Readers Insight
Publisher of open access books and journals
PJMLS
Print ISSN: 2707-4471. Online ISSN: 2707-448X

Research Article	Pak-Euro Journal of Medical and Life Sciences
DOI: 10.31580/pjmls.v7i3.3121	Copyright © All rights are reserved by Corresponding Author
Vol. 7 No. 3, 2024: pp. 571-580	
www.readersinsight.net/pjmls	**Revised:** September 20, 2024 **Accepted:** September 27, 2024
Submission: July 06, 2024	**Published Online:** September 30, 2024

INCIDENCE, RISK FACTORS, CLINICAL AND SUB-CLINICAL ASPECTS OF HEPATITIS A AND B PATIENTS AMONG ETHNIC GROUPS IN CIVIL HOSPITAL TURBAT, DISTRICT KECH, PAKISTAN

Abid Ali[1], Muhammad Sharif Hasni[1], Mir Chakar Rahim[1], Fareeda Marri[1], Ayesha Lal[1], Sirmast Faiz[2]

[1]**Institute of Biochemistry,** University of Balochistan, Quetta, Pakistan
[2]**Dr. Panjwani Centre for Molecular Medicine and Drug Research,** Karachi, Pakistan

***Corresponding Author:** Abid Ali. E. mail: abidzia187@gmail.com

Abstract

Hepatitis infection in worldly population has been critically increasing because of various human careless attitudes toward the viral infections of liver. However, most of the developed countries have successfully curbed the rate of hepatic infections with their wise preventive measures; nearly all under developing states including Pakistan are yet endemic to the viral infection of liver (hepatitis). Millions of people are globally infected by hepatitis each year. Half of the infected individuals develop cirrhosis and hepatocellular carcinoma. The ultimate consequence of this liver abnormality is mortality and morbidity which are reportedly causing death in millions of global populations. Recent studies have evidently shown that 400 million of the world population is infected by hepatitis. WHO's report published in 2015 has also notified the confirmed annual death caused by hepatitis, according to which 1.34 million people have died in the that year. The numbers of infections of hepatitis are increasing rapidly in Pakistan especially in district Kech (Turbat) where hundreds of people are diagnosed to have hepatitis infections. A still greater number of the population has not yet come to know that they have been infected and therefore keep the infection transferring to their families, relatives, and those to whom they become in contact with. Unawareness of the risk factors and transmission mode of the hepatitis viruses were found to be the major reason for the increasing numbers of hepatitis infections in population of Kech (Turbat) like other hugely infected districts of Pakistan. Unsafe use of the hair dressing tools, reuse of the unsterilized dental and surgical tools, transfusion of the unscreened blood, reuse of the disposable syringes, and careless use of contaminated water and food are also the key factors involved in the transmission of the viral hepatic diseases. Spreading awareness in populations of the country about these risking factors through governmentally supported campaigns can only help the country getting rid of the hepatic infections.

Keywords: *Morbidity, Mortality, Risk factors, Transmission, Unscreened blood, Viral infections*

INTRODUCTION

Hepatic infections are virus induced illness which are the basic reasons of causing death worldwide (1). Hepatitis infection affects an excessive number of people worldwide about 400 million (2). When these infections are not treated for any reason, it has been found that in the majority of severe cases, they result in deaths (2, 3). The primary cause of the high mortality rate among hepatic infections is long-term consequences, which can result in liver cirrhosis or HCC (Hepatocellular Carcinoma) (4). About 257 and 291 million people are thought to have a persistent HBV infection, putting them at a high risk of developing cirrhosis and HCC (5). Worldwide, one-third of HCC-related mortality is linked to HBV (6).

Almost all developing countries , including Pakistan, continue to experience a high incidence of hepatitis infection, despite the fact that many wealthy nations have effectively reduced the rate of this viral infection linked to liver disease (7). Large numbers of hepatitis patients are reported and diagnosed, but numerous individuals remain undiagnosed or visited no hospitals in the country because of inadequate medical facilities or lack of awareness (8).

Liver diseases are prevalent throughout a vast expanse of the world and is not limited to any specific area(9). According to reports, Asia, Africa, Australia, and South America are the most affected regions (10). As previously noted, developing countries are observed to have much higher prevalence. Despite the fact that advanced countries have developed effective strategies to combat this virus, hepatitis infections appear to be spreading there still due to a variety of factors, including drug injectors and

migrants(11). Most chronic HBV carriers in Southeastern Asia are said to have contracted this virus after birth or in their early ages of life (2, 12).

