

## Original Paper

# Hepatitis A in Kerbala: Eight Year Epidemiological Study

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## Abstract

**B** **Background:** Viral hepatitis is a contagious disease that continues to be a global burden. We have noticed from our clinical practice that the number of cases is growing especially in Kerbala Province.

**Aim:** we conduct this epidemiological study in Kerbala Province to investigate the incidence rate of Hepatitis A infection and to have an insight to the causative factors in view to addressing them and tackle this big health problem.

**Method:** Data from The Infectious Diseases Registration Office in Kerbala health directorate was revised to review all registered hepatitis cases between 2010 and 2017.

**Results:** of 9352 hepatitis patients, (58.8%) males and (41.2%) females registered in Kerbala Health governorate in eight years (2010-2017). Hepatitis A formed the majority of cases (61.7%) followed by hepatitis B and C. Converting frequency to incidence rates showed that the annual rate of the four main types of hepatitis were 0.069, 0.028, 0.013, 0.001 per 100,000 population, respectively. The incidence of hepatitis A rates in 2010-2017 in Kerbala fluctuated, however the median endemic was rising. Within the four main geographical areas in Kerbala (City Centre, Hindia, Al Hussainia and Hurr) the incidence of hepatitis A per 100,000 population was markedly higher in the city Centre.

Children and adolescents were the mostly affected age groups as they formed more than three quarters of the patients, but there was no significant gender difference. Seasonal variation was very clear as summer months were marked with significant increase in incidence rates.

**Conclusion:** Being a holy city where millions of pilgrims visit Imam Hussein (PUH) shrine appeared to play an important role in disease transmission where propagations started after religious occasions. Decision makers need to address the serious health issue and implement a more proactive plan for the near future.

**Keywords:** Viral hepatitis, Hepatitis A, Incidence, Primary Health Sector

## Introduction

Hepatitis A is an inflammation of the liver caused by hepatitis A virus (HAV) infection. <sup>(1)</sup> The virus is a single-stranded RNA genome belong to Hepatovirus and a member of Picornaviridae family. The virus shows stability in temperature and has acid resistance. <sup>(2)</sup> It transmitted through contact with the faeces of people infected with HAV <sup>(2)</sup>. This can be happened either by direct contact with faeces or indirectly by consuming food or water that has been contaminated by faecal matter of the

infected person. The replication of the virus in the hepatocytes leads to activation of the immune system and cause an inflammation of the liver. Hepatitis A infection in adults tend to progress to more complicated squali than in children. Common symptoms of hepatitis infection include fever, fatigue, abdominal pain, nausea, vomiting, and jaundice (yellowing of the skin and eyes). Symptoms usually appear 2 to 6 weeks after exposure <sup>(3)</sup>. Hepatitis A is self-limiting disease and unlikely cause chronic liver disease; in contrary to hepatitis B and C infection. Some people have mild

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symptoms to extent that they are not aware of the infection while others may develop complications like fulminant hepatitis, acute kidney injury, and even death in some cases.<sup>(1)</sup> Once someone has had this infection, the body produces antibodies that prevent reinfection and provide a lifelong immunity.<sup>(3)</sup>

Hepatitis A infection continues to be a burden across the continent especially developing countries including Iraq. The annual cases of HAV are 1.4 million across the globe; regions where risk factors can spread the disease record high incidence rate. <sup>(4)</sup> In developed countries hepatitis A infection during childhood is decreasing as a result of improved general hygiene; <sup>(5)</sup> However, there has been a new pattern of outbreak among young adults.<sup>(6)</sup>

