

# Current Prevalence of HBV and HCV Seropositivity: The Initiative for Attentiveness and Deterrence of Viral Hepatitis in the Qassim Region of Saudi Arabia

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## Abstract

**Background:** The spread of hepatitis B virus (HBV) and hepatitis C virus (HCV) continues at an alarming worldwide. This pandemic has created a dramatic, often overwhelming, impact on many countries including Saudi Arabia. The present study aimed to identify the prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) between 2008 and 2010 among local populations of Qassim region in Saudi Arabia.

**Methods:** Serum samples were obtained from 8,082 subjects (4,041 males, 4,041 females), aged 20 years and over, who visited King Fahad Hospital (Buraidah, Qassim) between years 2008 and 2011, before getting married.

**Results:** In 2008, hepatitis B virus surface antigen (HBsAg) were detected in 21/2918 (0.7%) subjects and antibodies to hepatitis C virus (anti-HCV) were detected in 4/2918 (0.1%) subjects. In 2009, HBV and HCV positives raised to 1.5% (38/2528) and 3% (8/2528) respectively. In 2010, the incidence of HBV was 54/2636 (2.04%), while the HCV was found 22/2636 (0.83%). Keeping the verity of increasing prevalence of HBV and HCV for 2008-2010 into consideration, it is predicted to substantial increase in both HBV and HCV infection rates in next three years. As it is estimated, 12.5% male, 5.1% female and 17.7% male, 5.2% female would be infected with HBV and HCV respectively by the year 2013.

**Conclusions:** However, these results are restricted to a limited population of young couples above 20 years who were willing to get married, but reflect the current status within the Qassim region in Saudi Arabia. Moreover, this emphasizes the urgency of further cross-sectional studies of HBV and HCV in the region and as well as vaccination programs against HBV in order to reduce the prevalence of these infections. The control and prevention of HBV and HCV infections require continuous monitoring as well as evaluation of prevention and surveillance strategies.

**Keywords:** Prevalence; Hepatitis B Virus (HBV); Hepatitis C Virus (HCV); Saudi Arabia

**Abbreviations:** HBV: Hepatitis B Virus; HCV: Hepatitis C Virus; HBsAg: Hepatitis B Surface Antigen; HCC: Hepatocellular Carcinoma; WHO: World Health Organization

## Introduction

Viral hepatitis infections remain an important health and socioeconomic problem worldwide, despite continued progress in their prevention and treatment. Globalization has erased borders and put the threat of viral infections on the agenda of all governments, especially those in Asia, the Middle East, and Africa [1]. The periodic evaluation of epidemiological data is important to better assess the health status of populations and for preparing more accurate future health strategies.

The most common causes of chronic hepatitis in the world are HBV and HCV, and their transmission occurs generally through direct contact with blood, the utilization of intravenous drugs, blood transfusions and/or hemocomponents, and via sexual relations. However, sexual relations appear not to be the most frequent mode of HCV transmission [2,3]. Infection by these two viruses may induce chronic hepatitis, which may lead to cirrhosis, and eventually to hepatocellular carcinoma (HCC) [4-7]. According to the World Health Organization (WHO) estimates, one third of the world's population have been infected with the HBV virus and more than 350 million have chronic infection, which represents approximately 7% of the total population. Infection with HCV is found in approximately 3% of the world population, which represents 170 million people [8-10].

This high prevalence of HBV and/or HCV certainly results in high medical costs, due to a great number of cases of fulminating hepatitis, hepatic cirrhosis and carcinoma, with fatal consequences for a significant part of the population by these pathologies. As evident from previous studies, the co-infection by HBV and HCV is as frequent in Asia [11,12] as it is in western countries [13,14], varying from 10% to 15% of patients who are chronically infected by HBV. Patients infected simultaneously by HBV and HCV more frequently manifest the more severe hepatitis diseases and are at a significantly greater risk of developing fulminant hepatitis, hepatic cirrhosis and carcinoma [15,16]. This is particularly true in the underdeveloped and/or developing countries, where the prevalence of simultaneous infections by these viruses appears to be higher. Chronic hepatitis B is an important medical problem in Saudi Arabia as Al-Faleh et al. in the late 1980's showed that up to 7% of Saudi children were positive for HBsAg. The incidence of hepatitis B infection has declined to as low as 0.3% since the introduction of universal vaccination of all

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Saudi children in 1989. In spite of this remarkable decline, the burden of decompensated liver disease secondary to hepatitis B is estimated to increase drastically in the next 40 years as the previously infected children start aging [17,18].

