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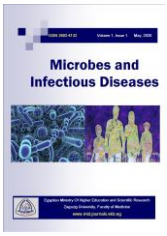

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Original article

Hepatitis B and Hepatitis C virus prevalence among Iraqi blood donors

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ABSTRACT

Background: Abstract Blood-borne viral infections are becoming more common all over the world. "Hepatitis B virus (HBV) and hepatitis C virus (HCV)" are two of the most frequently transmitted infectious agents through blood transfusion. We conducted this study between January 2020 and December 2020. The total number of blood donors was 171692, and they had their venous blood samples taken at the NBTC. Donors undergo screening for anti-HB core antibodies and HBsAg using an ELISA kit (Fortress Company/UK), while hepatitis C infection was screened by detecting anti-HCV antibodies using an ELISA kit (Fortress Company/UK). Any seropositive sample was confirmed by chemiluminescent immunoassay (CLIA). The total number of blood donors in Baghdad in 2020 was 171692, with 170504 males and 1188 females. These results showed a male-to-female ratio equal to 143:1. The prevalence of HBs, HB core, and HCV infection among blood donors for the 2020 year was 0.216%, 2.892%, and 0.135%, respectively. The total number of HBsAg-positive blood donors is 366/171692 (0.2%). Of the total male donors, 364/171692 (0.02%) were HBsAg positive, and of the total female donors, 2/1188 (0.019%) were HBsAg positive. Out of all HBsAg cases, 364/366 (99.5%) were positive male cases, and 2/366 (0.5%) were positive female cases. The seroprevalence of HBV is higher than that of HCV among blood donors, and both viruses represent a potential risk of transmission from blood donors to recipients in Baghdad City. Blood donors with negative HBsAg or positive anti-HBc Abs need additional Polymerase chain reaction (PCR) screening to detect occult HBV infection and can stop the spread of HBV to other people

Introduction

Transfusion of blood is an essential life-saving treatment for patient care, but its drawback is the potential to spread infections [1]. Despite the benefits of donating blood, all donors run the risk of contracting bloodborne pathogens, the most prevalent of which are "hepatitis C virus (HCV)," "hepatitis B virus (HBV)," and HIV [2]. Consequently, due to their sustained infection and

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the carrier situation, in addition to the reality that they cause various acute illnesses that can result in death, infectious diseases such as HIV, HBV, and HCV are of particular concern [3]. Globally, recent estimates indicate that HBV affects over 296 million people, while HCV affects around 58 million people, with approximately 1.5 million new infections each year [4].

Since 1950, it has been known that transfusions of blood and blood products carry a slight risk of hepatitis transmission. Blumberg published a paper in 1965 detailing the identification of the HBsAg (hepatitis B surface antigen) [5]. Purcell discovered the HBV (hepatitis B virus) in 1970 [6]. Recent studies confirm that anti-HBc can serve as a useful marker in detecting occult HBV infections, particularly in blood donor screening [7].

In 1989, the hepatitis C virus (HCV) was determined to be the main factor responsible for non-A and non-B hepatitis. Recent advancements have further elucidated the mechanisms of HCV transmission and its role in liver diseases [8]. Blood and blood products can transmit the hepatitis C virus (HCV), both parenterally and through sexual contact. Current studies highlight global burden of HCV and the importance of blood screening measures to prevent transmission [9].

HBV and HCV prevalence rates significantly dropped after the blood donor personation screening system was put into place [10]. The donors were also made more aware of the risk factors by being taught how HBV and HCV are transmitted [11].

Additionally, since the introduction of the HBV vaccine, HBV pervasiveness has declined globally, particularly in the younger age group. This drop is especially noticeable in kids under the age of due to the HBV vaccine's inclusion in the national vaccination program [12–13].

Over the past few decades, HBV infection in Iraq has decreased. 3.6% of blood donors had hepatitis B in 1973, 4.1% in 1984, and less than 1% in the 1990s [14]. This decrease is due to the government's adoption of prevention and control measures, including the implementation of the vaccination program, safe blood transfusions, and safe injections [15].

The aim of this study is to assess the prevalence of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) among blood donors at the National Blood Transfusion Center (NBTC) in Baghdad during the year 2020. to analyze the demographic and geographic distribution of HBV and HCV cases among these donors and provide the necessity of enhanced screening methods to prevent the transmission of bloodborne infections.

