Ten-year analysis of hepatitis B incidence in Iraq

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Abstract

Background: Hepatitis B virus infection is a major health concern globally, with regional and national variations that require context-specific analyses.

Aim: To assess trends, including age- and gender-specific variations, of hepatitis B virus incidence in Iraq from 2012 to 2022.

Methods: We analysed national surveillance data from 2012 to 2022 on confirmed hepatitis B virus cases among all age groups in Iraq. Joinpoint regression was used to estimate the annual percentage change and average annual percentage change in incidence.

Results: Annual incidence decreased from 9.7 per 100 000 population in 2012 to 3.5 in 2022. Incidence was consistently higher among males, however, joinpoint regression showed a significant decrease in incidence among males (-13.8%) and females (-14.9%). The lowest decrease (-41.1%) occurred after 2017 among those aged 0–4 years. Incidence among the 5–14 years age group peaked in 2014 and decreased thereafter (-10.8%). Among individuals aged 15–44 years, incidence increased until 2016 and then decreased significantly (-18.9%). Among those aged >45, incidence increased until 2015 and then stabilised.

Conclusion: Age- and gender-specific interventions are needed to strengthen hepatitis B prevention and control in Iraq.

Keywords: hepatitis B, viral disease, incidence, age, gender, surveillance, Iraq

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Introduction

Hepatitis B virus (HBV) infection remains a major public health concern globally, contributing substantially to liver-related morbidity and mortality. WHO estimates that 257 million people are chronically infected with HBV worldwide, resulting in nearly 887 000 deaths each year, primarily due to complications such as cirrhosis and hepatocellular carcinoma (*1,2*).

Despite its significant global burden, the incidence and prevalence of HBV vary across regions and population groups (*3*). Meta-analyses have reported high HBV prevalence in sub-Saharan Africa and East Asia, reflecting continuous transmission in areas with limited access to vaccination and screening services (*6,7*). These disparities highlight the need for targeted, context-specific public health strategies (*4,5*).

Iraq, located in the Eastern Mediterranean Region, faces unique challenges in controlling hepatitis B, due to population mobility, post-conflict recovery and barriers to consistent health care delivery. National epidemiologic data indicate that HBV continues to pose a public health threat, with variations across different regions and demographic groups (*8*). Iraq faces persistent challenges in managing infectious diseases, reinforcing the need to investigate hepatitis B dynamics at the national level (*9,10*).

This study used joinpoint regression, a statistical method for identifying significant changes in temporal trends, to examine age- and gender-specific patterns in hepatitis B incidence in Iraq (*11*). Using national health databases and surveillance systems, which contain confirmed hepatitis B surface antigen (HBsAg) cases reported by health care facilities, we analysed annual incidence data from 2012 to 2022. This approach allowed the identification of trends by age and gender, supporting a clearer understanding of HBV patterns in Iraq.

Findings from this study will inform public health decision-making and further research. By identifying significant trends and variations in HBV incidence, we provide evidence to support the design of targeted interventions for reducing the burden of HBV in Iraq. This research also contributes to global hepatitis B control efforts, offering insights into effective disease management in similar settings.

Methods

Study design

This retrospective observational study used secondary analysis of national health data to evaluate annual hepatitis B incidence in Iraq from 2012 to 2022, incorporating temporal analysis to assess trends over the study period. The incidence rates were age-standardised using the WHO standard population, to ensure comparability across age groups and over time.

To assess variability and precision, 95% confidence intervals (CIs) were computed for incidence rates and trend estimates. These CIs reflect the uncertainty around the estimates and serve as indicators of statistical reliability. Statistical significance was determined using a two-sided *P* value threshold ≥ 0.05, ensuring that identified trends or differences were interpreted with a clearly defined level of confidence

Data collection

The data were retrospectively sourced from national health databases and routine surveillance systems for hepatitis B in Iraq. These databases contain annual counts of confirmed HBsAg cases reported by health care facilities across the country. The dataset reflects reported cases, including diagnoses made through routine clinical assessments and screening. The primary demographic variables collected were age and gender.

Setting and case definition

The study included individuals of all age groups diagnosed with hepatitis B between 2012 and 2022. A confirmed hepatitis B case was defined as a patient who tested positive to HBsAg, according to national and WHO diagnostic guidelines. The ages were categorised into 4: 0–4, 5–14, 15–44 and > 45 years, enabling a detailed examination of age-specific patterns.