Kerbela Governorate is located in the central part of Iraq. The Holy City of Kerbela is a cosmopolitan city. Total area is 5,034 km<sup>2</sup> (1,944 sq mi), the number of people inhabit the governorate in 2017 is 1210577 individuals according to the Central Governorate Statistical Centre. Annually this city hosts a large number of pilgrims from all over the world; which makes it overcrowd in various times of the year. Meeting this huge number of pilgrim's demands is a big challenge to Kerbala governorate infra-structure system. Assessing the epidemiology of the HAV in this governorate is vital. Hence, we are conducting this study to evaluate the burden of HAV infection in Kerbela over the period 2010- 2017. In addition, revising the solid evidence that emerging from high quality studies across the globe confirming the effectiveness of HAV vaccine in preventing the disease and the safety of its administration to the adult individuals and children above the age of 12 months.<sup>(7)</sup> This will be the near future step that we need to consider to tackle this problem. In a systematic review of published studies, the protective effects of HAV vaccine was observed for up to 15 years after vaccination;<sup>(8)</sup> and a more recent analysis

demonstrated a high level of sero-protection for at least 20 to 30 years.<sup>(9)</sup>

### Objectives

- 1- Assess the incidence rate of positive hepatitis A viral marker in Kerbala governorate over 8 years from 2010- end of 2017
- 2- Investigating the relation between some demographic variables to the risk of contracting HAV. Those variables include age group, sex, occupation, place of residency (PHC).
- 3- To our knowledge this is the first study provides such a thorough insight to this preventable infection over a long period of time from 2010 until end 2017 and based on very well documented and reliable confirmed data.
- 4- This review will provide an enormous asset to any health professionals, policy decision makers or planner through the insight and the recommendations that we will offer to put an effective action to tackle this serious preventable problem.

## Materials and Methods

### Study Population

All Kerbela resident patients who presented to Al Hussieny Teaching Hospital, Paediatrics Hospital, Maternity and Obstetrics Hospital, Central Public Health Laboratory, Blood Bank and all the Primary Health Care centres across Kerbala governorate with jaundice or signs and symptoms suggestive of acute viral hepatitis were included in the study

### Case Definition and Criteria of Inclusion

The individuals who included in this study had a positive blood test for HAV; Serology (HAV-specific IgM and IgG antibodies) <sup>(10)</sup>. First test performed at the hospital or health centres then a confirmatory test is performed at the Public Health Laboratory in Kerbala and a final confirmatory test is done at the Central Public Health laboratory in Baghdad.

This study involved individuals of different gender and included children and adults.

Age was divided into five groups: less than one year, 1- 4 years, 5- 14 years, 15-45 and >45 year.

Study population were divided into four groups based on their place of residence according to Primary Health Care Sectors (PHC) in Kerbala (Kerbala Centre PHC, Hindia PHC, Hussainia PHC and Hurr PHC).

### **Study sample**

All eligible subjects recorded during the eight years study period extending from beginning from 1st January 2010 to 31st December 2017 were included in the study.

### **Data collection**

The infectious diseases registration system data base in Kerbala health directorate was revised to review all registered hepatitis cases between 2010 and 2017. All available information about hepatitis cases were entered into an Excel data base and all variables were coded including age, sex, occupation, place of residency and then entered into an SPSS data base for analysis. Additional information was obtained from the annual reports of the Iraqi Ministry of Health between 2010 and 2016.

### **Laboratory investigation**

The blood sample tested by the enzyme-linked Immunosorbent Assay (ELISA), sample of suspicious patients send to the central Health Laboratory in the governorate of Kerbala. Positive samples had a repeated confirmatory tests by more advance machine from Roche (COBAS). 10% of the positive results will send for further confirmatory ELIZSA test and PCR in the Central Laboratory Of Ministry Of Health in Baghdad according to establish agreement by Ministry of Health.

## **Results**

Total number of viral hepatitis over the period of the study from 2010-2017 was 9352. The distribution of the type of hepatitis virus showed that hepatitis A virus infection was the main type of hepatitis virus infection in Kerbala (61.7%)

compared to hepatitis B (25.2%), hepatitis C (11.7%) and hepatitis E (1.2%) figure 1). A total of 5771 cases of hepatitis A were registered in Kerbala governorate between 2010 and 2017, making an average of 571.75 cases per year. The average age of patients was 9.80 year. Summary of the analysis of demographic characteristic of the patients revealed male, children-adolescents and those living in the city centre predominance (table 1).