In this observational study of 8,082 subjects, we aimed to estimate the prevalence of HBV and HCV among the population of Qassim region in north-central Saudi Arabia. The study was conducted in a population of adult couples who were willing to get married, and serum was evaluated for the prevalence of HBsAg and anti-HCV markers for the calendar years 2008 to 2010.

## Methods

Each subject was examined by a physician and the data was recorded in an electronic chart followed by the screening for HBsAg and anti-HCV antibodies.

## Serum samples

The serum samples were collected from 8,081 individuals (4,041 males and 4,040 females; age, 20 years and above) between 2008 & 2010 and stored at -20°C or below until analysis. HBV marker: HBsAg was determined by using commercially available ELISA (Monalisa™ HBs Ag ULTRA, Bio-Rad). HCV marker: anti HCV antibodies were determined by ELISA (Murex anti-HCV, version 4.0, ABBOTT Diagnostics).

## Statistical analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS).

## Results

### Prevalence of HBV markers

Hepatitis B surface antigen prevalence was 0.7% or 21 of 2918

individuals tested, in the first year (2008) of screening (Table 1, Figure 1a). The analysis of the data shows that the large numbers of HBsAg positive male subjects (0.9%) were registered in comparison to female (0.5%) irrespective of insignificant difference statistically (Table 1, Figure 3). The 28.57% of HBV positive registered individuals were between the ages of 20-24 years and 61.9% between 25-35 years while 9.52% were aged of 36 and above (Figure 2a). In 2009, HBsAg was detected in 38 (28 males and 10 females) of 2528 individuals, which corresponds to a prevalence of HBV of 1.5% (Table 1, Figure 1a). As depicted in table 1, the significant difference ( $p=0.0047$ ) was noticed between HBV positive males (2.2%) females (0.8%) subjects (Figure 3). As evident from figure 2b, the age of 23.68% HBV infected subjects were between 20-24 years while 55.26% and 21.05% infection was recorded between the age of 25-35 & 36 years and above respectively.

In 2010, the increasing prevalence (2.0%) was found and consistently, significant difference ( $p=0.00015$ ) was observed between male (3.1%) and female (1.0%) subjects' positive to HBsAg (Table 1, Figure 1a). It was estimated that 14.81 % infected individuals were between the age of 20-24 years while it was estimated that 61.11 % and 24.07% was registered between the age of 25-35 & 36 years and above respectively (Figure 2c). Entirely, hepatitis B surface antigen prevalence was recorded 1.4% or 131 individuals of total 8082 subjects tested during the course of the study. Considerably, the large numbers ( $p=0.000001$ ) of HBsAg positive subjects were male (2.0%) in comparison to 0.8% female (Table 1).

### Prevalence of antibodies to HCV

Prevalence of antibodies to HCV were found in 4 (0.1 %), 3 males and 1 females of 2918 subjects tested in the first year (2008), of our study (Figure 1a) and difference though not significant ( $p=0.6247$ ) was registered in male (0.2%) and female (0.1%) subjects positive for HCV (Table 1). The prevalence of HCV was found as 50% in the 20-24 age group and 50% were recorded as 25-35 years (Figure 2a). In the second

Year	Sex	# Subjects	HBV+	% HBV+	p-value	HCV+	HCV+	p-value
2008	M	1459	13	0.9%		3	0.2%	
2008	F	1459	8	0.5%		1	0.1%	
2008	Both	2918	21	0.7%	3.82E-01	4	0.1%	6.25E-01
2009	M	1264	28	2.2%		5	0.4%	
2009	F	1264	10	0.8%		3	0.2%	
2009	Both	2528	38	1.5%	4.78E-03	8	0.3%	7.26E-01
2010	M	1318	41	3.1%		19	1.4%	
2010	F	1318	13	1.0%		3	0.2%	
2010	Both	2636	54	2.0%	1.51E-04	22	0.8%	8.16E-04
All 3	M	4041	82	2.0%		27	0.7%	
All 3	F	4041	31	0.8%		7	0.2%	
All 3	Both	8082	113	1.4%	1.47E-06	34	0.4%	8.02E-04