Statistical analysis

The data were compiled using Microsoft Excel and joinpoint regression software version 5.2 was used to analyse trends in annual hepatitis B incidence per 100 000 population in Iraq from 2012 to 2022 *(13)*. A maximum of 2 joinpoints was permitted, based on the number of data points available to assess trend magnitude and direction over the entire period, we calculated the average annual percent change (AAPC) and the corresponding 95% confidence intervals (CIs). We estimated the annual percent change (AAPC) and 95% CIs for each segment of the regression model. Statistical significance was determined using a two-sided $P \geq 0.05$.

Joinpoint regression (version 5.0) was used to analyse trends in annual hepatitis B incidence rates per 100 000 population from 2012 to 2022 *(12)*. The model can be expressed as:

$$y = \beta 0 + \sum_{j=1}^{k} \beta j \cdot \left(x - \text{Joinpoint}_j\right) + e$$

Eq. 1

This model captures variations in annual incidence rates over time, where y is the incidence rate, x is the calendar year, $\beta 0$ is the intercept, βj is the slope for each segment, joinpointj represents the joinpoint for segment j, and ϵ is the error term.

The APC for each segment (j) was calculated as follows:

$$APC_j = \left(exp\left(\beta_j\right) - 1\right) \times 100$$

Eq. 2

The AAPC was computed by averaging the segment-specific APCs *(12)*:

$$AAPC = \frac{\prod_{j=1}^{k} (1+APC_j)^{1/k-1}}{k} \times 100$$

Eq. 3

Ethics considerations

The study protocol was approved by the ethics review board of Shahid Beheshti University of Medical Sciences (Approval ID: IR.SBMU.PHNS.REC.1404.044), and by the Research Committee of the National Centre for Training and Human Development, Ministry of Health, Iraq (Approval ID: IRAQ.MOH.FORM NUMBER 04/2012; Decision number: 24). Approval was granted to analyse anonymised data collected through national surveillance systems. The evaluation focused on programme data and did not involve direct interaction with human participants or biological specimens. The dataset obtained from the Ministry of Health, Iraq, contained no personal identifiers or data that could compromise patient confidentiality. The requirement for informed consent was waived because of the retrospective nature of the study.

Results

The overall incidence decreased from 9.7 per 100 000 population in 2012 (95% CI: 2.2–15.8) to 3.5 in 2022 (95% CI: 1.1–4.2). Throughout this period, incidence was consistently higher among males than females (11.9 vs 7.4 in 2012; 3.9 vs 2.6 in 2022). Among children aged 0–4 years, incidence decreased from 1.3 to 0.1 per 100 000. In the 5–14 years age group, incidence peaked at 9.6 in 2014, and decreased to 1.0 in 2022. Among individuals aged 15–44 years, incidence decreased from 13.3 in 2012 to 2.8 in 2022. For those aged over 45 years, incidence peaked at 20.0 in 2013 and decreased to 9.7 by 2022 (Table 1).

Joinpoint regression detected significant changes in incidence trends by age group and gender over the study period. In the 0–4 years age group, a significant increase was observed from 2012 to 2017 (APC: 32.4%), followed by a sharp decrease from 2017 to 2022 (APC: -41.1%). The 5–14 years age group experienced a marked increase from 2012 to 2014 (APC: 73.03%), then decrease through 2022 (APC: -10.8%). Among individuals aged 15–44 years, incidence increased from 2012 to 2016 (APC: 44.7%), followed by a significant decrease from 2016 to 2022 (APC: -18.9%). For those aged > 45 years, incidence increased significantly from 2012 to 2015 (APC: 52.9%), then plateaued with a non-significant decrease thereafter (APC: -2.6%).