### **Annual distribution**

The total mean incidence rate of hepatitis A in Kerbala governorate between 2010 and 2017 was 0.064 per 100,000 population. The number of recorded cases of Hepatitis A in Kerbala in 2017 was 383 with incidence rate of 0.031 per 100,000. In 2014-2016 the incidence rates were 0.053, 0.068 and 0.074, respectively. However, the median endemic index has increased from 685 to 796 cases in the last five years. The highest record 0.104 was in 2013 as shown in table 2 and figure 2.

### **Gender**

The results showed that males formed the majority (54.6%) of the cases while the female percentage was 45.4%, with male to female ratio of 1.20 (Figure 2), but the difference was not significant.

### **Age distribution**

For age distribution, those below 15 year of age were the main affected group with more than three quarters of total cases (figure 3).

### **Geographical distribution**

The incidence of hepatitis A for the total reviewed period was highest in Kerbala Centre PHC of 0.102 followed by Hurr and then Hussainia with 0.052, 0.046 respectively. Hindia PHC recorded the lowest percentage of 7.8% of total number of cases (table 3, figure 4).

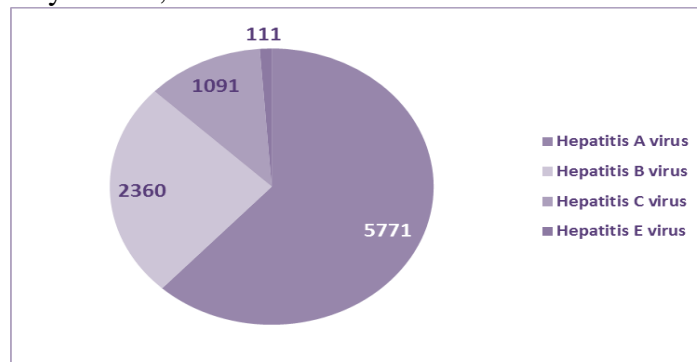
Looking at the frequency of the HAV cases over the years in each sector showed that the incidence rate was continuously the lowest, and the rates in 2017 were the lower than the previous years. The Hurr PHC constantly recorded the second highest incidence rate (0.052 per 10,000) over the years after the City Centre PHC, and

fluctuations were almost similar in the four sectors, but the rates peaked in 2013 (figure 5).

**Seasonal variation**

The monthly distribution of hepatitis cases in the governorate showed significant differences in the incidence rates across the different months in the sectors, with peak incidence during July 1.414, June 0.8

(figure 6). Revision of the monthly incidence of hepatitis A showed a consistent temporality with the religious mass gathering occasions in Kerbala governorate. There was no significant difference between male and female cases in relation to the monthly distribution value as shown in figure 6.



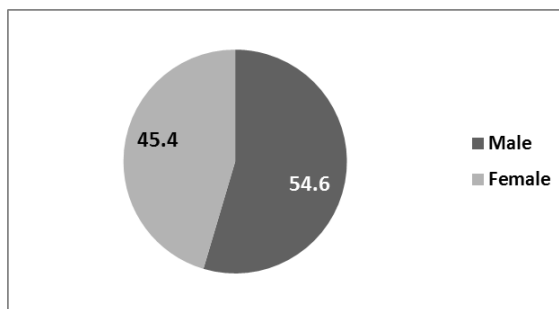
**Figure 1.** The type of Hepatitis virus infection in Kerbala governorate between 2010 and 2017 (n=5771)

**Table 1.** The demographic characteristic of the patients with HAV in Kerbala governorate between 2010 and 2017 (n=5771)

