroprevalence was for 2013 which form 0.81% (38/4673), followed by 0.64% (37/5809) for 2012 and 0.21% for 2011. There was a highly significant ($P=0.000$) differences in Seroprevalence of Anti-HCV Ab between the three years of study. Anti-HC Ab Seroprevalence was significantly ($P=0.009$) higher in female (0.72%) as compared to male (0.41%), with male to female ration of 0.57:1.

Conclusions: The impact of HCV on health and medical care in Iraq is a major problem for the community and infectious disease physicians as this study illustrate evolving of new epidemiological characteristics.

Keywords: Hepatitis; HCV; HCC; Seroepidemiology; Samara

Introduction

Chronic hepatitis C prevalence was 3% in the global population [1] and 14% to 45% of the untreated cases of HCV infection develop chronic liver diseases and cirrhosis 20 years after acquisition of disease [2]. In Eastern Mediterranean Region, the prevalence of hepatitis C virus was variable and range from 1% to 2.5% in most countries, with a high prevalence reported in Egypt (>10%) [1], and in Libya, Sudan and Yemen (2.5% - 10%) [3]. Worldwide the HCV prevalence was with a range of 0.4% in Germany to 22% in Egypt [3]. However, the range of HCV prevalence in 21 regions was 1.2% in Tropical Latin America to 3.8% in Central Asia, with overall mean prevalence of 2.8% [3]. HCV prevalence was with a range of 0.32% to 7.1% in Iraqi general population [4,5]. However, most of the reported studies for Iraq are performed on selected study population [6]. To our

knowledge, no data was reported concerning Samara city and thus we conducted this study to determine the seroepidemiology of hepatitis C viral infections in Samara community.

Materials and Methods

Settings

Samara General Hospital and primary health care centers in Samara District.

Study design

Retrospective study

Study population

The study conducted in Samara General Hospital and primary health care centers in Samara District. Records of subjects with

hepatitis C viral infections during three years (2011, 2012 and 2013) were included in the study. Their age range from 1 to 59 years, with a mean age of 26.7 ± 4.9 years. The total number of tested serum samples was 16165, of them 5683 for 2011, 5809 for 2012 and 4673 for 2013. Of the total 9648 (60%) are male and 6517 (40%) are female. Table1. All the serum samples was tested for HBsAg, using commercially- available (ELISA) kits. The results read by a Micro well reader and compared in a parallel manner with controls; optical density read at 450 nm on an ELISA reader.

Table1: Study population.

Year	Number Tested	Male Number [%]	Female Number [%]
2011	5683	3204 [56.4]	2479 [43.6]
2012	5809	3091 [53.2]	2718 [46.8]
2013	4673	3353 [71.7]	1320 [28.3]
X ²			
P			
Total	16165	9648 [59.7]	6517 [40.3]

Results

Prevalence of Hepatitis C virus

The overall Anti-HCV Ab seroprevalence was 0.54% (87/16165) and the highest seroprevalence was for 2013 which

Table3: Gender Prevalence of Hepatitis C Virus.

Year	Number Tested		Number Positive		Percent		Male Vs. Female	
	Male	Female	Male	Female	Male	Female	X ²	P
2011	3204	2479	6	6	0.19	0.24	0.19	NS
2012	3091	2718	15	22	0.49	0.81	2.4	NS
2013	3353	1320	19	19	0.57	1.44	8.94	0.003
X ²			6.26	17.8				
P			0.044	0				
Total	9648	6517	40	47	0.41	0.72		

Total: male versus female: X² = 6.83, P=0.009

Age distribution of Hepatitis C virus

The overall Seroprevalence of Anti-HC Ab was significantly ((X² =35.5, P=0.000) different between age groups, with higher prevalence (1.62%, 23/1421) in the age group >45 years, followed by age group of 1-4 years (1.22%, 3/246). In addition, for 2013, Anti-HC Ab Seroprevalence was significantly (X² =37.6, P=0.000) different between the age groups, with higher prevalence in age

Table 4: Age Group Distribution of the Prevalence of Hepatitis C Virus.

