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Spatiotemporal distribution and burden of hepatitis diseases in the Kingdom of Saudi Arabia: A nationwide analysis

Mohamed Ali Alzain [1, 2], Rafat Zrieq [1, 3, *], Reem M. Ali [4], Anas O. Tirawi [5], Awfa Y. Alazzeh [6], Rozan Attili [7], Hamoud F. Alshammari [8], Fahad D. Algahtani [1]

[1]*Department of Public Health, College of Public Health and Health Informatics, University of Ha'il, Ha'il, Saudi Arabia*
[2]*Department of Community Medicine, Faculty of Medicine and Health Sciences, University of Dongola, Dongola, Sudan*
[3]*Applied Science, Research Center, Applied Science Private University, Amman, Jordan*
[4]*Department of Clinical Laboratory Sciences, Faculty of Applied Medical Sciences, University of Ha'il, Ha'il, Saudi Arabia*
[5]*Faculty of Medicine, Yarmouk University, Irbid, Jordan*
[6]*Department of Clinical Nutrition, College of Applied Medical Sciences, University of Ha'il, Ha'il, Saudi Arabia*
[7]*Medical Laboratory Science, Pharmacy and Medical Science, Hebron University, Hebron, Palestine*
[8]*Department of Health Administration, College of Public Health and Health Informatics, University of Ha'il, Ha'il, Saudi Arabia*

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ABSTRACT

Hepatitis infection poses a significant challenge to global health. Saudi Arabia is also at risk from this illness, but as of now, there hasn't been a comprehensive countrywide study to examine how widespread and serious this disease is within the nation. This study aimed to look into how hepatitis disease is distributed over time and space within Saudi Arabia and to understand its impact. We used data from the Saudi Arabian Ministry of Health to conduct descriptive analyses. Our time-based analysis from 2014 to 2019 showed a rise in the number of hepatitis cases. In 2019, our place-based analysis found that the rate of hepatitis infections differed across various areas, with the Jazan region experiencing the highest rates. Hepatitis B was identified as the most frequent type, making up 68% of all hepatitis infections, followed by hepatitis C (27%) and hepatitis A (5%). Among the regions, Al-Jouf had the highest rate of hepatitis A infections. Jazan saw the highest rate of hepatitis B, and Mecca had the highest rate for hepatitis C. Our study of different population groups found that men, Saudi nationals, and individuals older than 45 years had higher rates of hepatitis compared to others. These results offer important insights for public health authorities and medical professionals to create effective prevention and treatment strategies that are specifically designed for those most at risk and areas that are most affected.

1. Introduction

Infectious diseases are a major death cause worldwide, accounting for more than 3.7 million deaths annually. Therefore, disease surveillance data of infectious diseases is crucial to determine the need for public health intervention. Hepatitis infections are among the major global health issues that affect millions of people worldwide (WHO, 2017a). Hepatitis is a collection of viral infections that target liver cells, leading to inflammation, liver impairment, and potentially fatal consequences. The long-term manifestation of this illness increases the risk of developing liver cancer, cirrhosis, and other associated problems. There are five primary hepatitis viruses responsible for these infections, namely A, B, C, D, and E. Each variant exhibits distinct methods of transmission, symptoms, and treatment options (WHO, 2023). The World Health Organization (WHO) reports that around 325 million individuals globally suffer from chronic hepatitis infections, which result in over 1.4 million fatalities annually. These statistics surpass the death tolls caused by HIV/AIDS or malaria (WHO, 2017b). It is the seventh leading cause of death globally (WHO, 2017a; Buckley and Strom, 2016; Miamen et al., 2012). Around 2 billion people have been exposed to hepatitis B virus (HBV), with 248 million being carriers (CDC, 2019; Schweitzer et al., 2015). Hepatitis C virus (HCV) infects approximately 170

* Corresponding Author.
Email Address: rafatzuraiq@yahoo.com (R. Zrieq)
https://doi.org/10.21833/ijaas.2024.01.021
Corresponding author's ORCID profile:
https://orcid.org/0000-0001-8586-7583

million individuals. HCV can cause chronic hepatitis, cirrhosis, and hepatocellular carcinoma, leading to 350,000 deaths each year (Blach et al., 2015). Control measures, such as HBV vaccination and blood donor screening, have successfully reduced the prevalence of HBV and HCV infections. Testing blood donors is crucial for transfusion safety and tracking community prevalence.