Materials and Methods

Study Area

The study data were obtained from the NBTC in Baghdad, the main city of Iraq where the blood bank is located. Nearly twenty hospitals in the central area use this blood bank's services.

Study Design

This study was a retrospective cross-sectional design analyzed the information of blood donors recorded at the National Blood Transfusion Center (NBTC) in Baghdad, Iraq. The study used a convenience sample of all blood donors who participated from January 1 through December 31, 2020. Both sexes and all age groups were invited to participate in the study.

Laboratory Examination

The blood samples obtained from the blood donors were analyzed for the presence of anti-HCV and HBsAg using the Wantai AiD™ HBsAg "Enzyme-Linked Immuno-Sorbent Assay (ELISA)" and Wantai AiD™ anti-HCV ELISA test kits, respectively (Fortress Company/UK). The participants (n = 171692) were blood donors visiting the NBTC in Baghdad, Iraq. and the data analyzed in this study were retrospectively collected from pre-existing routine records of blood donors from January 1 to December 31, 2020. Age- and sex-specific demographic information on blood donors was gathered from the blood bank's records.

Since this was a retrospective study using pre-existing records, direct informed consent was not required.

Every contributor supplied a quantity of five milliliters of blood, which was drawn by venipuncture and stored at 2–8 °C until testing as instructed by the blood banks and kit manufacturers. Testing was performed on the same day as the venipuncture. Ethical approval for this study was obtained from the Microbiology Department, College of Medicine, University of Baghdad, ensuring compliance with confidentiality and data protection standards. Administrative approval was also obtained from the National Blood Transfusion Center (NBTC) in Baghdad, allowing access to the required data and records. Statical analyses were conducted using SPSS software. Statistical

significance was considered only if the P value was less than 0.05.

Results

The overall count of individuals who donated blood in 2020 in Baghdad city was 171692, of which 170504 were males and 1188 were females. The total number of blood donors with HBs Ag positivity is 366/169692; the number of HBs Ag positive males was 364/1692 out of total donor males; and the number of HBs Ag positive females was 2/5532 (0.019%) out of total donor females. The total HBs Ag positive male number out of total HBs Ag cases was 364/366 (99.5%), while for females it was 2/366 (0.5). Table 1.

The total number of positive anti-HBc antibodies was 4907/171692 (2.9%), which represents the occurrence of HBV infections among total blood donors in 2020. 4819 were males, which is equal to 98.2% of the total anti-HBc Abs positives, while females represent 2.8% (88/1188).

The HBs Ag represented 7.0% of total positive anti-HBc antibodies (366/4907), while anti-HBc antibodies positive/HBs Ag negative were 4541/4907 (93.0%) blood donors in Figure 1.

The results showed that 294/366 (80.3%) of HBs Ag-positive blood donors were living in Baghdad city, while the remaining 72/366 (19.7%) were living outside Baghdad city (Figure 2).

The monthly distribution of HBs Ag positive donors according to their ages revealed that the highest age mean was in May (40.7±9.8 years old), while the highest median age (42 years) was in May; the widest range was in April (64–21) years old; and the highest count was in April (n = 40/366). These results are illustrated in Table 2 and Figure 3.

The total number of HCV-positive cases was 229/171692 (0.013%), which represents the occurrence of HCV infection amongst blood donors in 2020; the HCV-positive males were equal to 227/229 (99.1%) of the total HCV-positive cases, while the HCV-infected males (n = 227) represent 0.013% (227/170504) of the total donor males. The HCV-positive females were 0.09% (2/229) of the total HCV-positive cases, and when measuring their percentage from the total female donors, it was equal to 2/1188 (0.019). These results are shown in Table 3.

The monthly distribution of HCV-Abs positive donors according to their ages revealed that the highest age mean was in April (38.3±8.9 years old), while the highest median age (37.5 years) was in January; the widest range was in November (67-21) years old; and the highest count was in December (n = 28/229). These results are illustrated in Table 4 and Figure 4.

HBV infection was the primary cause of viral hepatitis in most cases among blood donors. (96%, n = 4097), while HCV infections represented 4% (n = 229) of the cases; these results are illustrated in Figure 5.