HBV: Hepatitis B virus; HCV: Hepatitis C virus

**Table 1:** Prevalence of HBV and HCV in the population studied for the year 2008 to 2010.

Infection	Variable	log OR	OR	Std. Error	z value	Pr(> z )
HBV	(Intercept)	-718.21		172.15	-4.17	3.02E-05
	Year	0.50	165%	0.12	4.14	3.41E-05
	Sex=M	0.99	268%	0.21	4.65	3.25E-06
HCV	(Intercept)	-1330.97		357.15	-3.73	1.94E-04
	Year	0.93	252%	0.25	3.71	2.08E-04
	Sex=M	1.36	389%	0.43	3.19	1.41E-03

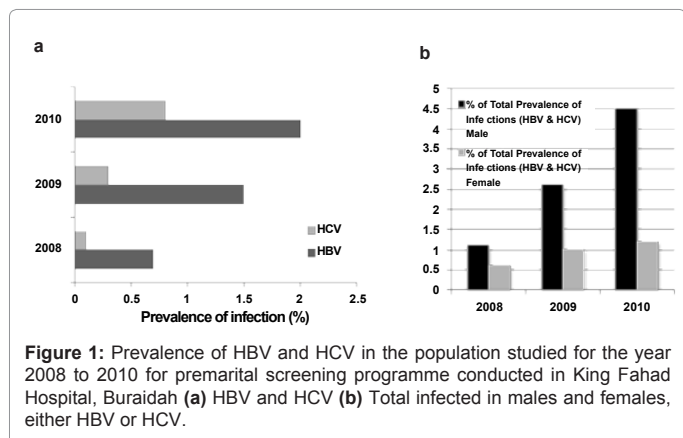
HBV: Hepatitis B virus; HCV: Hepatitis C virus

**Table 2:** Relationship between study year and gender on infection rate of HBV and HCV.

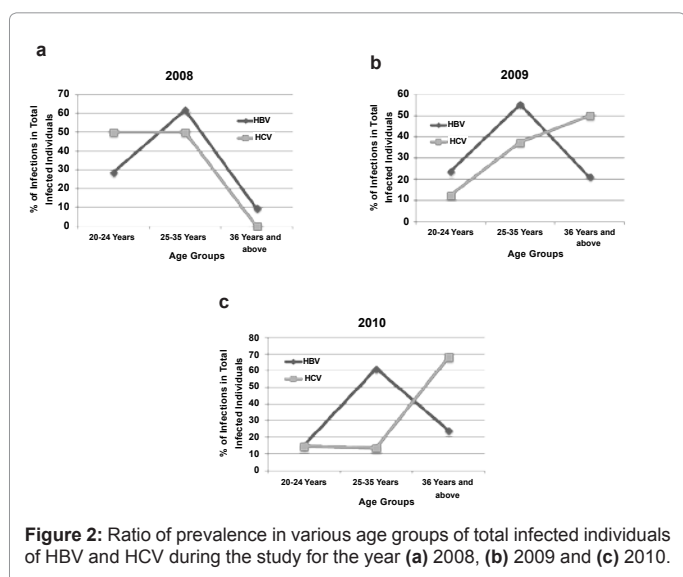
year (2009) of our analysis, the increasing incidence of HCV was found 8 (0.3%), 5 males and 3 females of 2528 (Figure 1a). Persistently, a difference irrespective of statistically significant ( $p=0.7261$ ) was observed in male (0.4%) and female (0.2%) prevalence of HCV (Table 1).