HBV and HCV are particularly widespread in the Middle East and North Africa (MENA) regions, with varying prevalence among different countries. Several MENA countries exhibit significantly higher rates of infection compared to the global average. The World Health Organization (WHO) states that the estimated prevalence of hepatitis C in the MENA region ranges from 2% to 5% of the population, surpassing the global average of 1%. Additionally, the report indicates that approximately 2% to 8% of the population in the region is affected by hepatitis B (WHO, 2017b).

Within the MENA region, the Kingdom of Saudi Arabia (KSA), as a prominent country, faces a comparable challenge with a considerable prevalence of hepatitis. Roughly 3% of the population grapples with chronic hepatitis B, while around 1.5% endures chronic hepatitis C (Alswaidi and O'Brien, 2010; Abdo et al., 2012). This places a substantial strain on the healthcare system, emphasizing the criticality of implementing preventive measures and accessible treatment options. To tackle this issue, the Saudi government has implemented a national immunization campaign against HBV for newborns since 1989 (Tufenkeji and Kattan, 1994). Despite the marked reduction in the prevalence of hepatitis B since that time to 2015, it has been noticed that hepatitis B showed a sudden increasing trend from 2015 to 2016 (Aljumah et al., 2019).

In this study, we tracked the incidence rate of all hepatitis diseases in KSA based on the data retrieved from the Ministry of Health during the period (2014-2019) and ran a full descriptive analysis of the data for 2019. The aim of the current descriptive epidemiology study is to investigate the incidence of hepatitis diseases in KSA regions to provide a detailed and comprehensive understanding of the burden and distribution of the disease across different regions in the country. The study can help identify the groups or areas with the highest burden of each hepatitis disease, the risk factors for these diseases, and the effectiveness of current prevention and control measures. By identifying patterns and trends, this study can help public health officials and healthcare providers develop targeted prevention and treatment interventions to reduce the incidence and impact of hepatitis in the country.

2. Methodology

2.1. Study area

KSA ranks as the second-largest country in the Arab world, following Algeria, and holds the position of the fifth-largest in Asia. It shares its northern borders with Jordan and Iraq, is neighbored by Kuwait to the northeast, and is surrounded by Qatar, Bahrain, the United Arab Emirates to the east, Oman to the southeast, and Yemen to the south. Occupying about 80% of the Arabian Peninsula, KSA is situated between the latitudes of 16° and 33° N and longitudes of 34° and 56° E. As of 2019, the total population of KSA exceeds 34 million, with more than 21 million being Saudi nationals and around 13 million consisting of expatriates (GASTAT, 2023).

KSA is considered a destination for religious tourism for Muslims. It attracts a large population, such as Hajj and Umrah, which are religious trips undertaken by Muslims worldwide. The number of pilgrims and Umrah pilgrims who entered the KSA in 2019 reached more than 9 million (GASTAT, 2023).

2.2. Study design, data source, and collection

This study employs a descriptive and retrospective research design. It aims to analyze and report the incidence rates of various hepatitis diseases (hepatitis A, B, C, and others) in KSA over a specified time frame (2014-2019), using annual reports from the Ministry of Health. These reports were obtained from the official website of the GASTAT (2022), which contains official statistical data collected from various sources in cooperation with government and private agencies, with the aim of monitoring and documenting information in the KSA over the years. These reports provide data including incidences, demographics, and geographic distribution (GASTAT, 2022).

2.3. The variables

The key variables included in this study were incidence rates by year (2014-2019) of different types of hepatitis (A, B, C, and others.), with a focus in 2019 on the geographic location (all KSA regions) and demographic information (age, gender).

2.4. Data analysis

The data was retrieved from the Ministry of Health website in an Excel sheet and then transferred to SPSS (version 26). The cumulative incidence of different types of hepatitis disease was calculated by dividing the number of confirmed cases by the total population per 100,000 for the entire KSA and each of the thirteen administrative regions (Porta, 2014). Temporal trends analysis of the incidence rates of different types of hepatitis diseases was analyzed over the study period (2014-2019) using Excel to visualize changes over time. We perform weight cases by frequency different weights for statistical analysis. Moreover, the Chi-square test was used to examine the distribution of different types of hepatitis cases by region, gender, nationality, and age group. Two-tailed P-value < 0.05 was considered statistically significant.