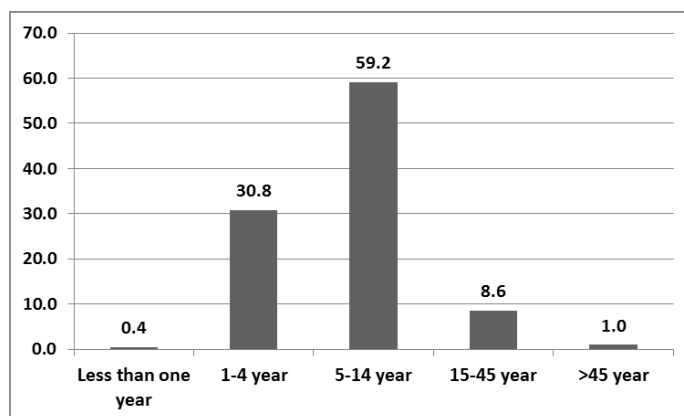
Variable	Category	Frequency	Percentage
Age Category	Less than one year	22	0.4
	1-4 year	1267	30.8
	5-14 year	2826	59.2
	15-45 year	401	8.6
	>45 year	50	1.0
Gender	Male	2492	54.6
	Female	2074	45.4
Primary Health Sectors	Kerbala Centre PHC	2861	66.7
	Hindia PHC	425	7.8
	Hussainia PHC	381	7.4
	Hurr PHC	899	18.1
Total		5471	100.0

**Table 2.** The annual distribution of hepatitis A in Kerbala governorate between 2010 and 2017 (n=5771)

Year	Frequency	Percentage	Incidence per 10000
2010	556	9.6	0.055
2011	685	11.9	0.066
2012	719	12.5	0.067
2013	1139	19.7	0.104
2014	603	10.4	0.053
2015	796	13.8	0.068
2016	890	15.4	0.074
2017	383	6.6	0.031
<b>Total</b>	5771	100.0	0.064



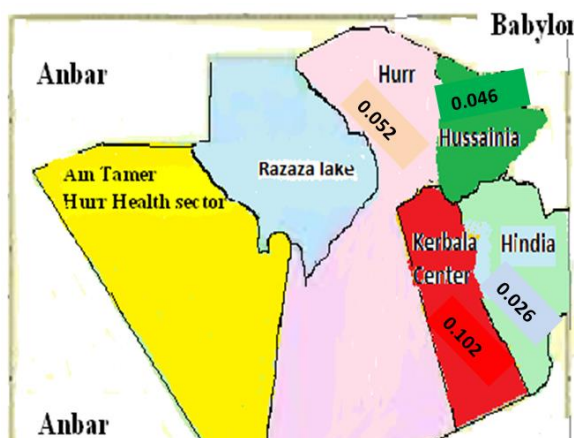
**Figure 2.** The gender distribution of hepatitis A cases in Kerbala governorate between 2010 and 2017 (n=5771)



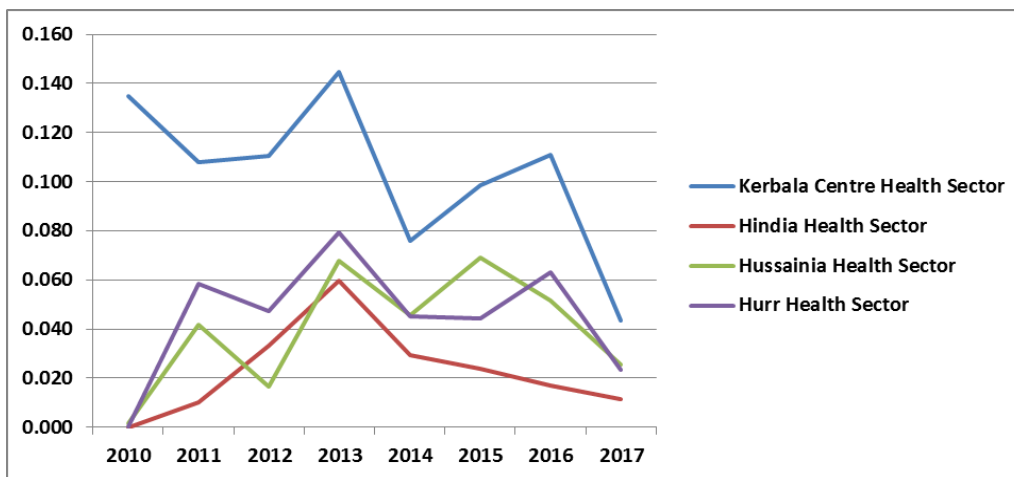
**Figure 3.** The age distribution of hepatitis A cases in Kerbala governorate between 2010 and 2017 (n=5771)