Year	Variable	Age Group in Years				X2	P
		1-4	5-14	15 - 45	>45		
2011	Number tested	94	199	4811	579	4.05	NS
	Number positive	0	1	8	3		
	Percent	0	0.5	0.17	0.52		

form 0.81% (38/4673), followed by 0.64% (37/5809) for 2012 and 0.21% (12/5683) for 2011. There was a highly significant (X² =19, P=0.000) differences in seroprevalences of Anti-HCV Ab between the three years of study, (Table 2).

Table2: Prevalence of Hepatitis C Virus.

Year	Number Tested	Number Positive	Percent
2011	5683	12	0.21
2012	5809	37	0.64
2013	4673	38	0.81
X ²	19		
P	0		
Total	16165	87	0.54

Gender influence on prevalence of Hepatitis C virus

The Seroprevalence of Anti-HC Ab was not significantly different in female as compared to male for 2011 (X² =0.19, P>0.05) and 2012 (X² =2.4, P>0.05). However, Anti-HC Ab Seroprevalence was significantly (X² =8.94, P=0.003) higher in female (1.44%) as compared to male (0.57%) for 2013. When the data of the 3 years pooled together, the Anti-HC Ab Seroprevalence was significantly (X² =6.83, P=0.009) higher in female (47/6517; 0.72%) as compared to male (40/9648; 0.41%), with male to female ration of 0.57:1 (Table 3).

group >45 years (3.46%, 12/347), followed by age group of 1-4 years (2.8%, 2/72). Furthermore, there was significant (X² =9, P=0.029) difference for Anti-HC antibody Seroprevalence in age group of >45 years (1.62%,8/495), followed by age group of 1-4 years (1.25%,1/80) for 2012. However, in 2011, there was no significant (X² =4.05, P>0.05) differences between the age groups, (Table 4).

2012	Number tested	80	275	4959	495	9	0.029
	Number positive	1	2	26	8		
	Percent	1.25	0.73	0.52	1.62		
2013	Number tested	72	191	4063	347	37.6	0
	Number positive	2	0	24	12		
	Percent	2.8	0	0.59	3.46		
	X ²	2.61	1.34	11.5	11.8		
	P	NS	NS	0.003	0.003		
Total	Number tested	246	665	13833	1421	35.5	0
	Number positive	3	3	58	23		
	Percent	1.22	0.45	0.42	1.62		

Total: male versus female: X² = 6.83, P=0.009

In the age group of 1-4 years there was no significant (X² =2.61, P>0.05) differences in anti-hepatitis C virus antibody over the study years. In addition, the same pattern was demonstrated for the age group of 5-14 years. However, there was a significant difference in Anti-HC Ab between the study years in both age groups of 15-45 ((X² =11.5, P=0.003) and >45 years (X² =11.8, P=0.003), (Table 4).

Age group distribution of the prevalence of Hepatitis C virus in relation to gender

Table 5: Age Group Distribution of the Prevalence of Hepatitis C Virus in Relation to Gender.

Year	Gender	Variable	Age group in years				X ²	P
			1 -4	5 -14	15 - 45	>45		
2011	Male	Number tested	56	150	2731	267	2.69	NS
		Number positive	0	1	4	1		
		Percent	0	0.67	0.15	0.37		
	Female	Number tested	38	49	2080	312	2.48	NS
		Number positive	0	0	4	2		
		Percent	0	0	0.19	0.64		
			X ²	ND	0.33	0.15	0.21	
		P		NS	NS	NS		
2012	Male	Number tested	47	161	2632	251	15.7	0.001
		Number positive	0	2	8	5		
		Percent	0	1.24	0.3	1.99		
	Female	Number tested	33	114	2327	244	3.53	NS
		Number positive	1	0	18	3		
		Percent	3.03	0	0.77	1.23		
			X ²	1.44	1.43	5.22	0.45	
		P	NS	NS	0.022	NS		
2013	Male	Number tested	46	120	2953	234	49.7	0
		Number positive	2	0	9	8		