Table 1 Annual incidence of hepatitis B in Iraq by age and gender, 2012–2022

Year	Total per 100 000 (95% CI)	Male	Female	0–4 years	5–14 years	15–44 years	> 45 years
2012	9.7 (2.2–15.8)	11.9	7.4	1.3	2.1	13.3	18.2
2013	11.1 (2.3–18.6)	13.4	8.9	1.1	4.7	15.4	20.0
2014	9.0 (2.7–11.2)	9.8	8.1	0.9	9.6	11.5	7.9
2015	8.3 (2.4–14.7)	9.7	6.9	0.8	1.6	12.0	16.5
2016	5.2 (1.8–9.8)	6.1	4.3	0.6	1.0	7.9	8.9
2017	5.2 (1.9–9.3)	5.9	4.4	1.0	1.5	7.6	8.5
2018	5.2 (2.2–9.1)	5.8	4.6	0.3	1.2	7.9	9.0
2019	4.2 (1.6–6.8)	4.5	3.0	0.1	0.7	5.1	8.9
2020	2.6 (0.8–4.3)	2.5	1.9	0.3	0.5	3.1	3.9
2021	2.4 (0.9–4.0)	2.6	1.6	0.1	0.6	3.1	3.6
2022	3.5 (1.1–4.2)	3.9	2.6	0.1	1.0	2.8	9.7

CI = Confidence interval

In terms of gender-specific trends, a significant decrease was observed in males from 2012 to 2020 (APC: -13.8%), followed by a non-significant change from 2020 to 2022. Among females, incidence decreased significantly from 2012 to 2014 (APC: -14.9%), and continued to decrease through 2022 (APC: -17.5%).

Overall incidence for both genders decreased significantly from 2012 to 2014 (APC: -14.7%), and continued to decrease from 2014 to 2022 (APC: -16.3%). Confidence intervals for these estimates are shown in Table 2. Supporting visual trends are presented in Figures 1 and 2.

Table 3 presents the joinpoint regression results, including the APC and AAPC with the corresponding CIs and *P* values, stratified by age group and gender. Results are shown for the full study period and for the last 5 years (2018–2022).

In the 0–4 years age group, the APC over the full period was not statistically significant (3.6%; $P = 0.181$), but the AAPC for 2018–2022 showed a significant decrease (-43.8%; $P = 0.025$). For the 5–14 years age group both APC (-2.1%; $P = 0.619$) and AAPC (5.43%; $P = 0.619$) were nonsignificant. The 15–44 years age group showed no significant change (APC: 6.4%; $P = 0.862$; AAPC: 1.5%; $P = 0.862$). Similarly, among those aged over 45 years, neither APC (10.3%; $P = 0.217$) nor AAPC (11.5%; $P = 0.217$) reached statistical significance.

Among males, the APC showed a significant decrease (-13.8%; $P = 0.006$). A similar trend was observed in females (APC: -14.9%; $P = 0.002$) and in the combined group (APC: -14.7%; $P = 0.001$). In the last 5 years, the AAPC remained significantly negative in females (-17.4%; $P = 0.001$) and for both genders combined (-16.5%; $P = 0.001$), but was not significant in males (-9.4%; $P = 0.442$).

P values indicate the significance of AAPC differences between groups. Notably, the trend among males and females showed statistically distinct patterns.

Discussion

This study identified a significant reduction in hepatitis B incidence in Iraq between 2012 and 2022, with distinct patterns among age groups and between males and females. The overall trend reflects the impact of national immunisation programmes. Differences across subgroups highlight the need for continued, targeted public health efforts.

Table 2 Trends in incidence of hepatitis B (per 100 000 population) by age and gender in Iraq, 2012–2022

Variable	2012 (n)	2012 rate	2022 (n)	2022 rate	Overall APC (%)	95% CI	Trend 1 (years)	APC (%)	95% CI	Trend 2 (years)	APC (%)	95% CI
0–4 years	62	1.3	4	0.06	3.6	-15.8 to 27.7	2012–2017	32.4 *	8.7, 94.3	2017–2022	-41.1 *	-84.5 to -20.7
5–14 years	282	3.2	108	0.99	-2.1	-12.9 to 10.2	2012–2014	73.0 *	33.4, 141.8	2014–2022	-10.8 *	-21.4 to -7.6
15–44 years	2084	13.3	521	2.7	6.4	-8.1 to 23.3	2012–2016	44.7 *	13.8, 135.2	2016–2022	-18.9 *	-59.4 to -3.5
≥ 45 years	892	18.2	646	10.7	10.3	-4.4 to 24.9	2012–2015	52.9	-18.8, 173.9	2015–2022	-2.6	-18.8 to 16.9
Male	2074	11.9	9.8	3.7	13.8 *	-19.04 to -9.95	2012–2020	-15.7 *	-19.7, 11.5	2020–2022	-1.2	-47.2 to 84.7
Female	1248	7.4	499	2.4	-14.9 *	-21.8 to -9.4	2012–2014	0.45	-40.3, 69.0	2014–2022	-17.5 *	-23.8 to -10.6
Both genders	3322	9.7	1279	3.0	-14.7 *	-21.4 to -9.4	2012–2014	-5.6	-42.7, 55.4	2014–2022	-16.3 *	-22.5 to -9.6