**Table 3.** The geographical distribution of the incidence rate of HAV cases in Kerbala governorate between 2010 and 2017 (n=5771)

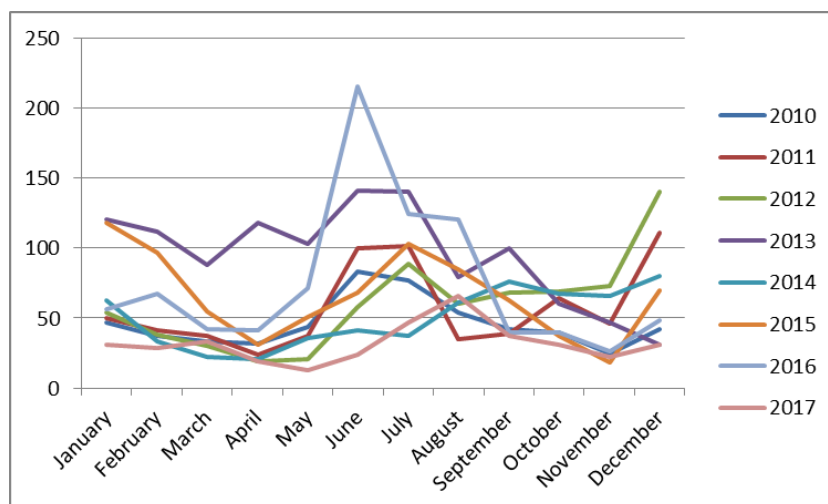
Primary PHC in Kerbala Governorate	Frequency	Percentage	Incidence
Kerbala Centre PHC	3808	66.7	0.102
Hindia PHC	444	7.8	0.026
Hussainia PHC	424	7.4	0.046
Hurr PHC	1035	18.1	0.052
Total	5771	100.0	0.069



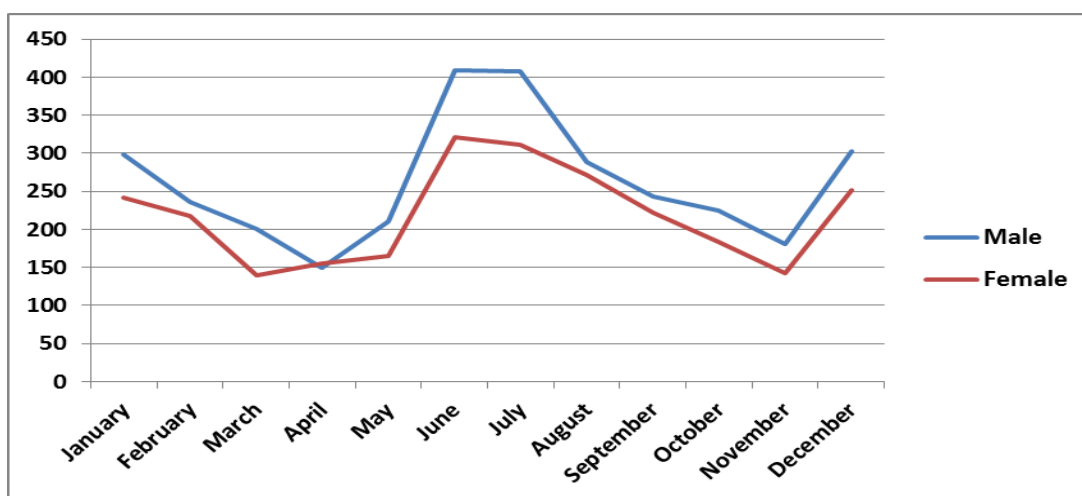
**Figure 4.** The geographical distribution of the incidence rate of HAV cases in Kerbala governorate between 2010 and 2017 (n=5771)