3. Results

3.1. Increased incidence rates of hepatitis diseases in KSA during 2014-2019

Our analysis revealed increases in the incidence rates of hepatitis diseases A, B, and C, while other hepatitis diseases remained relatively stable (Fig. 1). The incidence rate of hepatitis rose from 0.42 cases per 100,000 in 2014 to approximately 0.74 in 2018-2019. Likewise, Hepatitis B increased from 14.05 cases per 100,000 in 2014 to 22.24 and 19.9 cases per 100,000 in 2018 and 2019, respectively. Hepatitis C also witnessed a significant increase in its incidence rate from 5.48 cases per 100,000 in 2014 to 10.28 in 2018. Overall, the incidence rates of hepatitis A, B, and C increased, while other hepatitis diseases showed relatively stable incidences throughout the study period.

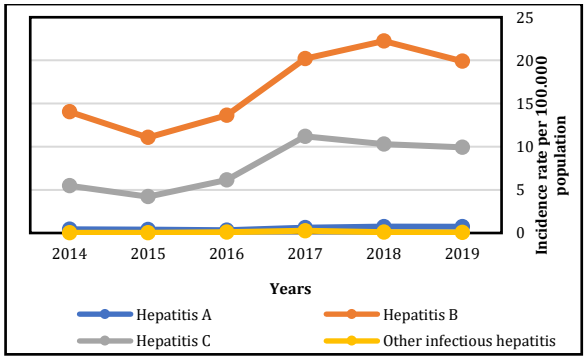

Fig. 1: The distribution of different types of hepatitis infection between 2014 to 2019

3.2. The incidence rates of the different hepatitis diseases vary among KSA regions

Overall, the incidence of hepatitis diseases in different regions of KSA was assessed in 2019. The distribution of the different hepatitis disease cases across KSA regions was statistically significant (p.value<0.001). The highest incidence of hepatitis diseases was observed in the Jazan and Mecca regions (53,19 and 42,13 cases per 100,000 populations, respectively). Remarkably, hepatitis infection was less likely in the upper regions of the country, e.g., Hail, Al-Jouf, and Tabuk. The incidence rates of different types of hepatitis diseases were also assessed and compared among the different regions of the country. The highest hepatitis A cases were observed in the Al-Jouf region (9.775 cases per 100,000 population), while no cases were reported in Hail, Al Baha, and the northern regions (Table 1). For hepatitis B, the highest incidence rate was observed in the Jazan region (46.97 cases per 100,000 population). Contrary to hepatitis A, the Al-Jouf region recorded the lowest incidence rate of hepatitis B (1.13 cases per 100,000 population). Regarding hepatitis C, the highest incidence was observed in the Mecca region (15.44 cases per 100,000 population) and the lowest in the Tabuk region (3.37 cases per 100,000 population). In summary, the results revealed variations in the incidence rates of hepatitis A, B, and C across KSA regions.

3.3. The incidence rates of hepatitis diseases among gender

When comparing the results for males and females, there are noticeable differences in the incidence rates of hepatitis diseases (Table 2). For males, the overall incidence rate was higher, with 6,345 cases and an incidence rate of 32.136 per 100,000 populations. In comparison, females had a lower overall incidence rate, with 4,131 cases and an incidence rate of 28.54 per 100,000 populations.

Remarkably, males had a markedly higher incidence rate of HBV (21.34 per 100,000 population) in comparison to females (17.94 per 100,000 population) (Table 2). For HAV, males had an incidence rate of 0.75 per 100,000 populations, while females had a slightly lower rate of 0.72 per 100,000 populations. Similarly, the incidence rates for HCV were 9.993 and 9.872 per 100,000 populations for males and females, respectively. The incidence rate for other infections in males was 0.051 per 100,000 populations, while females had an incidence rate of 0.014 per 100,000 populations. These findings suggest that there may be gender-related differences in the risk factors or susceptibility to hepatitis infections in KSA.