A recent World Health Organisation (WHO) report makes it widely visible that hepatitis caused approximately one and half millions per year losses in 2015. Those are comparable with death-rates from tuberculosis , which caused 1.37 m losses. A bit greater losses caused by Human Immunodeficiency Virus, which caused 1.06 m losses annually (8, 13). Hepatitis also has a greater death rate than malaria, which is estimated to result in the deaths of 0.44 million people a year (14). This data shows a significant increase in death rates from liver infections of about 63% since 1990 (15). Comparing to any other type of liver inflamations, HBV and HCV have the most deadly effects, leading to over 95 percentage of death (7, 16).

Hepatitis A virus (HAV) belongs to the family *Picornaviridae* and is an unenveloped RNA virus (1, 2). Initial ethologic agents and its spread pathway remained discovered during last half of the twentieth-century (6). However, in the 17th and 18th centuries, its epidemiological characteristics initially appeared and were reported (1, 11). HAV mostly spreads via fecal oral pathway (17). It can spread by close personal contact , consuming unclean food-particles along with water-droplets (17, 18). Hepatitus A virus can remain infectious in surroundings for more than seven days, however that may turn inactive by heating up to 85-100 centigrade in 1-6 minutes (19). HAV infection usually appear as Fever, Nausea, Stomach Pain, Dark Urine, Juandice, and they typically happen aftere twenty eight days when they come into interaction with viral particle (20). At the early ages signs don't exhibit, that makes diagnosing of illness more complicated. Older children, on the other hand, are more at risk for viral-hepatic-infections (21). Symptoms of hepatitis A virus exist commonly for a half year , however in certain cases (10–15%), the illness lasts for a few weeks or several months (20).

The family *Hepadnaviridae* contains the partially double-stranded circular DNA virus known as the hepatitis B virus (HBV), which is enclosed with HBsAg (Hepatitis-B surface antigens) that is among main reasons of both acute-hepatitis and chronic-hepatitis. Hepatitis B Virus can spread by a number of routes, including percutaneous (i.e., skin penetration) (22). Contact with body fluids or blood that is contaminated (23). Moreover, blood transfusions, unsafe needle or injection processes, mother-to-child relationships during the perinatal period, and sexual contact can all spread it (24). Hazrads of hepatitis B are significantly higher as compared to hrpatitis A virus (24). It has been indicated that in Southeastern Asia, the majority of chronic HBV carriers were infected either at birth or at an earlier age(25). In contrast, men are more likely than women to contract hepatitis B. Hepatitis B is responsible for Hepatocellular Carcinoma, and many types of cancer, making it one of the leading causes of mortalities worldwide (25).

Pakistan is currently at danger for hepatic infections, which are becoming more common day by day (26). Several hepatitis-related studies have been carried out in the country so far have provided a clear picture of the prevalence of hepatitis in the Pakistani community (27). Even though there have been many initiatives to reduce the prevalence of hepatitis, in major districts, including district Kech/Turbat, but still there is a high prevalence rates, indicating that the infection rate as not completely decreased (27).

MATERIALS AND METHODS

BLOOD SAMPLING AND COLLECTION

Blood samples were collected from Civil Hospital Turbat district Kech in order to compile information on patients who tested positive for hepatitis-A and hepatitis-B. Entire medical records from Patients with positive HAV or HBV test results were recorded from the consultants who examined them. A few groups of individual , including women who were pregnant, those with heart, renal, or thyroid issues, those with metabolic issues, and those with any kind of genetic abnormality were not included in this research. Many factors, including ethnic grouping (Baloch, Brahui, Saraiki, Pashtun, and Punjabi), ages, genders, marital-status, economic status, along with positivity ratio of hepatitis A and B individuals have been cautiously assessed.

Five milliliters (5ml) of blood were drawn from each patient's vein using thoroughly cleaned 10-ml syringes, and the blood was then placed into test-tube using no anti-coagulating agents. Collected blood-sample have been let for coagulating in a normal temperature for a while to extract the serum. Later blood-samples have been centrifuged for 15 minutes in 5 ^{0}C at 3000 RPM. Serum from blood have been separated and kept into Eppendorf-Tubes in -20 ^{0}C to facilitate further processing after centrifugation.