**Figure 5.** The geographical distribution of the annual incidence rate of HAV cases in Kerbala governorate between 2010 and 2017 (n=5771)



**Figure 6.** The monthly distribution of hepatitis cases among the primary PHCs in Kerbala governorate between 2010 and 2017 (n=5771)



**Figure 7.** The monthly HAV infection in Kerbala governorate between 2010 and 2017 according to gender (n=5771)

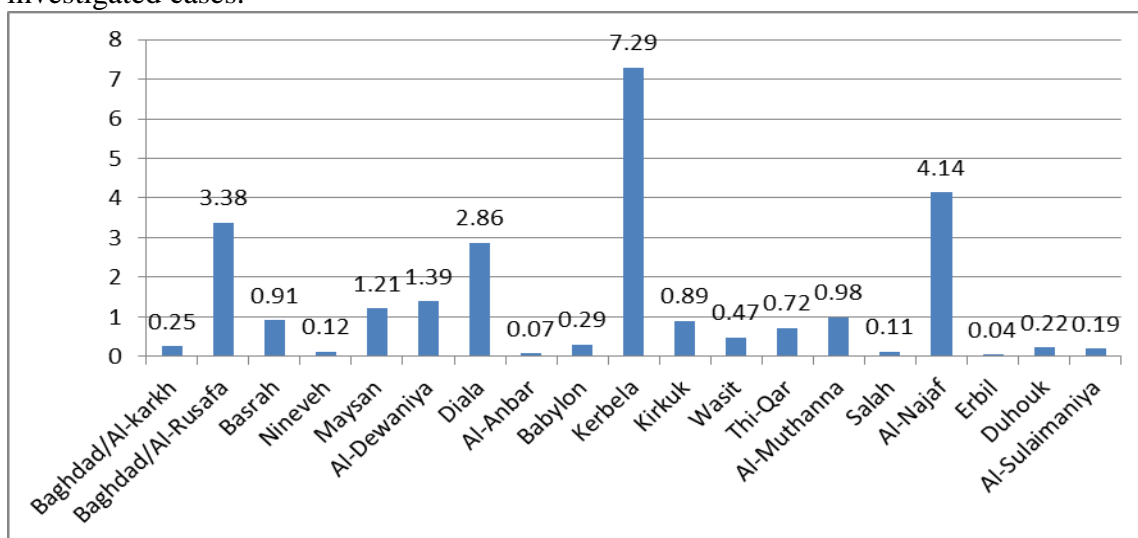
**Occupation**

Children and students formed the great majority of cases (95.4%). Small proportions were house wives or private workers (1.3%), while a small proportion was formed by other categories.

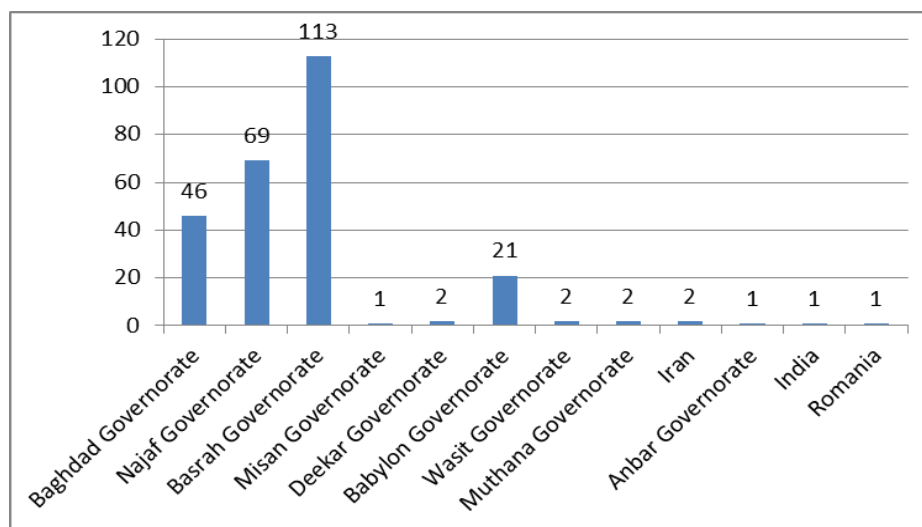
Among those where the source of referral was reported, about two thirds (58.8%) of cases were referred to be tested from the central public health laboratory while only one third (31.7%) were referred from Kerbala paediatric hospital. The mortality rate was 0.12 per 1000,000 as there was only one reported death in all the investigated cases.