Table 1: Incidence of different hepatitis types by region in KSA

Regions	population	Type of hepatitis n (Incidence rate/100.000 population)					P-value
		HAV	HBV	HCV	Other	Total	
Riyadh	8,660,885	55(0.635)	1089 (12.57)	562(6.49)	1(0.012)	1707(19.71)	<0.001
Mecca	9,033,491	44(0.487)	2365(26.18)	1395(15.44)	2(0.02)	3806(42.13)	
Medinah	2,239,923	16(0.714)	451(20.13)	181(8.08)	1(0.04)	649(28.97)	
Qaseem	1,488,285	3(0.201)	172(11.55)	131(8.80)	1(0.06)	307(20.63)	
Eastern Region	5,148,598	53(1.029)	1105(21.46)	591(11.48)	3(0.06)	1752(34.03)	
Aseer	2,308,329	14(0.606)	399(17.28)	217(9.40)	0	630(27.29)	
Tabuk	949,612	6(0.606)	131(13.79)	32(3.37)	0	169(17.79)	
Hail	731,147	0	28(3.83)	20(2.73)	0	48(6.56)	
Northern region	383,051	0	80(20.88)	17(4.44)	0	97(25.32)	
Jazan	1,637,361	4(0.244)	769(46.97)	94(5.74)	4(0.24)	871(53.19)	
Najran	608,467	5(0.823)	139(22.84)	80(13.15)	0	224(36.81)	
Al-Bahah	497,068	0	76(15.29)	56(11.27)	0	132(26.56)	
Al-Jouf	531,952	52(9.775)	6(1.13)	26(4.89)	0	84(15.79)	
Total	34,218,169	252(0.736)	6810(19.90)	3402(9.94)	12(0.04)	10476(30.62)	

P-value < 0.001 indicates statistical significance; "n" refers to the number of cases. Incidence rates are presented per 100,000 populations; Note: "Other" refers to other types of hepatitis not specified

Table 2: Demographic distribution of the incidence rates of HAV, HBV, HCV, and other hepatitis in KSA 2019

Variables	Population	Type of hepatitis n (Incidence rate / 100.000 population)					P-value
		HAV	HBV	HCV	Other infection	Total	
Total	34,218,169	252(0.74)	6810(19.90)	3402(9.94)	12(0.035)	10476(30.62)	
Age group							
< 1 year	2,304,832	6(0.26)	11(0.48)	7(0.30)	0	24(1.041)	<0.001
1-<5 years	2,844,501	26(0.91)	27(0.95)	18(0.63)	0	71(2.49)	
5-<15 years	5,545,462	65(1.17)	39(0.70)	11(0.20)	1(0.018)	116(2.09)	
15-<45 years	18,591,499	137(0.74)	3955(21.27)	1171(6.30)	5(0.027)	5268(28.33)	
>45 years	4,931,875	18(0.36)	2778(56.33)	2195(44.50)	6(0.12)	4997(101.32)	
Nationality							
Saudi	21,112,611	150(0.7104)	5108(24.19)	2436(11.54)	3(0.014)	7697(36.46)	<0.001
None-Saudi	13,105,558	102(0.778)	1702(12.98)	966(7.37)	9(0.069)	2779(21.20)	
Gender							
Male	19,743,884	148(0.75)	4214(21.34)	1973(9.993)	10(0.051)	6345(60.6)	<0.001
Female	14,474,285	104(0.72)	2596(17.94)	1429(9.872)	2(0.014)	4131(32.14)	

P-value < 0.001 indicates statistical significance; "n" refers to the number of cases; Incidence rates are presented per 100,000 populations in parentheses

3.4. The incidence rates of hepatitis diseases among nationalities

When considering nationality, a statistically significant association was found between nationality and hepatitis incidence ($p<0.001$). Among Saudis, a total of 7,697 cases of hepatitis were identified (Table 2), resulting in an incidence rate of 36.46 per 100,000 population. Specifically, 3 cases of other infections were reported (0.014 per 100,000 population), along with 2,436 cases of Hep C (11.54 per 100,000 population), 5,108 cases of Hep B (24.19 per 100,000 population), and 150 cases of Hep A (0.7104 per 100,000 population). The total Saudi population included in the study was 21,112,611.