BIOCHEMICAL ANALYSIS

LFT (liver Function Test) was performed to measure the increased level of two of the important hepatic enzymes called ALT (Alanine Aminotransaminase) or SGPT (Serum glutamic-pyruvic transaminase) and AST (Aspartate aminotransferase) or SGOT (Serum Glutamic-Oxaloacetic Transaminase). This test was carried out with Humalyzer 3500 (Germany) equipment and the commercially available chemical kits that aided in measuring the enzymatic level.

RESULTS AND DISCUSSION

PREVALENCE OF HAV AND HBV

Overall 1259 persons have been examined in order to diagnose hepatitis A and hepatitis B infections. 676 (53.7%) individuals have been found to have HAV and HBV infections. Among the 676 patients with the infection, 17.4% (219/1259) had HAV infection, 36.3% (457/1259) had HBV infection, and 46.3% (583/1259 were determined with no infection (Table I).

Table I. Overall prevalence of HAV and HBV in district Kech, Balochistan

	Prevalence of HAV and HBV		
S. No	**Category**	**No. of patients**	**%age**
1	HAV	219	17.39
2	HBV	457	36.30
3	Normal	583	46.31
	Total	1259	

ETHNIC-WISE PREVALENCE OF HAV & HBV

Primary emphasis was given to the incidence of HAV and HBV in the different ethnic group in district Kech. The Baloch community in Kech among the five main ethnic groups included in this study had the greatest proportion of HAV and HBV-positive people made up 321/1259 (25.5%), followed by Brahui 167/1259 (13.26%), Pashtun 109/1259 (8.66%), Punjabi 43 (3.42%) and Saraiki 36 (2.86%) (Table II).

Table II. Ethnic wise prevalence of HAV and HBV in district Kech, Balochistan

	Ethnic wise Prevalence of HAV and HBV				
S. No	**Ethnic group**	**HAV**	**HBV**	**Total**	**%age**
1	Baloch	94	227	321	25.5
2	Brahui	55	112	167	13.26
3	Pashtun	35	74	109	8.66
4	Punjabi	19	24	43	3.42
5	Sraiki	16	20	36	2.86

AGE WISE PREVALENCE OF HAV & HBV INFECTION

HAV and HBV infected individuals were categorized into three age groups and given names accordingly:

1. Group-1 (1-20 yrs)
2. Group-2 (21-40 yrs)
3. Group-3 (41-60 yrs)

The persons in group-2 (21-40 years) had greatest incidence of both hepatitis-A and hepatitis-B, accounting for 393/1259 (31.21%). Group-1 (1-20 years) had the second-highest infection rate, with

177/1259 (14.05%). The people in group-3 (41–60 years old) had the lowest infection rate, with 106/1259 (8.41%).(Table III)

Table III. Age wise prevalence of HAV and HBV in district Kech, Balochistan

Age wise Prevalence of HAV and HBV				
Groups (Age in years)	**Male**	**Female**	**Total**	**%age**
Group I (1 to 20)				
HAV	28	25	53	4.21
HBV	65	59	124	9.85
Group II (21 to 40)				
HAV	62	42	104	8.26
HBV	135	154	289	22.95
Group III (41 to 60)				
HAV	26	36	62	4.92
HBV	29	15	44	3.49

HYGIENE CONDITION OF HEPATITIS A AND HEPATITIS B PATIENTS

Patients' hygiene condition has been classified as Good, Moderate, and Poor. Majority of HAV and HBV patients, according to the data collected, were suffering from poor hygiene (401/1259, or 32%). Comparatively fewer of the 149/1259 HAV and HBV patients, 12 percent were found to be in satisfactory hygienic conditions. Moreover, 126 out of 1259 patients (10%) had neither poor nor adequate hygiene and as a result, were classified as people with intermediate hygiene. The remaining 583/1259 (46%) were not infected and were not maintained in any groups (Table IV).

Table IV. Hygiene condition of HAV and HBV in district Kech, Balochistan

Hygiene condition of HAV and HBV				
Hygiene condition	**HAV**	**HBV**	**Total**	**%age**
Poor	111	290	401	32
Good	88	61	149	12
Moderate	20	106	126	10

ASSOCIATED RISK FACTORS OF HAV & HBV INFECTION

A questionnaire-based survey was carried out to evaluate associated risk factors. Major risk factor was dental tool with 31.85% followed by blood transfusion 28.51%, surgical tools 26.61%, hair dressing tools 24.38%, body fluid 22.80, contaminated food 16.28%, syringes 15.57%, contaminated water 13.19, ear/nose piercing 8.98%, accident 6.91% and sexual contact 4.92%.