Table 1. The Hepatitis B viral markers among blood donors.

	Males	Females	Total Number
Total blood donors	170504	1188	171692
HBs Ag Positive	364	2	366
Anti-HBc Abs Positive	4819	88	4907

Table 2. The monthly distribution of HBs Ag-positive donors according to their ages.

Parameter	January	February	March	April	May	June	July	August	September	October	November	December
Mean (±SD)	34.9 (±9.2)	40.2 (±10.5)	37 (±9.9)	39.8 (±10.4)	40.7 (±9.8)	34.9 (±6.6)	41.3 (±9.4)	38 (±10.4)	40.1 (±9.9)	35.4 (±9.2)	35.9 (±8.7)	36 (±9.2)
Median	35	38	34	39	42	35	41	35	38	36	33	36
Range	29	38	30	43	39	29	32	35	39	36	29	35
Count	25	39	24	40	27	24	30	29	35	36	26	31

Table 3. The distribution of anti-HCV Abs positivity among blood donors in 2020.

	Males	Females	Total Number
Total blood donors	170504	1188	171692
Anti-HCV Abs Positive	227	2	229
Anti-HCV Abs Negative	170277	1186	171463

Table 4. The monthly distribution of HCV Abs positive donors according to their ages.

	January	February	March	April	May	June	July	August	September	October	November	December
Mean±SD	**36.8±10.0**	**35.6±12**	**33±9.6**	**38.3±8.9**	**35.4±10.1**	**38±11**	**34.9±11**	**37.1±8**	**35±8.6**	**32±9.3**	**36.8±12**	**34±9.5**
Median	**37.5**	**34**	**28.5**	**36.5**	**34**	**34**	**29.5**	**35.5**	**35**	**28.5**	**33.5**	**31**
Range	**60-22**	**58-20**	**55-23**	**55-22**	**57-24**	**60-22**	**54-22**	**57-24**	**48-23**	**53-19**	**67-21**	**65-22**
Count	**24**	**16**	**24**	**22**	**13**	**10**	**14**	**22**	**12**	**18**	**26**	**28**

Figure 1. The HBs Ag positivity among anti-HBc Abs positive blood donors.

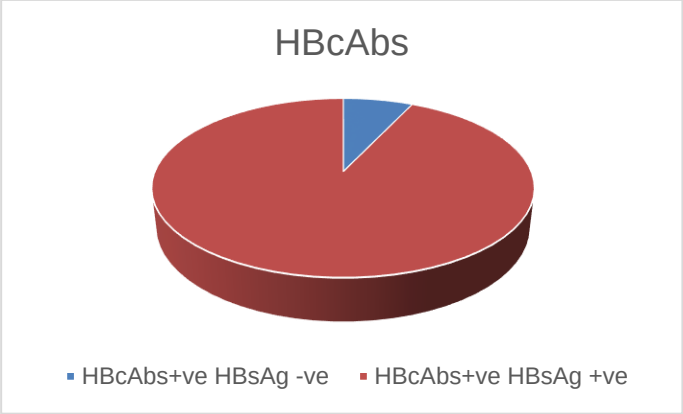


Figure 2. Geographic distribution of HBs Ag positive cases.