	Female	Percent	4.35	0	0.3	3.42	5.77	NS
		Number tested	26	71	1110	113		
		Number positive	0	0	15	4		
		Percent	0	0	1.35	3.54		
	X ²		1.16	ND	15	0.04		
P		NS		0	NS			
Total	Male	Number tested	149	431	8316	752	47.4	0
		Number positive	2	3	21	14		
		Percent	1.34	0.7	0.25	1.86		
	Female	Number tested	97	234	5517	669	5.67	NS
		Number positive	1	0	37	9		
		Percent	1.03	0	0.67	1.35		
	X ²		0.05	1.64	13.9	0.59		
	P		NS	NS	0	NS		

The age distribution of Anti-HC Ab is shown in Table 5. There was no significant differences in HCV antibody Seroprevalence between age groups in both male ($X^2 = 2.69$, $P > 0.05$) and female ($X^2 = 2.48$, $P > 0.05$) for the year 2011. However, in male individuals the higher HCV Seroprevalence (0.67%, 1/150) was in age group of 5-14 years, while in female (0.64%, 2/312) was in the >45 years age group. There were no significant differences in Seroprevalence of HCV within each age group between male and female.

Regarding 2012, in male subjects there was a significant difference ($X^2 = 15.7$, $P = 0.001$) in HCV Seroprevalence between age groups, with a higher prevalence (1.99%, 5/251) in >45 years age group. However, in female there was no significant ($X^2 = 3.53$, $P > 0.05$) difference in HCV Seroprevalence between the age groups, with a higher prevalence (3.03%, 1/33) in 1-4 years age group. Comparison between Seroprevalence between male and female within each age group indicated a significant ($X^2 = 5.22$, $P = 0.022$) difference in age group 15-45 years only.

In male individuals, there was a highly significant ($X^2 = 49.7$, $P = 0.000$) differences in HCV Seroprevalence between age groups, with a higher prevalence in the age of 1-4 years (4.35%; 2/46), followed by >45 years (3.42%; 8/234) age group. However, in female, there was no significant differences in HCV Seroprevalence between age groups, with a high prevalence (3.54%, 4/113) in >45 years age group. Male to female comparison. Within each age group demonstrated a significant ($X^2 = 15$, $P = 0.000$) difference in 15-45 years age group.

When the data of the 3 years pooled together, the HCV Seroprevalence was significantly different between the age groups for male ($X^2 = 47.4$, $P = 0.000$), but not female ($X^2 = 5.67$, $P = 0.000$). In both male (1.86%, 4/752) and female (1.35%,

9/669) subjects, the higher HCV Seroprevalence was found in the >45 years age group. Within each age group, the comparison between male and female shows a significant ($X^2 = 13.9$, $P = 0.000$) difference in HCV Seroprevalence in the 15-45 years age group, with a higher predominance in female (0.67%, 37/5517) than in male (0.25%; 21/8316).

Discussion

The present study indicated that HCV (Anti-HCV) prevalence was 0.54%, which was significantly higher ($X^2 = 19$, $P = 0.000$) in 2013 (0.8%) as compared to 2012 (0.64%) and 2011 (0.21%). This Seroprevalence was about twice to that reported in blood donors (0.26%) in Baghdad [7], but slightly higher to that reported in a national normal population (0.4%) study [6]. The prevalence rate of Anti HCV was lowest in Erbil, Sulaymaniyah, Karbala, Al Qadisiyah, Al Muthanna, Al Basrah and Dahuk (<0.3%) and highest in Babylon, Al Najaf and Thi Qar (> 0.9%) [6].