In district Kech Turbat, virally transmitted hepatitis is very common. All of it is due to several needless and thoughtless human actions that contribute to the spread of liver viruses (28). The spread of the hepatitis virus is facilitated by many risk factors, including reuse of syringes, reckless use of hair styling tools, transfusions of unscreened blood, and the repeated use of syringes (29).

This research aimed at evaluating the prevalence of hepatitis A and hepatitis B in district Kech while taking the patients' age, gender, and ethnic background into account. Similarly, the sociodemographic details of the patients were carefully recorded. Subclinical symptoms and clinical alterations that have occurred in the liver were taken into consideration in addition to the major risk factors (30).

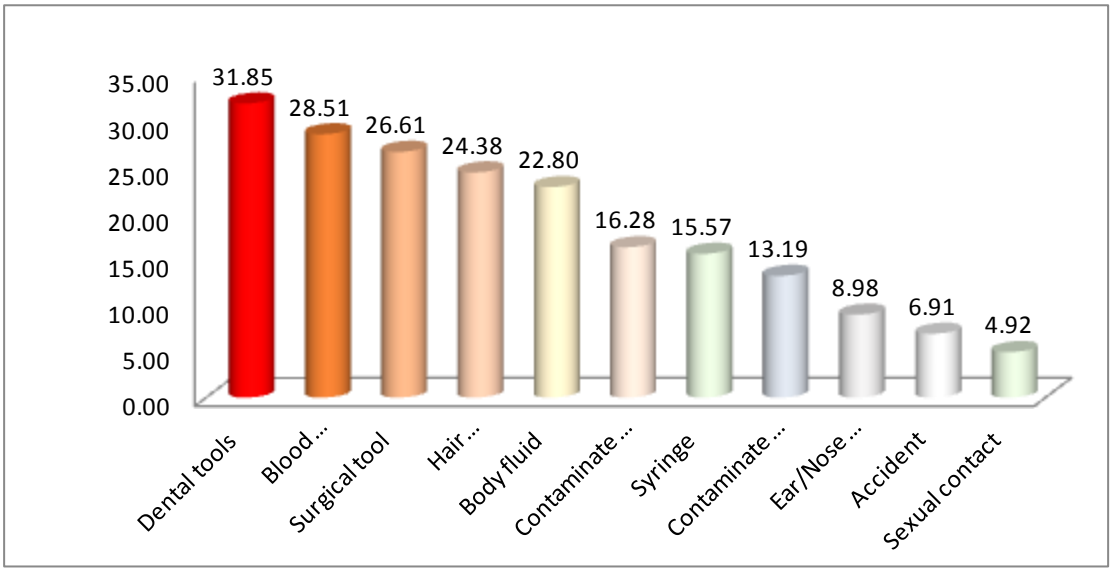

Fig. I. Associated risk factors of HAV and HBV in district Kech, Balochistan

The results of this research indicated that HBV was more prevalent than HAV in district Kech (Turbat). Researches in the districts Panjgur, Peshawar, and Lahore, where HBV infections were greater than HAV infections, produced a similar conclusion (31). This may be the case since HAV infections typically do not show any symptoms, thus people are ignorant of their illness and never consider seeing a specialist (31, 32). Additionally, males were proportionately more likely to have both HAV and HBV infections (HAV=9.21% and HBV=19.69%) in contrast to females (HAV=8.18% and HBV=16.6%) of district Kech. This result agreed with the research shown in Jaffar Abad district, Balochistan (Ahmed, 2018). Research studies in Swabi by Muhammad et al. (2021) and in Pishin by Sanaullah et al. (2020) revealed the opposed outcome, with more female infection than male infection (33).

According to data on the ethnic distribution of hepatitis A and B prevalence in district Kech, the majority of afflicted people were from the Baloch, Brahui, Pashtun, Punjabi, and Saraiki communities. In the district of Kech, the infection rate was lowest in Saraiki. This could be the result of variations in the numbers of each group's populations in Kech. It was shown that people between the ages of 21 and 40 were the most at risk for hepatic viruses. Several studies conducted around the country discovered a similar pattern. The ages range of 1 to 20 years old became the second most infested. The outcomes are consistent with those of others who obtained comparable results in the 0–14 age group(34). The age range with the lowest infection rate continued to be 41–60 years old. The variance in the number of patients in the various age groups contributes to the diversity in our results.