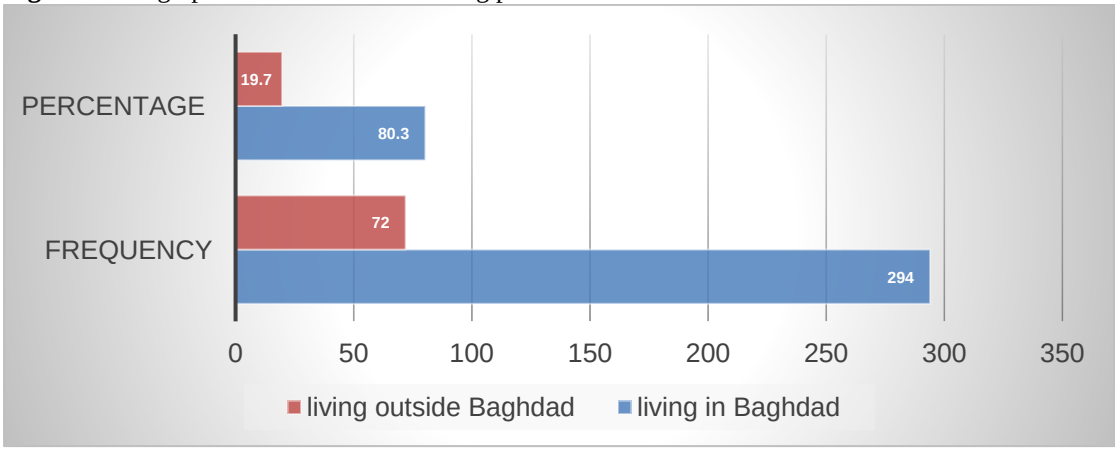


Figure 3. Monthly distribution of HBs Ag-positive blood donors according to their ages.

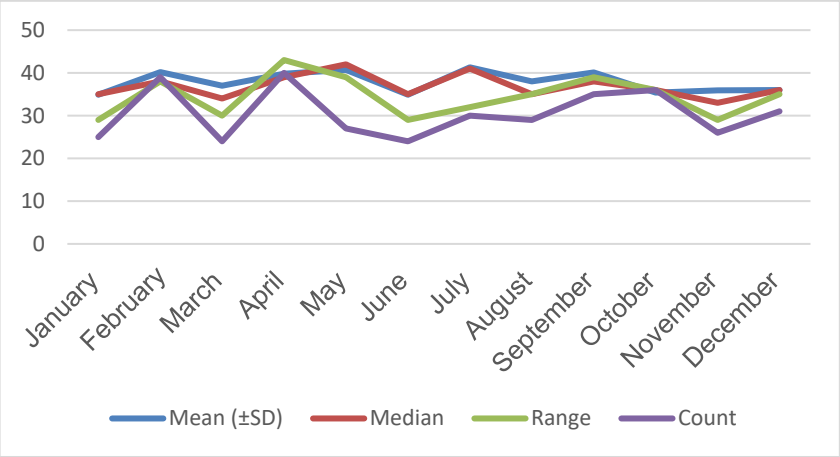


Figure 4. Monthly distribution of HCV Abs positive blood donors according to their ages.

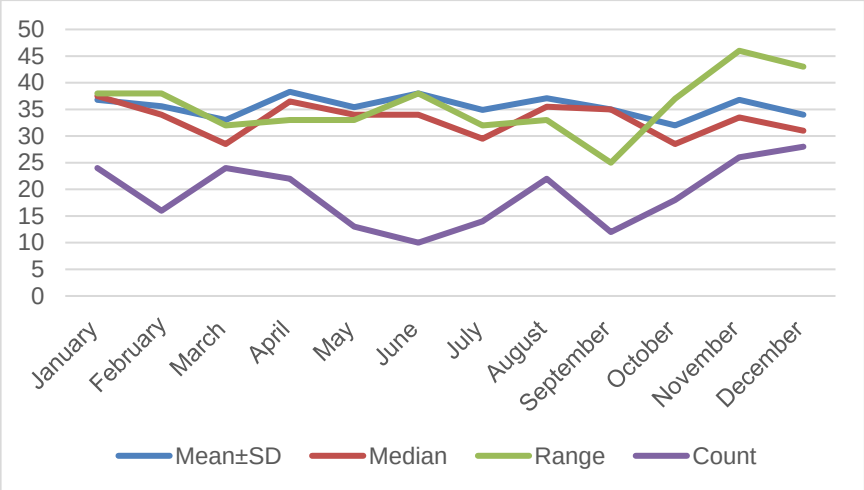
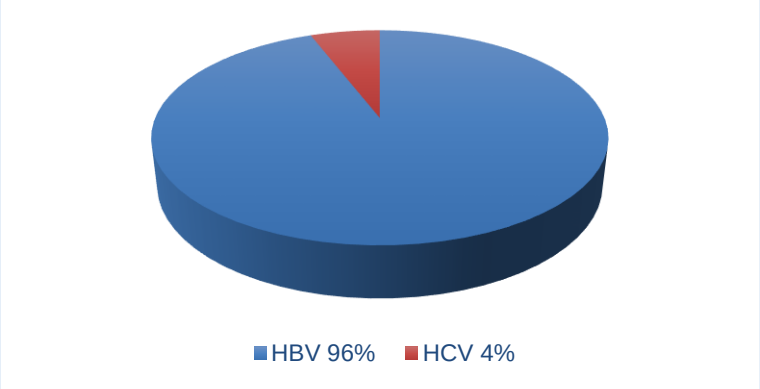


Figure 5. An analysis of the infection rates of Hepatitis C Virus (HCV) and Hepatitis B Virus (HBV) among individuals who donated blood.