The comparison of the incidence rates of hepatitis A in Kerbala governorate and other Iraq governorates in 2016 as, an example; showed that Kerbala governorate reported the highest incidence rate which was more than double the incidence in the country (3038 per 10,000 population). Next governorate in incidence was Najaf governorate which is also visited by millions of pilgrims (figure 8).

There were 261 case of hepatitis whose residence was outside Kerbala governorate mostly from other governorates in Iraq (figure 9).



**Figure 8.** The incidence of hepatitis A per 10,000 population in different governorate in Iraq in 2016 (n= 2698) <sup>(11)</sup>



**Figure 9.** The residence distribution of hepatitis A cases in Kerbala governorate whose residence is outside Kerbala between 2010 and 2017 (n=261, 4.5% of total cases)

## Discussion

Over the eight years of our study there were 5771 cases of viral hepatitis A, which is similar to the incidence in the surrounding countries (Iran, India, Pakistan and Gulf countries<sup>(12, 13)</sup> This just reflect the huge burden that this disease will imply on our country in every aspects as a whole and its implications on the infected persons and their families. If we try to assess the economic burden of hepatitis A infection in adolescents and adults considering the lost work hours costs as a result of morbidity (work absences which has an effect on the national economy if the infected person is a state employee or a personal income problem if the patient is self-employed). In addition, the cost of medical interventions including hospitalization, physicians, health workers, investigations and drug therapy. Also the inability to perform the housekeeping tasks especially for the female patients is another issue that should not be overlooked because of its vital impact on the family member's emotional stability. One study in the United States investigated the influence that HAV infection may have on the economy, taking into account the cost of the medical management, morbidity and mortality; the outcome of this analysis was that the annual cost of hepatitis A infection was estimated at \$488.8 million.<sup>(14, 15)</sup>

The annual incidence of HAV infection since 2010 – 2017 has increased over the years as indicated by median endemic index as shown in table 2; and this finding was suggested in many published studies.<sup>(16, 17)</sup> However, In 2013 the incidence peaked to 0.104 and this marching the outbreaks that reported by many other countries like in Europe especially in France and Italy; The USA had a similar outbreak.<sup>(18)</sup>

The decline in the incidence rate in Kerbala may be attributed to either increase the public awareness about the disease due to the shifting of the age group that contracting the infection; therefore, more infected symptomatic teenagers than young

asymptomatic children. In addition, the implementation of Hepatitis Prevention Programme by the Iraqi Ministry of Health since 2010 may had an impact; Unfortunately due to lack of resources the programme was not fully implemented and in need for updating.