The prevalence of HCV was recorded 12.5% in the subjects between the age of 20-24 years and 37.5% in the age group of 25-35 years (Figure 2b). Surprisingly, it was estimated that the prevalence of HCV positives between the age of 36 years and above was registered 50% of total HCV infected subjects (Figure 2b). In the final year of the study, the prevalence of HCV was much higher and it was 0.8% or 22 (19 males and 3 females) of 2636 subjects and the significant difference ( $p=0.0008$ ) between males (1.4%) and females (0.2%) positive subjects was registered apparently (Table 1, Figure 1a). The prevalence of HCV was 14.81% in the age group of 20-24 years while it was 13.63% in 25-35 years age group (Figure 2c). Remarkably, the prevalence of HCV positive was registered 68.18% of total HCV positives in the age group of 36 years and above (Figure 2c). The total prevalence of HCV was 0.4% during the course of our study and significant difference ( $p=0.0008$ ) was recorded between males (0.7%) and females (0.2%).

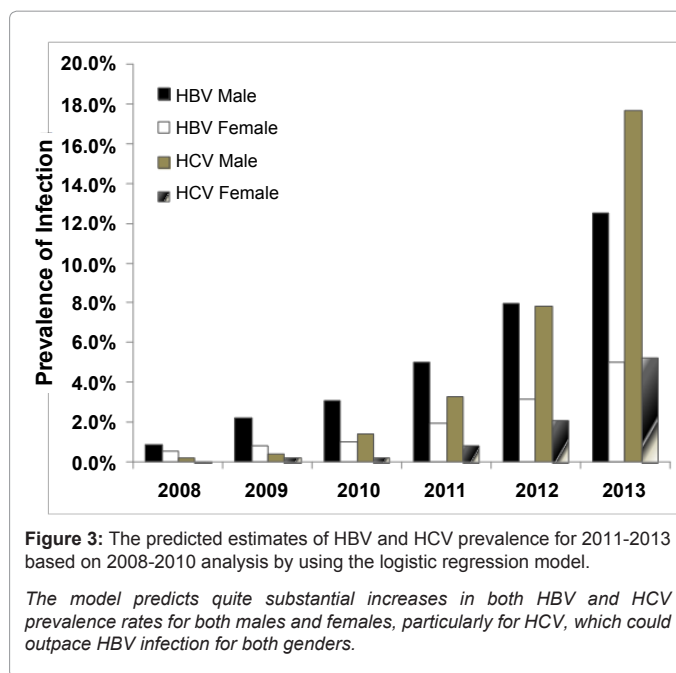
As depicted in figure 1b, the prevalence of total infected subjects (HBV or HCV) was 1.1% in males and 0.6% in females while it was found to be 2.6% of males and 1.0% of females in 2009. In the final year



**Figure 1:** Prevalence of HBV and HCV in the population studied for the year 2008 to 2010 for premarital screening programme conducted in King Fahad Hospital, Buraidah (a) HBV and HCV (b) Total infected in males and females, either HBV or HCV.



**Figure 2:** Ratio of prevalence in various age groups of total infected individuals of HBV and HCV during the study for the year (a) 2008, (b) 2009 and (c) 2010.



**Figure 3:** The predicted estimates of HBV and HCV prevalence for 2011-2013 based on 2008-2010 analysis by using the logistic regression model.

The model predicts quite substantial increases in both HBV and HCV prevalence rates for both males and females, particularly for HCV, which could outpace HBV infection for both genders.

(2010) of our screening, the prevalence of HBV or HCV was 4.5% in males and 1.2% in females).

## Discussions

HBV and HCV infections account for a substantial proportion of liver diseases worldwide and significant problem in public health. Despite progress in the diagnosis and treatment of viral hepatitis, their occurrence is still high in some parts of the world. In the context of globalization, which currently facilitates the large-scale spread of disease more than ever, all regions are exposed to the risk of viral infections [19,20]. The nonexistence of an anti-HCV vaccine amplifies the risk of HCV transmission and explains why the incidence of HCV infection is still increasing all over the world. This is the reason why periodical reevaluation of epidemiologic data is necessary in all countries [21,22]. Saudi Arabia has been classified as a country with an intermediate prevalence of both hepatitis B and C, based on surveys using blood donors. In the present study, we observed significantly increasing prevalence 0.7%, 1.5%, 2.0 % of HBV in 2008, 2009, 2010 respectively, in the premarital screening programme conducted in King Fahad Hospital, Buraidah in Qassim region. The study indicate that 2.04% were found positive for HBsAg which is lower than that reported in the eastern region (6.7%) and the southwestern region (5.4%), but higher than that reported from the central region (1.5%) of Saudi Arabia [23,24]. This prevalence is higher than that reported from Western countries (0.1-0.5%), but lower than that from the Far Eastern countries [25,26]. Previous studies signify that the prevalence of HBsAg among blood donors has been found to be 9.8% in Yemen, 3.8% in Syria, 1.2-1.7% in India and 1.2% in Egypt [27-30].