Discussion

Blood-borne viruses, including HBV and HCV, continue to pose significant global public health concerns, particularly in regions with inadequate screening and prevention programs. According to the latest statistics, HBV chronically affects approximately 296 million individuals, while HCV impacts around 58 million people worldwide, highlighting the ongoing burden of these infections [16].

The findings of this study revealed that among blood donors in Baghdad, the prevalence of HBsAg and anti-HBc Abs was 0.216% and 2.892%, respectively. These results suggest a relatively low prevalence of active HBV infection among blood donors, which aligns with findings from previous

studies conducted in other Iraqi regions, such as Babylon and Najaf (0.7%) and Kerbala (3.5%) [17, 18, 19, 20]. The lower prevalence observed in this study may be attributed to enhanced blood screening policies, improved donor selection criteria, and the effectiveness of the national HBV vaccination program.

Comparing our results with neighboring countries, a study conducted in Duhok found a slightly higher prevalence of HBsAg positivity (0.78%) among healthy blood donors [21]. the seroprevalence of hepatitis B virus (HBV) among blood donors in Egypt is approximately 1.8%, which is lower than the previously reported 5%. [22]. Similar findings from Kuwait reported HBsAg prevalence rates of 1.1% among Kuwaiti nationals and 3.5% among non-Kuwaiti Arabs, indicating disparities potentially driven by differing healthcare access and immunization programs [23]. In Saudi Arabia, HBV prevalence among blood donors was 3.8%, whereas Iran demonstrated a declining trend, with HBV prevalence among blood donors in Mashhad, Ahvaz, and Tehran reported OBI rates of 0%, while centers in Isfahan, Shiraz, and Kerman reported rates of 0.9%, 0.08%, and 2.36%, respectively. The downward trend in Iran is likely due to robust national vaccination campaigns, stringent blood transfusion safety measures, and increased public awareness [24]. The relatively low prevalence observed in our study supports the effectiveness of Iraq's HBV vaccination strategy and enhanced blood donation screening practices [26].

In the present investigation, 0.135% of the samples revealed HCV-Ab positivity. Less HCV-Ab was found in Iraq (0.5% of blood donors tested positive), compared to what was found in Babylon [15]. Depending on the nation, the prevalence of HCV-Ab-positive patients ranged from 0.4% to 19.2% (27–29). A study found that Iran had a 0.5% prevalence of HCV-positive cases [28], compared to 0.4% in Saudi Arabia [25].

This study's findings, which were consistent with those of other studies carried out in various Iraqi cities and in other nations like Iran, showed that seropositive donors had an elevated rate of HBV infection compared to HCV infection (30). All these studies demonstrated that in seropositive blood donors, HBV infection was more prevalent than HCV infection. Health services must be available to teach people about the places where HBV is contagious and how it spreads.

Conclusion

All blood donors give their blood freely, so it is crucial to thoroughly screen donated blood for HBsAg, anti-HBc Abs, and HCV, utilizing test methods with enhanced diagnostic performance. Transfusion-transmissible viral infections are quite prevalent in donated blood, and this is a problem. To stop the spread of HBV to others, blood donors with negative HBsAg and positive anti-HBc Abs require further testing using a polymerase chain reaction. The efficacy of the initial screening test, the efficacy of their program in selecting blood donors, and various risky behaviors at different geographic locations could all contribute to the variations in the prevalence of HCV infection observed around the world.

Limitations to this study

The lack of data from donors regarding their exposure to risk factors for the transmission of both viruses, such as past blood transfusions, dental extractions, surgical procedures, cupping, and tattooing, which all occurred during the incubation periods for both viruses, HBV and HCV, presents a significant challenge. The addition of certain risk factors to the donor reports will help assess them, and this study may offer a useful basis for comparison for future research on the same subjects.