The present study demonstrated an increase in anti-HCV with time which agreed to previously reported study in blood donors [7]. In Babylon, a higher anti-HCV was found in Iraqi patients with inherited blood disorders who received multiple blood transfusion [8], while it was 0.32% in general population, 0.17% in healthy blood donors, 0.8% in high risk groups [4]. Tawfeq, et al. [9] reported lower HBV prevalence in blood donors who reported 0.29% prevalence in Babylon. Al-Kubaisy, et al [10] found a very high prevalence of HCV infection among children with Thalassemia in Baghdad (67.3%). In contrast, Omer, et al. [11] reported low rate of hepatitis C infection among patients with leukemia who receive multiple blood transfusion in Baghdad.

Recent review reported significant differences in prevalence and epidemiology of hepatitis C virus infection exist among the Middle East countries or even inside the countries regions [12]. However, most of the included studies in this review were performed in risk group rather than general population. Depending on the available data it may be suggested that HCV transmission in the Eastern Mediterranean Region occurs in health care setting and primarily associated with unsafe injections [1]. Global hepatitis C prevalence are mostly based on hepatitis C virus Seroprevalence studies data [13] and data submitted from different countries and WHO regions [3].

The HCV prevalence was 0.4% in Germany, 0.8% in Canada, 1.1% in France and Australia, 5%- 1.5% in India, 1.5% -2.3% in Japan, 1.8% in USA, 2.1% in Indonesia, 3.2% in China, 4.9% in Pakistan, 2.5-10% in Italy and 18%-22% in Egypt [3]. However, the range of HCV prevalence in 21 regions was 1.2% in Tropical Latin America to 3.8% in Central Asia, with overall mean prevalence of 2.8% [3]. HCV prevalence was with a range of 0.32% to 7.1% in Iraqi general population [4,5]. Mohamed Hanafian, et al. [14] conducted a systematic review to estimated the HCV burden globally and their review included the data from 1990 to 2005 using Global Burden of Diseases that divided the world into 21 regions rather than 6 WHO regions, to achieve epidemiology homogeneity. Their review finds that globally the prevalence of anti-HCV increased from 2.3% to 2.8% between 1990 and 2005. Asia Pacific, Tropical Latin America and North America have low prevalence (<1.5%); Central and East Asia and North Africa/ Middle East are with high prevalence (>3.5%); whereas South and Southeast Asia, sub-Saharan Africa, Andean, Central and Southern Latin America, Caribbean, Oceania, Australasia, and Central, Eastern and Western Europe have moderate prevalence (1.5%-3.5%).

The present study HCV Seroprevalence was lower to that reported for Babylon but higher to that reported for general population national survey and in Baghdad in general population [4-6]. In addition, our study Seroprevalence was higher to that reported for Germany, similar to that of Canada, but lower to that reported for India, Japan, USA, Indonesia, China, Pakistan, Italy, and Egypt [3]. Furthermore, the present study HCV prevalence was lower to that reported for 21 regions [14].

In the Middle East countries, HCV prevalence was 0.2% in general population (<1%) [15], 0.12%-1.3% in blood donors, 10.6% -63.8% in patients with thalassemia [16,17], 24.8% in haemodialysis patients [15] in Iran. Among Bahrani, the HCV prevalence range was 9.24% in hemodialysis patients to 40% in those with haemolytic anaemia [18]. In Oman, HCV prevalence was 0%-1% in general population, 0.9%-1.5% in blood donors, 13.4% in kidney transplant patients and 26.5% in hemodialysis patients [19]. In Qatar, HCV prevalence was 6.3% in general population, and 44.6% in patients with dialysis [20,21]. In Jordan, the Seroprevalence in general population was 0.65% to 6.25%, 40% in multi-transfusion hereditary hemolytic anaemia,

and 28% in hemodialysis patients [21]. In Kuwait, anti HCV was from 0.8% to 5.4% in blood donors [22].