Moreover, the patients are impacted by the viral illness sanitation practices were also observed in order to inform of any changes brought on by the virus. The incidence of patients with poor hygiene was higher, according to the results. Just a few of the patients had decent hygienic. Moderate hygiene conditions were reported by a smaller proportion of patients. This demonstrated clearly the serious influence of viral infection of the hepatic level of hygiene. Hepatitis sero-epidemiological trends in developed nations differ from those in underdeveloped ones owing to improved hygienic conditions and sanitation (35). In most emerging nations, hepatistis remains supplementary prevaklent than HIV due to insufficient hygenic, poor hygienic, and over-crowding (26, 36). Most of these illnesses caused by HAV still have no symptoms (27, 37). Mostly people in Pakistan are visible to HAV infection at a yearly ages. Current study and previous studies conducted in Karachi show that 96.6% of people in different socioeconomic strata develop anti-HAV seropositivity (38). Based on researches performed in Karachi, medical-students exhibited lesser sero-prevalence frequency ninety six percent compared to workers of junior socio-economic classes with hundred percent (33). Enhanced livelihood state along with good hygienic state would cause a shift in the anti-HAV age-related sero-prevalence pattern (31). Researches from Khyber Pakhtunkhwa, too, revealed province's inadequate hygienic conditions which was a major contributing factor to the highest prevalence of liver

infection. These findings concur with an Iranian study from 2022 that found that inadequate hygiene is the main cause of the high incidence of liver infections.

A number of socio-graphical findings indicates that married people have infected with HAV and HBV at higher rates than single people. This outcome agreed with the Swabi study's results (39). Dental tools pose a significant risk for the spread of hepatic viral infections, particularly hepatitis B; this could be the primary cause of the high prevalence of hepatitis among married people (40). Disappointingly, only 2.54% of the patients had received vaccinations, with 0.87% having received all recommended vaccinations and 1.66% having only partial vaccinations (mostly for hepatitis B). This has happened simply because people make every effort to avoid getting vaccinated because of various rumors that have been going around about the vaccine's negative effects and the general lack of knowledge almost the significance and effectiveness of taking precautionary measures against the viral hepatitis (40). Likewise, the patients' educational records enabled us to draw the conclusion that the majority of hepatitis A and B infection were observed in illiterate people. Therefore, the main cause of the high rate of hepatic infections among the people living in the Kech district is a lack of understanding regarding the viral infections' mode of transmission (41). Families with the lowest economic levels had the greatest number of affected persons. Thus, limited access to free healthcare services may be the primary cause of the rise in HAV and HBV infections (42). Occupational records also showed that, in comparison to employed people, unemployed people were more likely to be infected.

The main risk factors for HAV and HBV that were identified through questionnaires were dental tools, blood transfusion, surgical tools, other bodily fluids, ear/nose piercing and accident. Other risk factors that were found to be in agreement with the results included many usage of insecure hairdressing tools, contaminated food (especially in cases of HAV), contaminated water (especially in cases of HAV), reusing of syringes, and sexual contact (43). Lots of common signs and symptoms of hepatic viral illnesses have been documented to include fever, dark urine, jaundice, abdominal pain, nausea, and fatigue (44). Additional symptoms that have been carefully observed from the infected patients and mentioned by other workers include headaches, muscular and joint pain, vomiting, weight losses, appetite losses, and constipation (44, 45).

Clinical research has demonstrated that, in comparison to HAV in male patients, the AST measure was significantly greater in N.G-II (21-40 years) patients. In contrast, two HAV female groups (ages 1–20, and 21–40) showed improvements over normal groups. Likewise, with regard to HBV, both sexes have demonstrated an increase in AST levels. It was noted that the ALT concentration in male patients was higher than in female ones. Higher ALT levels were recoded for all three age groups of HBV in both males and females. Research done in Lahore, Karachi, Quetta, and Kech (Turbat) supported this outcome (46).