Ethics approval

This study has been approved by the Scientific Committee of the Department of Microbiology, College of Medicine, University of Baghdad, as per approval letter No. 474-2020.

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Competing interests

No conflicts of interest are disclosed by the writers.

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This study is self-funded.

Data availability

All data supporting the findings of this study are included in the article

Authors' contribution

Every author contributed significantly to this research. Shaymaa Jawad Kadhim and Nisreen

Jawad Kadhim came up with the idea and created the study. Mohammed Razak Ali, Raed H. Ogaili, and Yaqoob Abdul Wahid Saleh collected the data and conducted the laboratory analyses. Rabab Qasim Mohammed handled the statistical analysis and data management. All authors participated in the interpretation of the results, wrote and critically edited the paper with significant intellectual content, and ultimately gave their approval for the final version to be submitted.

References

1- Ahmed R, Fatima M, Ashfaq J, Tariq SF, Naseer I, Asif M, et al. Frequency of Hepatitis B, C, and Human Immunodeficiency Virus in Blood Donors. Cureus. 2022 Jun;14(6).

2- Onyango CG, Ogonda L, Guyah B, Okoth P, Shiluli C, Humwa F, Opollo V. Seroprevalence and determinants of transfusion transmissible infections among voluntary blood donors in Homabay, Kisumu and Siaya counties in western Kenya. BMC Research Notes. 2018 Dec;11:1-6.

3- Hussein NR, Haj SM, Almizori LA, Taha AA. The prevalence of hepatitis B and C viruses among blood donors attending blood bank in Duhok, Kurdistan Region, Iraq. International Journal of Infection. 2017 Jan 1;4(1).

4- World Health Organization (WHO). Hepatitis B and C Factsheets. Geneva: WHO; 2023. Available at: https://www.who.int.

5- Seeger C, Mason WS. Molecular biology of hepatitis B virus infection. Virology. 2015 May 1;479:672-86.

6- Schaefer S. Hepatitis B virus taxonomy and hepatitis B virus genotypes. World Journal of Gastroenterology. 2007;13(1):14-21.

7- Mak LY, Wong DK, Pollicino T, Raimondo G, Hollinger FB, Yuen MF. Occult hepatitis B infection and hepatocellular carcinoma: Epidemiology, virology, hepatocarcinogenesis and clinical significance. Journal of Hepatology. 2020 Oct 1;73(4):952-64.

8- Razavi H, Waked I, Sarrazin C, Myers RP, Idilman R, Calinas F, et al. The present and future disease burden of hepatitis C virus (HCV) infection with today's treatment paradigm. Journal of Viral Hepatitis. 2014 May;21:34-59.

9- Blach S, Zeuzem S, Manns M, Altraif I, Duberg AS, Muljono DH, et al. Global prevalence and genotype distribution of hepatitis C virus infection in 2015: A modelling study. The Lancet Gastroenterology & Hepatology. 2017 Mar 1;2(3):161-176.

10- Domingue MP, O'Brien SF, Grégoire Y, Lanteri MC, Stramer SL, Camirand Lemyre F, Lewin A. Implementing pathogen reduction technology while discontinuing blood donor deferral criteria for sexual risk behaviors: A simulation study. Transfusion. 2024 Oct;64(10):1949-58.

11- Sosa-Jurado F, Palencia-Lara R, Xicoténcatl-Grijalva C, Bernal-Soto M, Montiel-Jarquin Á, Ibarra-Pichardo Y, et al. Donated blood screening for HIV, HCV and HBV by ID-NAT and the residual risk of iatrogenic transmission in a tertiary care hospital blood bank in Puebla, Mexico. Viruses. 2023 Jun 6;15(6):1331.

12- Chang MH, Chen DS. Prevention of hepatitis B. Cold Spring Harbor Perspectives in Medicine. 2015 Mar 1;5(3):a021493.

13- World Health Organization (WHO). Global progress towards hepatitis B control through vaccination: Global perspectives from the WHO report 2023. World Health Organization. 2023. Available at: https://www.who.int.