In Saudi Arabia, the prevalence of HCV infection was low in general population, less in children than adults and intravenous drug use are the main modes of infections [23,24]. HCV prevalence was with 18% to 46% in patients with regular hemodialysis [25]. Anti-HCV detected in 41% of individuals screened recipients for preparation of renal transplantation [26]. In United Arab Emirates was reduced from 23% reported in 1995 [27] to 1.8% as reported in 2009 [1]. Anti-HCV was 0.46% among blood donors from Northern Cyprus, soldiers from Turkey and soldiers from Northern Cyprus [28]. In Syria, anti-HCV prevalence was 48.9% among hemodialysis patients [29], 60.5% among intravenous drug abusers, 1.96% among the prostitutes, and 0.95% among blood donors, [30], 3% among health care workers and 1% in the general population [30].

Ani-HCV was 0.4% in health care workers and 0.6% in Lebanon [31] and higher in hemodialysis patients [32]. In Yemen, the anti-HCV was 1.7% in healthy population, 2.7 among blood donors, and 33.75 in patients with chronic liver diseases and in 33.8% in patients with regular hemodialysis [33]. In Turkey, anti-HCV was found in 1% to 2.1% in healthy individuals, and 4.5% in hemolytic anaemia [34,35]. In Sudan, anti-HCV prevalence was 2.2% to 3% in general population and 23.7% in hemodialysis patients [36,37].

In Egypt, the Seroprevalence of HCV in blood donors was 14.5%, 70.4% in hemodialysis patients, 7.7% in health care workers and 75.7% in children with thalassemia [38]. In addition, HCV prevalence was 12.1% of rural primary school children, 18.1 % of rural village residents, 22.1% of army recruits, 16.4% in children with hepatomegaly, 46.2% of hemodialysis adults, 47.2% in adults with hepatoma or chronic liver diseases, and 54.9% of multi-transfused children [39]. In Algeria, HCV antibodies found in 0.18% among blood donors and 0.19% of pregnant women [40].

Although the above summarized studies indicated varied prevalence of HCV, a newly reported review suggests a narrow prevalence scale [1]. The estimated anti-HCV prevalence in the Middle East Regions was with a range of 0.6% in Djibouti to 13.5% in Egypt; however, it was 3.21% in Iraq. In addition, it was 1-0.7% for Lebanon; 1-2% for Syria, Iran, Qatar, Yemen, Oman, Somalia, Libya, Bahrain, Kuwait, Saudi Arabia, Emirates; >2% -3% for Jordan, Sudan, Afghanistan, Morocco; and 4.9% for Pakistan [1]. Thus the present study HCV prevalence was lower (0.54%) to that reported by WHO regional office for Iraq and even less than the lower prevalence estimates (0.6%) for Djibouti.

Recent review [41] reported a summary of data extracted from 21 studies (from 1994 -2009) reporting prevalence of maternal HCV infection indicated a prevalence range from 0.04% in Pakistan [42] to 15.8% in India. In addition, 8 (38.1%)