The whole outcome demonstrated that for the past few years, there has been a significant incidence of both HAV and HBV in the district (Kech). The number of infections increases due to a number of reasons (already mentioned). In order to combat the diseases, prompt and effective action is needed.

CONCLUSION

Hepatitis remains a global disease that has not yet been completely eradicated. It is still reported that many underdeveloped nations have high levels of HAV, HBV, or both infections at the same time. In addition to other nations where hepatitis is widespread, Pakistan has also been experiencing an increase in hepatitis infection cases daily. Many factors, including the hazardous use of surgical and hairdressing instruments, insecure blood transfusions, and most importantly repeated syringe use, are contributing to the uncontrollably rising number of HAV and HBV infections in the district Kech. Both infections are affecting a sizable portion of the population. The majority of the male population is affected with these illnesses. The greatest numbers of hepatitis cases were diagnosed in married people. Hepatitis infection prevalence can also be attributed to risky sexual contact. The illiterate groups in Kech had the highest infection rates, indicating that ignorance about the hepatic virus's mode of transmission was the primary cause of the rising frequency of hepatitis. Living in unclean conditions was another factor contributing to

the spread of hepatitis diseases. The rising rate of hepatitis infections is also partially explained by not getting the recommended immunization against the viral infection.

RECOMMENDATION

The main causes of the high incidence of hepatitis in the city are inadequate medical management, inadequate medical facilities, and inadequate health care. The ignorance of both the general public and health facilitators has been the root cause of all of these issues. As a result, it is vital to inform the public of their responsibilities through awareness programs, which obviously cannot be carried without the support and collaboration of relevant health authorities. To make a significant efforts to combat the prevalence of hepatitis, health officials, the general public, and the support of the federal and local governments must work together.

Conflict of Interest:

Authors have no conflict of interest.

References:

1. Cardell K, Åkerlind B, Sällberg M, Frydén A. Excellent response rate to a double dose of the combined hepatitis A and B vaccine in previous nonresponders to hepatitis B vaccine. The Journal of Infectious Diseases. 2008;198(3):299-304.
2. Aggarwal R, Ranjan P. Preventing and treating hepatitis B infection. British Medical Journal. 2004;329(7474):1080-6.
3. Gerlich WH. Medical virology of hepatitis B: how it began and where we are now. Virology Journal. 2013;10:1-25.
4. Kim WR. Epidemiology of hepatitis B in the United States. Hepatology. 2009;49(S5):S28-S34.
5. Ma X, Zhang Q, He X, Sun W, Yue H, Chen S, et al. Trends in prevalence of HIV, syphilis, hepatitis C, hepatitis B, and sexual risk behavior among men who have sex with men: results of 3 consecutive respondent-driven sampling surveys in Beijing, 2004 through 2006. Journal of Acquired Immune Deficiency Syndromes. 2007;45(5):581-7.
6. Trépo C, Chan HL, Lok A. Hepatitis B virus infection. The Lancet. 2014;384(9959):2053-63.
7. Song JE. Diagnosis of hepatitis B. Annals of Translational Medicine. 2016;4(18).
8. Wolters B, Junge U, Dziuba S, Roggendorf M. Immunogenicity of combined hepatitis A and B vaccine in elderly persons. Vaccine. 2003;21(25-26):3623-8.
9. Garfein RS, Vlahov D, Galai N, Doherty MC, Nelson KE. Viral infections in short-term injection drug users: the prevalence of the hepatitis C, hepatitis B, human immunodeficiency, and human T-lymphotropic viruses. American Journal of Public Health. 1996;86(5):655-61.
10. Edamoto Y, Hara A, Biernat W, Terracciano L, Cathomas G, Riehle HM. Alterations of RB1, p53 and Wnt pathways in hepatocellular carcinomas associated with hepatitis C, hepatitis B and alcoholic liver cirrhosis. International Journal of Cancer. 2003;106(3):334-41.
11. Chu C-M, Sheen I-S, Liaw Y-F. The role of hepatitis C virus in fulminant viral hepatitis in an area with endemic hepatitis A and B. Gastroenterology. 1994;107(1):189-95.
12. Gimson A, White Y, Eddleston A, Williams R. Clinical and prognostic differences in fulminant hepatitis type A, B and non-A non-B. Gut. 1983;24(12):1194-8.
13. Mathiesen L, Skinoj P, Nielsen J, Purcell R, Wong D, Ranek L. Hepatitis type A, B, and non-A non-B in fulminant hepatitis. Gut. 1980;21(1):72-7.
14. Thiers V, Kremsdorf D, Schellekens H, Goudeau A, Sninsky J, Nakajima E. Transmission of hepatitis B from hepatitis-B-seronegative subjects. The Lancet. 1988;332(8623):1273-6.
15. Torbenson M, Thomas DL. Occult hepatitis B. The Lancet Infectious Diseases. 2002;2(8):479-86.
16. Lok AS, McMahon BJ. Chronic hepatitis B: update 2009. Hepatology. 2009;50(3):661-2.
17. Abesig J, Chen Y, Wang H, Sompo FM, Wu IX. Prevalence of viral hepatitis B in Ghana between 2015 and 2019: A systematic review and meta-analysis. PloS One. 2020;15(6):e0234348.
18. Sperle I, Steffen G, Leendertz SA, Sarma N, Beermann S, Thamm R, et al. Prevalence of hepatitis B, C, and D in Germany: results from a scoping review. Frontiers in Public Health. 2020;8:424.
19. Samo AA, Laghari ZA, Baig NM, Khoso GM. Prevalence and risk factors associated with hepatitis B and C in Nawabshah, Sindh, Pakistan. The American Journal of Tropical Medicine and Hygiene. 2020;104(3):1101.