14- Al-Rubaye A, Tariq Z, Alrubaiy L. Prevalence of hepatitis B seromarkers and hepatitis C antibodies in blood donors in Basra, Iraq. BMJ Open Gastroenterology. 2016;3(1):e000067.

15- Wong DK, Seto WK, Cheung KS, Chong CK, Huang FY, Fung J, et al. Hepatitis B virus core-related antigen as a surrogate marker for covalently closed circular DNA. Liver International. 2017 Jul;37(7):995-1001.
16- Hussein NR. Prevalence of HBV, HCV, and HIV and Anti-HBs antibodies positivity in healthcare workers in departments of surgery in Duhok City, Kurdistan Region, Iraq. Int J Pure Appl Sci Technol. 2015;26(2):70.
17- Hussein NR, Rasheed ZA, Taha AA, Shaikhow SK. The prevalence of hepatitis D virus infection amongst patients with chronic active hepatitis B virus infection in Duhok Governorate. Int J Pure Appl Sci Technol. 2015 May 1;28(1):1.
18- Al-Rubaye A, Tariq Z, Alrubaiy L. Prevalence of hepatitis B seromarkers and hepatitis C antibodies in blood donors in Basra, Iraq. BMJ Open Gastroenterol. 2016;3(1):e000067. [DOI][PubMed]
19- Al-Nafakh RT, lteef Al-Fadhul SA, Al-Sherees HA, Al-Charrakh AH. Seroprevalence of HBV, HCV, and HIV among blood donors in the main blood bank in Najaf Province, Iraq. Indian J Public Health. 2019 Apr 1;10(4).
20- Hussein NR, Haj SM, Almizori LA, Taha AA. The prevalence of hepatitis B and C viruses among blood donors attending a blood bank in Duhok, Kurdistan region, Iraq. Int J Infect. 2017 Jan 1;4(1).
21- Awadalla HI, Ragab MH, Osman MA, Nassar NA. Risk factors of viral hepatitis B among Egyptian blood donors. [Journal Name Missing]
22- Azzam A, Khaled H, Elbohy OA, Mohamed SA, Mohamed SM, Abdelkader AH, et al. Seroprevalence of hepatitis B virus surface antigen (HBsAg) in Egypt (2000–2022): a systematic review with meta-analysis. BMC Infect Dis. 2023 Mar 10;23(1):151.
23- Abdullah SM. Prevalence of hepatitis B and C in donated blood from the Jazan region of Saudi Arabia. Malays J Med Sci. 2013 Mar;20(2):41.
24- Ahmadi MH, Sharifi Z, Ghasemi A, Abbasian S. Occult hepatitis B in Iranian blood donors, an overview of the challenges: A narrative review. Health Sci Rep. 2023 Aug;6(8):e1466.
25- Meena M, Jindal T, Hazarika A. Prevalence of hepatitis B virus and hepatitis C virus among blood donors at a tertiary care hospital in India: a five-year study. Transfusion. 2011;51(1):198-202.
26- Hall EW, Bradley H, Barker LK, Lewis KC, Shealey J, Valverde E, et al. Estimating hepatitis C prevalence in the United States, 2017–2020. Hepatology. 2025 Feb 1;81(2):625-36.
27- Vriend HJ, van Veen MG, Prins M, Urbanus AT, Boot HJ, De Coul EO. Hepatitis C virus prevalence in The Netherlands: migrants account for most infections. Epidemiol Infect. 2013 Jun;141(6):1310-7.
28- Khodabandehloo M, Roshani D, Sayehmiri K. Prevalence and trend of hepatitis C virus infection among blood donors in Iran: A systematic review and meta-analysis. J Res Med Sci. 2013;18(8):674-82.
29- Alhilfi HSQ, Alhashimi RAH, Alsaad RKA. Seroprevalence of Hepatitis B and Hepatitis C Virus among blood donors in Missan Governorate – Iraq. Int J Innov App Stud. 2015;11(3):816-820.
30- Yaşar KK, Gursoy S, Bakar M, Kehribar HA. Seroprevalence of hepatitis B, C, and HIV/AIDS in asylum seekers in Istanbul. J Microbiol Infect Dis. 2014 Mar 1;4(1):20-5.