studies reported prevalence of HCV <1%, and 7 (33.3%) studies reporting prevalence of >2%. Furthermore, 5 studies performed in the last 5 years which indicated HCV prevalence of 0.15% to 1.4%, with exception of that performed in Egypt [43] was with 15.7% prevalence [41]. Gasim, et al. [44] in a regional review in Arab and African countries reported HCV prevalence for Arab countries ranged from 0.5% in Tunisia to 8.6% in Egypt. In addition, they reported HCV prevalence for African countries ranged from 1% in Ivory Coast to 16.5% in Malawi. In a systematic review [45], the epidemiology of HCV in Egypt, suggest that a massive hepatitis C virus epidemic at the national level must have occurred with substantial transmission still ongoing today. Overall hepatitis C virus prevalence was 5%-15% among pregnant women, 5% - 25% among blood donors, 10%-55% among multi-transfused patients, 50%- 90% in dialysis patients, and 0% - 40% among general population. Recent review [46] concerning HCV prevalence which included the articles published after 1995, indicated that HCV prevalence in the general population in Africa was 0.1% to 17.5% depending on the country. Highest prevalence was found in Egypt (17.5%), Cameroon (13.8%) and Burundi (11.3%), while the lowest prevalence reported for Zambia, Kenya, Malawi and south Africa. Anwar, et al [47] using PCR for 4246 blood samples from general population found that 4.9% of the subjects were confirmed to harbor active hepatitis C virus infection. In a survey performed in Canada from 2007 to 2011 as a nationally representative sample indicated that HCV seroprevalence was 0.5% [48]. A systematic review for Europe suggest that anti-HCV prevalence in general population ranged from 0.4% to 5.2% and varied widely between European countries and within the same country [49]. For example, 10 studies reviewed for Italy, and the anti-HCV ranged from 2.4% to 22.4%, in addition, one study performed at 2006 with a prevalence of 16.3% in community [50]. Flichman, et al. [51] retrospective study carried out in blood donors in Argentina for the period from 2004 to 2011 found that anti-HCV was reduced from 0.71% in 2004 to 0.46% in 2011. Ethnic disparities persist with regards to the prevalence of hepatitis C in the Central California Valley and the reported prevalence may be underestimating because the study population enrolled only healthy volunteers [52]. HCV high prevalence was found in Native American (2.8%), followed by Caucasians (0.59%), Hispanics (0.45%), African Americans (0.38%) and Asians (0.2%). The overall prevalence of HCV is on the decline, but the isolated pockets of very high prevalence in different districts within the same country (for e.g. Italy, Punjab, Iraq...) pose a serious health care problem [53]. The reported studies indicated that HCV Seroprevalence decreased over time [7,5,1], our study demonstrated an increase in anti-HCV in 2013 as compared to 2012 and 2011. This illustrates such increased pockets in Iraq, which represent a serious health impact and thus a regional and national survey is warranted. In a Polish nationwide survey anti-HCV detected in 2.93% in an elderly population [54].

The Seroprevalence of Anti-HC Ab was not significantly in female as compared to male for 2011 and 2012. However, Anti-HC

Ab Seroprevalence was significantly ($X^2 = 8.94$, $P = 0.003$) higher in female (1.44%) as compared to male (0.57%). When the data of the 3 years pooled together, the Anti-HC Ab Seroprevalence was significantly ($X^2 = 6.83$, $P = 0.009$) higher in female (0.72%) as compared to male (0.41%), with male to female ratio of 0.57:1, however, Attalla, et al. [6] found higher prevalence of Anti-HCV in male (0.5%) than in female (0.3%) but the difference was not statistically significant in national population. The present study findings not agreed to that reported by others in Iran [55], Pakistan in blood donors, India in outpatients clinic visitors [56] and USA blood donors [52] as the prevalence was higher in male than female. In Egypt, higher HCV prevalence was detected in males compared to females among village residents [57] and blood donors [58]. In Pakistan, although the probability trends were slightly higher in males of all age groups than in females, the differences not statistically significant [47,59,60]. In a nationwide survey in Poland did not indicate a significant effect of gender on HCV prevalence [54].