20. Lim JK, Nguyen MH, Kim WR, Gish R, Perumalswami P, Jacobson IM. Prevalence of chronic hepatitis B virus infection in the United States. Official Journal of the American College of Gastroenterology 2020;115(9):1429-38.
21. Le MH, Yeo YH, So S, Gane E, Cheung RC, Nguyen MH. Prevalence of hepatitis B vaccination coverage and serologic evidence of immunity among US-born children and adolescents from 1999 to 2016. JAMA Network Open. 2020;3(11):e2022388-e.
22. Zheng Q, Zou B, Wu Y, Yeo Y, Wu H, Stave CD, et al. Systematic review with meta-analysis: prevalence of hepatic steatosis, fibrosis and associated factors in chronic hepatitis B. Alimentary Pharmacology & Therapeutics. 2021;54(9):1100-9.
23. Alberts CJ, Clifford GM, Georges D, Negro F, Lesi OA, Hutin YJ. Worldwide prevalence of hepatitis B virus and hepatitis C virus among patients with cirrhosis at country, region, and global levels: a systematic review. The Lancet Gastroenterology & Hepatology. 2022;7(8):724-35.
24. Bivegete S, McNaughton AL, Trickey A, Thornton Z, Scanlan B, Lim AG. Estimates of hepatitis B virus prevalence among general population and key risk groups in EU/EEA/UK countries: a systematic review. Eurosurveillance. 2023;28(30):2200738.
25. Razavi HA, Buti M, Terrault NA, Zeuzem S, Yurdaydin C, Tanaka J, et al. Hepatitis D double reflex testing of all hepatitis B carriers in low-HBV-and high-HBV/HDV-prevalence countries. Journal of Hepatology. 2023;79(2):576-80.
26. Fakheri Sueini V, Parsa Nahad M, Talaeizadeh A, Moradi M, Alborzi A, Pirmoradi R. Prevalence of Hepatitis B Virus Markers among the Women with Breast Cancer. Asian Pacific Journal of Cancer Prevention. 2024;25(2):547-53.
27. Iacob S, Csiki I, Iacob R, Ghioca M, Constantinescu I, Chiper B. Hepatitis B Prevalence and Referral Rates in Vulnerable Populations Undergoing Community-Based Screening—Results from the LIVE (RO) 2 Program. Viruses. 2024;16(8):1318.
28. Kimera A, Atuyambe L, Mutyaba H, Nantongo C, Namagembe A, Nalumansi AM. Prevalence and factors associated with hepatitis b vaccination uptake and completion among communities targeted for mass vaccination in gulu: a cross-sectional study. BMC Public Health. 2024;24(1):866.
29. Le L-V, Suy S, Chou M, Chan P-l, Heng K, Phou S. Knowledge, attitudes, practices and prevalence of hepatitis B and C and hepatitis B vaccination coverage among public sector healthcare workers in Cambodia. Global Health & Medicine. 2024;6(2):108-16.
30. Mohamud AK, Inchon P, Suwannaporn S, Prasert K, Dirie NI. Assessment of prevalence and risk factors associated with Hepatitis B virus infection among blood donors in Mogadishu Somalia. BMC Public Health. 2024;24(1):690.
31. Nasrallah GK, Chemaitelly H, Ismail AI, Nizamuddin PB, Al-Sadeq DW, Shurrab FM. Prevalence of hepatitis B and C viruses among migrant workers in Qatar. Scientific Reports. 2024;14(1):11275.
32. Razavi-Shearer D, Child H, Razavi-Shearer K, Voeller A, Razavi H, Buti M. Adjusted estimate of the prevalence of hepatitis delta virus in 25 countries and territories. Journal of Hepatology. 2024;80(2):232-42.
33. Shabil M, Yadav A, Shamim MA, Ahmed M, Satapathy P, Zaidan AA. Prevalence of hepatitis B and C infections among HIV-positive men who have sex with men: A systematic review and meta-analysis. Health Science Reports. 2024;7(6):e2206.
34. Beard N, Hill A, editors. Combined "test and treat" campaigns for human immunodeficiency virus, hepatitis B, and hepatitis C: a systematic review to provide evidence to support World Health Organization treatment guidelines. Open Forum Infectious Diseases; 2024: Oxford University Press US.
35. Campusano C, Kanner R, McDonell C, Morris M, Duarte M, Price JC. High prevalence of hepatitis B virus susceptibility among persons undergoing community-based hepatitis C virus treatment. Harm Reduction Journal. 2024;21(1):25.
36. Huang X, Zheng X, Chen L, Zhuang C, Yang C, Zang X. Active surveillance of hepatitis E: a 10-year epidemiological analysis in a city in eastern China. Emerging Microbes & Infections. 2024;13(1):2373315.
37. Pagheh AS, Alemzadeh E, Nazar E, Moodi M, Sharifi F, Miri-Moghaddam E. Monitoring of hepatitis B infection in the elderly population of eastern Iran. Vacunas. 2024.
38. Vasconcelos MPA, Sánchez-Arcila JC, Peres L, de Sousa PSF, Castro-Alves J, Albuquerque HG. Seroprevalence of hepatitis B, C, and D and associated factors in the semi-isolated Yanomami Amazonian indigenous community. BMC Infectious Diseases. 2024;24(1):15.