Figure 5 showed clearly that summer months were associated with higher incidence of hepatitis A in Kerbala and this result was also noticed in most reviewed studies in other counties<sup>(19)</sup>. This is more likely related to the environmental factors mostly the higher mean temperature and hot weather in Kerbala in these months when people tend to consume more ice cream, cold and frozen drinks, beverages, tap water and fresh or frozen fruits. All would contribute in spreading HAV. The European hepatitis A outbreak in 2013 was believed to be associated with mixed frozen berries, raw shellfish.<sup>(18)</sup>

The clinical presentations of infected individuals with HAV vary significantly with age; ranging from asymptomatic or very mild symptoms in more than 50% of infected children under the age of 6 year to 5% in children before 4 years to 10% in those between 4-6 years with hepatitis symptoms up to 75% of infected adults with recognized hepatitis symptoms<sup>(20, 21)</sup>. Therefore, Children play an important role in HAV transmission. Children generally have asymptomatic or unrecognized illnesses, so they may serve as a source of infection, particularly for household or other close contacts<sup>(22)</sup>.

As regards the geographical distribution of HAV infection in Kerbala as shown in table 3 and figure there was an obvious variation among the sectors. This may be related to the socioeconomic status.<sup>(20)</sup>The standard of living in different sectors in Kerbala governorate varies from high to very low one. In the latter people live in urban slums with very poor sanitary conditions, household crowding and inadequate water supplies; Field visits showed that some inhabitants drink water from wells, streams, canals, rivers and ponds contaminated

directly from cesspools and sewers<sup>(23)</sup>. Faeco-oral contamination of drinking water will result in the propagation of the virus among them.<sup>(24, 25, 26)</sup> This might explain the high incidence of HAV in Hurr PHC. While in Kerbala Centre PHC where the standard of living was much better the reported cases of HAV infection were much higher than other sectors in Kerbala; This likely due to the high influx rate of pilgrims and tourists from all over the world. There were 261 cases of hepatitis whose residence was outside Kerbala governorate mostly from other governorates in Iraq (figure 8, 9). The revision of the monthly incidence of these cases revealed a coincidence with the important religious occasions characterized with mass gathering in the governorate<sup>(11)</sup> This finding also observed by previous studies<sup>(27)</sup>

There was no significant difference between male and female in contracting HAV, while in some developing and developed countries there were outbreaks in male community, largely because men have sex with men MSM<sup>(28)</sup> Our study result similar to other studies that student at high risk of HAV infection<sup>(29)</sup>.

Unfortunately, Karbala had the highest recorded cases of HAV in comparison to other governorate in Iraq as showed in figure<sup>(8,9)</sup>.<sup>(11)</sup> Obviously, this finding is likely the result of the entire issues that discussed above but surely infected foreign visitors had an impact as well.<sup>(27)</sup>

One important limitation of this study is the lack of follow up information and poor hospital data which is needed to complete the descriptive picture of the clinical side of the problem.

## Conclusions

Based on the thorough analysis of all the evidence that we had about HAV infection; we can conclude that HAV is the predominate type of viral hepatitis in Kerbala; it's account for 61% of total viral hepatitis cases. We expect that the incidence rate is even higher than the

recorded one; mainly because of the patients underrepresentation to the hospital due to the nature and modesty of the disease symptoms especially in younger children thus less notification. The role of young children in spreading the infection is underestimated.

The cosmopolitan city of Kerbala is at high risk of HAV infections due to the huge demand of ever expanding province and the enormous number of visitors whether tourists or pilgrims traveling to Kerbala on several occasions each year. This eventually straining the province infrastructure and make it a hot spot of such a highly communicable disease. Children and adolescents are the main victims as they represented more than three quarters of cases. The disease carries a low mortality rate but great morbidity burden which necessitate urgent wide intensive preventive measures to cope with this epidemic.

## Recommendations

Increase public awareness thorough hand washing after toilet use and before food preparation, is the cornerstone of prevention especially people who are highly spreading the disease like food handler.

Active governmental plan to improve infrastructure, this involve water supply, maintain the water pipes and improve swage system

Hepatitis A can be prevented by vaccination, therefore, an active vaccine campaign need to be initiated by governmental bodies and policy planner.

Visitors need to have their immunization card showing their active immunization status before them crossing the Iraqi borders

Travel remains a key risk factor for the acquisition of HAV infection. To minimize this source, vaccination of susceptible individuals prior to travel is imperative.

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