The overall Seroprevalence of Anti-HC Ab was significantly ($X^2 = 35.5$, $P = 0.000$) different between age groups, with higher prevalence (1.62%) in the age group >45 years, followed by age group of 1-4 years (1.22%). In addition, the same patterns were demonstrated for 2013 and 2012 but not 2011. Furthermore, there was a significant difference in Anti-HC Ab between the study years in both age groups of 15-45 and >45 years. Thus our results indicated that HCV Seroprevalence peak in 1-4 years (1.22%) then decline and peak again in >45 years (1.62%). In the national population survey, anti-HCV Seroprevalence was 0.3% in age 0f 1-10 years and increased gradually with age to pear at of >40 years [6]. Shakeri, et al. [55] from Iran found that HCV prevalence was higher in those with age of 50 – 59 years; however, the mean age of their population study was 39 years. Prevalence of HCV peak at 55-64 in Central, East and Southern sub-Saharan Africa; Americas; Eastern Mediterranean; Asia; and Eastern, and Western, Europe; however, West sub-Saharan African the curve have two peaks, 1st at 15-19 years and 2nd at 55-64 years. In Western Pacific the pattern of Seroprevalence across age in Australasia exhibit a rapid increase in prevalence peaking 1st at 20-24 years and later in 55-64 years age. In addition, in Central Europe an early peak in ages 1-4 years is seen in Central Europe [14].

In a review for 2009 to 2011 in Canada reported that HCV Seroprevalence was higher in age of 50 to 79 as compared 14 to 49 years Rotermann, et al. [48]. In Egypt, the HCV prevalence increased dramatically with age with the highest rates observed among populations aged >40 years [45]. HCV prevalence of 4% to 7% was reported among Egyptian children from rural school children and attending outpatients clinics [60-62]. In a prospective study, maximum seropositivity of IgM anti HCV was in 10-20 years of age group of suspected cases of hepatitis and in 0-10 years of controls [63].

HCV prevalence was highest in the age group of 20-29 and 30 -39 years among general population of Lahore, Pakistan

[47]. In contrast to our findings HCV prevalence decreased in individuals with age of >40 years [59,64,65]. However, our study HCV prevalence was agreed to that reported by others [56]. The differences in HCV age related prevalence in different reported studies may be due to influence of the exposure to different risk factors, religious and social behaviors in different communities. For example, in Australasia, the estimated peak prevalence at ages 20-24 years may reflect the high incidence of HCV among persons who use injecting drugs reported recently [66,67].

Mother-to-infant transmission is the commonest route of transmission in children, with a vertical transmission rate of 5% [68]. Thus the higher HCV Seroprevalence in the ages of 1-4 years in our study population may be a reflect of high rate vertical transmission and an indicator of high infection in pregnant women. This finding could ascertain the need for a screening of pregnant women in antenatal period. This screening program is cost-effective, since the cost of HCV case treatment is more expensive [\$15000] than performing HCV screening for > 6000 samples [1].

The present study higher HCV Seroprevalence was higher in older age group (>45 years) which it was twice to that reported for general population in Iraq [6], however, it is lower to the mean of the prevalence in North Africa and Middle East [69,3]. Those are in adult age when the HCV screening programs are founded in Iraq (1995), which means they are not included in the screening program and thus with increasing age the prevalence increased due to both vertical and horizontal infections. In addition, during this period Iraq was under economic sanction and after the American occupation of Iraq, the disrupt the health care system. The shortage of materials and equipment for blood screening lead to that blood and blood products given to patients without screening [8]. Furthermore, the possibility of transmission via tattooing, piercing, Hujama, and health care settings due to that these practices conducted by unsafe healthy practices. Sexual transmission also may be implicated as cause that leads to high rate of HCV transmission because of the loss of monitoring program for HCV in prostitutes.

The impact of HCV on health and medical care in Iraq is a major problem for the community and infectious disease physicians as this study illustrate evolving of new epidemiological characteristics. There are insufficient data about HCV prevalence and prevention methods in most of the Iraqi Governorates. In Iraq, information about the prevalence of HCV infections has generally been limited to laboratory data and personal interest of research projects in certain education institutes. There is no national routine surveillance which represents the sound data source in the Iraqi community. To establish public health strategies for Iraq, well-programmed, population based and certain HCV infections at risk survey are needed in Iraqi community. Thus because of such problem, a national screening community based program on the basis of regional and sub-regional sampling are warranted.

Health care setting need to implement and address primary prevention programs and a grassroots programs and support is an essential in control and prevention of HCV infections in health setting.

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