39. Hofmeister MG, Rosenthal EM, Barker LK, Rosenberg ES, Barranco MA, Hall EW. Estimating prevalence of hepatitis C virus infection in the United States, 2013-2016. Hepatology. 2019;69(3):1020-31.
40. Makuza JD, Rwema JOT, Ntihabose CK, Dushimiyimana D, Umutesi J, Nisingizwe MP. Prevalence of hepatitis B surface antigen (HBsAg) positivity and its associated factors in Rwanda. BMC Infectious Diseases. 2019;19:1-10.
41. Patel EU, Thio CL, Boon D, Thomas DL, Tobian AA. Prevalence of hepatitis B and hepatitis D virus infections in the United States, 2011–2016. Clinical Infectious Diseases. 2019;69(4):709-12.
42. Villar LM, Geloneze B, Vasques ACJ, Pires MLE, Miguel JC, da Silva EF, et al. Prevalence of hepatitis B and hepatitis C among diabetes mellitus type 2 individuals. PloS one. 2019;14(2):e0211193.
43. Aguilera A, Trastoy R, Rodríguez-Calviño J, Manso T, de Mendoza C, Soriano V. Prevalence and incidence of hepatitis delta in patients with chronic hepatitis B in Spain. European Journal of Gastroenterology & Hepatology. 2018;30(9):1060-2.
44. Falla AM, Hofstraat SHI, Duffell E, Hahné SJM, Tavoschi L, Veldhuijzen IK. Hepatitis B/C in the countries of the EU/EEA: a systematic review of the prevalence among at-risk groups. BMC Infectious Diseases. 2018;18:1-12.
45. Hussain S, Patrick NA, Shams R. Hepatitis B and C prevalence and prevention awareness among health care workers in a tertiary care hospital. International Journal of Pathology. 2018:16-21.
46. Lingani M, Akita T, Ouoba S, Sanou AM, Sugiyama A, Tarnagda Z. High prevalence of hepatitis B infections in Burkina Faso (1996–2017): a systematic review with meta-analysis of epidemiological studies. BMC Public Health. 2018;18:1-11.