In contrast, expatriates had a lower overall incidence rate of hepatitis, with 2,779 cases identified (21.20 per 100,000 population). The breakdown for expatriates showed 9 cases of other infections (0.069 per 100,000 population), 966 cases of Hep C (7.37 per 100,000 population), 1,702 cases of Hep B (12.98 per 100,000 population), and 102 cases of Hep A (0.778 incidence rate). The total non-Saudi population included in the study was 13,105,558. These results indicate that the incidence rates of hepatitis, particularly Hepatitis C, Hepatitis B, and other Hepatitis infections, are higher among Saudi individuals compared to non-Saudi individuals.

3.5. The incidence rates of hepatitis diseases among different age groups

Our research focused on the occurrence rates of various hepatitis types among different age groups. We found that the highest overall occurrence rate of hepatitis diseases was in individuals older than 45 years (Table 2). Additionally, our analysis showed differences in occurrence rates among age categories. Specifically, Hepatitis A occurrence was most significant in the 15 to under 45 age group, with 21.27 cases per 100,000 people, pointing out a greater impact on this group. For Hepatitis B, the occurrence rate peaked in the over-45 age group at 56.33 cases per 100,000 people, indicating a higher risk. Similarly, Hepatitis C's highest occurrence was in the over-45 age group, with 44.50 cases per 100,000 people, suggesting an increased vulnerability among this demographic. This data implies that individuals over the age of 45 have a higher risk of Hepatitis C infections. Notably, the variance in occurrence rates between age groups was statistically significant ($p<0.001$), underscoring the disparities in hepatitis prevalence related to age.

4. Discussion

KSA, as a prominent country in the Middle East and North Africa (MENA) region, experiences a relatively high occurrence of hepatitis, similar to many other nations. The country deals with various types of hepatitis, including Hepatitis A Virus (HAV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and others. Despite the varied incidence rates of these viruses, KSA has seen a decrease in hepatitis cases before 2014, attributed to enhanced infection control practices, vaccination programs, and heightened awareness of preventive strategies. This improvement is supported by research from Alshabanat et al. (2013). Contrarily, our investigation reveals an upward trend in the incidences of HAV, HBV, and HCV from 2014 to 2019. According to our findings, HBV is the predominant type of hepatitis in KSA, constituting 65% of all hepatitis cases, followed by HCV and HAV, which represent 32.47% and 2.4% of the cases, respectively. This pattern echoes earlier studies, such as one by Alshabanat et al. (2013), which found that HBV was the most common form of viral hepatitis between 2006 and 2010, making up 53% of cases, with HCV and HAV following at 30% and 17%, respectively. Another epidemiological study found that the average annual incidence of seropositivity per 100,000 served population was the highest for HBV infection (104.6), followed by HCV (78.4) (Memish et al., 2010). Collectively, our and other studies suggest that the proportion of HBV as a causative agent for hepatitis diseases has been increasing at the expense of HAV during the last two decades. This suggestion can be attributed to the fact that KSA implemented childhood hepatitis A vaccination in its universal mass vaccination

program in 2008, which subsequently reduced the infection by HAV (Badur et al., 2021).

Moreover, our results revealed that the incidence rates of hepatitis diseases generally vary among KSA regions. The highest incidence rates were found in Jazan and Mecca regions (53,19 and 42,13 cases per 100,000 populations, respectively), while the lowest was reported in Hail, Al-Jouf, and Tabuk. Multiple factors could contribute to this variation in the different regions of KSA. Some possible reasons include population density and socioeconomic factors. Interestingly, Jazan and Mecca have the highest population densities (97.93 and 54.55 person per square kilometers), while Hail, Al Jouf, and Tabuk are among the lowest population densities regions (ranging between 5.82-6.9 person per square kilometer) in KSA (GASTAT, 2023). With more people living in close proximity, there is an increased risk of viral transmission and spread. This implies that crowding in some Saudi regions is a strong potential factor for spreading hepatitis diseases in KSA and therefore, authorities should take that in account in their strategies to control hepatitis diseases. Moreover, it is possible that the influx of Yemeni refugees and migrants into Jazan because of the war on the Saudi-Yamani border that began in 2015 may have resulted in increased transmission of hepatitis infections, as these infections are endemic in Yemen and can spread through various routes such as blood contact, sexual contact, and contaminated medical equipment. Another factor contributing to the high incidence rate of hepatitis infections in the Mecca region is the huge number of pilgrims who visit Mecca each year for religious reasons, including people from various countries. As a result, the intensive activities and rituals involving close physical contact may contribute to the spread of hepatitis infections, increasing the chance of hepatitis transmission. However, further research and analysis would be needed to provide a more comprehensive understanding of the specific factors influencing the hepatitis disease burden in each region.