The prevalence of HCV in Qassim region was found to be 0.1%, 0.3%, 0.8% in 2008, 2009 and 2010 respectively. This is comparable with other low-risk populations such as those in Northern Europe (0-4 per cent in the United Kingdom) [31]. It was lower than for other areas (1-4 per cent and 2 per cent in the USA and Japan) [32,33]. Also, this prevalence is much less than that of neighboring countries, such as Egypt; 16-18% [34].

As sketched in table 2, the results of logistic regression of infection versus year and sex show a strong relationship between study year as well as gender on infection rate ( $p < 0.001$  in all cases). Affect of each study year on infection is 165% for HBV and 252% for HCV. In addition, males show 268% stronger likelihood of HBV infection than females, and 389% more for HCV. A chi-squared test showed an acceptable generalized linear model fit using a binomial distribution with logit link function ( $p < 1e-6$  for both HBV and HCV). Conspicuously, we calculated predicted estimates of HBV and HCV infection for next three (2011-2013) based on the previous 3 years study for 2008-2010 using logistic regression model. The model predicts quite substantial increase in both HBV and HCV infection rates for both males and females, particularly for HCV, which could outpace HBV infection for both genders (Figure 3).

As discussed above, the study was restricted to couples who participated in premarital screening and this may be one of the explanations for low-risk populations. Secondly, Saudi Arabia is a low-risk population in terms of drug abuse and sexual promiscuity (apparently) owing to strict legislation and enforcement. Since donors are not less than 20 years of age, it was difficult to assess the minimum age of acquisition of HBsAg or antibodies to HCV. Unfortunately, it cannot be determined which of these explanations play a larger role, unless the study is done on the general population.

The number of HBV and HCV positive males versus females was significantly higher in the entire study population. Differences between the sexes may be due to lifestyle differences, such as sexual promiscuity and trivial exposures among males. Though the actual cause is not known, it is traditionally thought that the main route of transmission is generally via the parenteral route (59 per cent of cases in one study) [35]. This includes surgical operations, unsanitary ear piercing and intravenous drug abuse. Sexual routes may play a minor role [36], though in a study involving prostitutes in another country, this constituted the main source of infection [37].

The highest prevalence of HBV was registered in the age group of 25-35 years. It is usually in the earlier half of the second decade that male population initiates their career, becomes socially and sexually active. Notably that most of the subjects in the screening were also from the age group of 25-35 years (Data not shown). Shockingly, the prevalence of HCV in the final year of study was registered as 68.2% of total HCV positives being in the 36 years and above age group. Detailed epidemiological studies are required to correlate these observations with prevalence of Hepatitis B and C.

El-Beltagy et al. (2008) [38] have indicated that family history of HBV infection was found to be significantly associated with HBV prevalence. This result could be due to the close contact between family members especially children and adolescents. Shared towels, shaving items, toothbrushes are common among families of a lower socioeconomic level. Al-Faleh et al. (1999) [17] acknowledged that HBV infection in Saudi Arabia is acquired mainly by horizontal transmission early in life.

## Conclusions and Recommendations

The control and prevention of HBV and HCV infections require continuous monitoring as well as evaluation of prevention and surveillance strategies. The surveillance and prevention of HCV is still more challenging than that of HBV because the infections of HCV are generally asymptomatic and may remain undiagnosed for a long time and there is no vaccine available against HCV as well. Despite

significant improvements in hygiene practices, screening, education messages, sterile needles, as well as blood transfusion safety and blood product treatment, the incidence of HCV infection continues to rise in Saudi Arabia. The increasing development cannot be easily interpreted as it may also partly reflect the results of intensified screening activities, improved surveillance, and accurate testing methods. Keeping these views into consideration, HCV to be an increasing public health concern in Saudi Arabia in the coming decades, calls for appropriate public health action.

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## Ethical Approval

All the subjects included in the study gave the informed consent to the work.

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