Surprisingly, Al-Jouf (which is among the lowest incidence regions for hepatitis diseases in general) recorded the highest incidence of hepatitis A in 2019. This is unlikely due to crowding or lack of immunization programs as Al-Jouf is among the lowest population density regions and involved in the universal mass vaccination program (Memish et al., 2010; Badur et al., 2021). It is more likely that Al-Jouf had a high incidence rate of HAV due to socio-economic, geographical, and environmental factors. Al-Jouf is characterized by its semi-arid climate and desert environment, which poses specific challenges to water and sanitation infrastructure, potentially increasing the chances of HAV transmission. Additionally, the region's agriculture-based economy might involve using untreated or inadequately treated wastewater for irrigation purposes, improper disposal of waste or the presence of open sewage systems, which can facilitate the spread of the disease increasing the risk of HAV transmission through contaminated food. Therefore, comprehensive public health initiatives and interventions to address the high incidence of HAV in the Al-Jouf region are recommended. A collaboration between local health, environmental and agricultural authorities is essential in implementing effective and sustainable interventions to mitigate the impact of Hepatitis A in this region. For HBV infection, the highest incidence rate was reported in Jazan. Our finding is consistent with other studies as Jazan region is well documented for high prevalence of HBV relative to the national level (Abdo et al., 2012; Alshabi et al., 2021; Abdullah, 2018; Ageely et al., 2015; AI-Faleh, 1999; Al Humayed et al., 2017; El-Hazmi, 1986). Previous studies reported that the high incidence rate of HBV is due to hospitalization (Ibrahim et al., 2012; Pereira et al., 2009). Although dental procedures, blood transfusion and history of surgery are important risk factors in many studies in KSA and the Arabian region, they were not associated with high risk of HBV in Jazan (Ibrahim et al., 2012; Al-Mazrou et al., 2004; Alswaidi and O'Brien, 2010). Contrary to HAV infection, the Al-Jouf region recorded the lowest incidence rate of HBV infection. This finding emphasized that the increased incidence rate of HAV in Al-Jouf regions is not due to a defect in the immunization program, as HBV was very low in this region. The incidence rate of HCV also varies among regions in KSA. In consistence with previous studies, our analysis showed that the highest incidence of HCV infection was observed in Mecca and Najran regions (Madani, 2007). The high incidence rate of HCV in Mecca has been attributed to several factors, including the lowest HCV testing rate and inadequate knowledge levels among residents of the Mecca compared to other regions (Alzahrani et al., 2023).

Our study also investigated the incidence rates of hepatitis diseases in general as well as individual types of hepatitis among Saudi and expatriate individuals. Our results indicated a higher incidence rate of hepatitis infections among Saudi individuals than expatriate individuals. These results are consistent with the previous studies reported that most hepatitis cases in general were in Saudi individuals (Alshabanat et al., 2013). Specifically, we found higher rates of HCV and HBV, while a slightly lower of HAV among Saudi individuals. This finding is partially differed from a previous study by Memish et al. (2010), which examined the prevalence of hepatitis infections in the general population of KSA during 2000-2007. Memish et al. (2010) study reported similar trends for HBV, with higher rates observed among Saudis compared to expatriate individuals (Alshabanat et al., 2013). However, it is worth noting that our findings regarding the rates of HAV and HCV are in contrast to those results of that study, where higher incidence rates of HCV and lower rates of HAV were found in expatriates than in Saudi individuals. This discrepancy may be attributed to differences in actions conducted latterly compared to that study time. For example, the reduced prevalence rate of HAV infection was

driven mainly by the implemented childhood hepatitis A vaccination in KSA in 2008 (Memish et al., 2010). The lower prevalence rates of HBV and HCV among expatriate v.s. Saudi individuals may be explained by the strict rules of conducting a medical investigation, including HBV and HCV tests, as prerequisites for entering KSA (Longva, 1999). On the other side, the higher incidence rates of HBV and HCV among Saudi individuals may be attributed to the unique sociocultural and demographic characteristics of the population. For example, it has been observed that certain cultural practices and behaviors, such as exposure to traditional medical procedures or the use of non-sterile instruments, particularly in cautery and cupping, can increase the risk of hepatitis transmission (Al-Rowais et al., 2010). Nevertheless, further research is needed to explore the underlying reasons for these disparities and to develop targeted interventions aimed at reducing the burden of hepatitis in KSA.

Our study also revealed significant differences in the incidence rates of hepatitis based on gender among the Saudi population. Like previous studies, our findings indicate that males had higher incidence rates of total hepatitis infections compared to females. However, the majority of increased incidence in the rate of hepatitis infections was due to HBV infection, as both the incidence rates of HAV and HCV infections between genders were very close. This aligns with studies by Memish et al. (2010) and Baha et al. (2013) that reported a markedly higher prevalence of HBV infection among males, possibly due to behavioral factors and hormonal differences, while less variation in the prevalence of HAV and HCV infections between genders (Alshabanat et al., 2013; Baha et al., 2013). These gender disparities highlight the need for targeted interventions and prevention strategies to reduce the burden of hepatitis. Further research considering age, socioeconomic status, and comorbidities would enhance our understanding of these disparities.

In our study, we also examined the incidence rates of hepatitis diseases in general as well as different types of hepatitis across various age groups. We found that the highest incidence rates of hepatitis diseases, in particular for HCV and HBV, were observed in the >45 years age group, while the highest incidence rate for HAV was found in the 5-<15 years age group. These findings are consistent with earlier reports that demonstrated age-related differences in the incidence of hepatitis (Baha et al., 2013; Asad et al., 2015). Studies conducted in KSA observed similar trends, with older age groups having greater incidence rates of HCV and HBV and younger adults having a larger burden of HAV (Al Humayed et al., 2017; Mehdi et al., 2000; Abaalkhail et al., 2014). The observed disparities in incidence rates among age groups could be due to a variety of causes. For example, alterations in immune system function among different ages may influence susceptibility to hepatitis infections. Moreover, variations in risk behaviors, access to healthcare, and immunization habits between age groups may also play a role in the reported discrepancies. Targeted preventative methods are critical for addressing the varied incidence rates of hepatitis among age groups. Focusing prevention measures on older age groups, such as testing, treatment, and awareness campaigns, can help reduce transmission and improve outcomes for HCV and HBV infections. Meanwhile, initiatives to promote vaccination and risk education among children aged 5 to 15 years old may be critical in reducing the HAV burden. Our findings support the idea that there are age-related differences in the incidence rates of different kinds of hepatitis. Targeted interventions and preventative measures should take into account the age groups most affected by each kind of hepatitis, with the ultimate objective of reducing the disease burden and promoting overall public health.

The findings of this study should be considered with some limitations regarding the study depending on secondary data obtained from the official website of GASTAT, which may lack some relevant variables.

5. Conclusion

This study sheds light on the incidence and burden of hepatitis infections in KSA. The incidence of hepatitis infections rose from 2014 to 2019 in KSA. The incidence rates of hepatitis infections are significantly varied among regions, genders, nationalities, and age groups. The rising trend of hepatitis infections in KSA highlights the critical need for effective prevention and control measures. The identification of groups at risk and regions should assist public health authorities in developing effective preventive measures and increasing access to options for treatment. Further research is warranted to better understand the factors influencing hepatitis disease burden within each region. To our knowledge, our study represents the only study that describes the distribution and burden of this disease in KSA at the country level.

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Compliance with ethical standards

Ethical consideration

The study was approved by the Biomedical Ethics Committee of the Ministry of Health-Ha'il branch (IRB log number: 2020-22).

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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