APC = Annual percent change; CI = confidence interval; n = number of confirmed cases.
(*) indicates statistically significant change (P < 0.05)

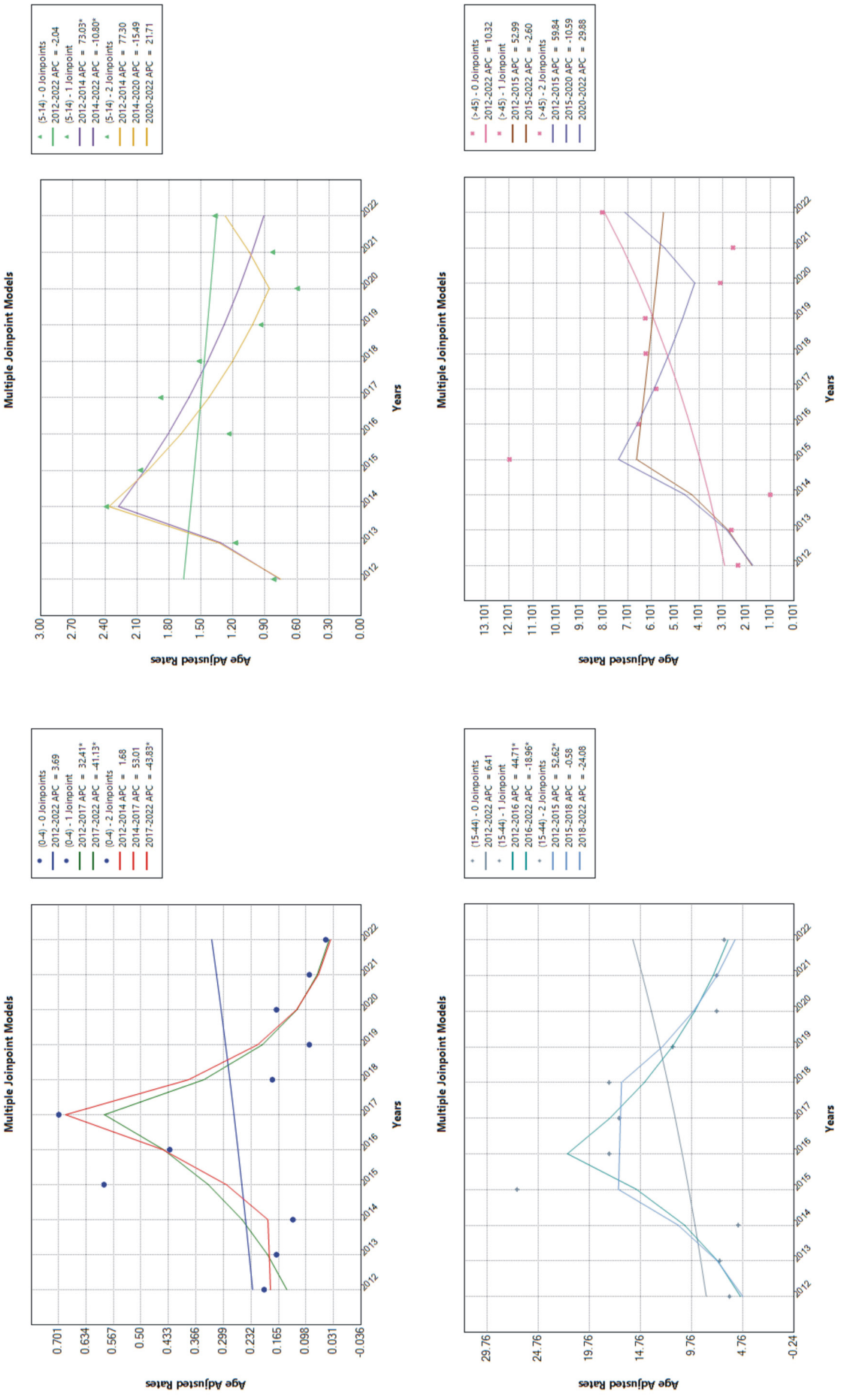

Figure 1 Changes in hepatitis B incidence in Iraq by age group, 2012–2022

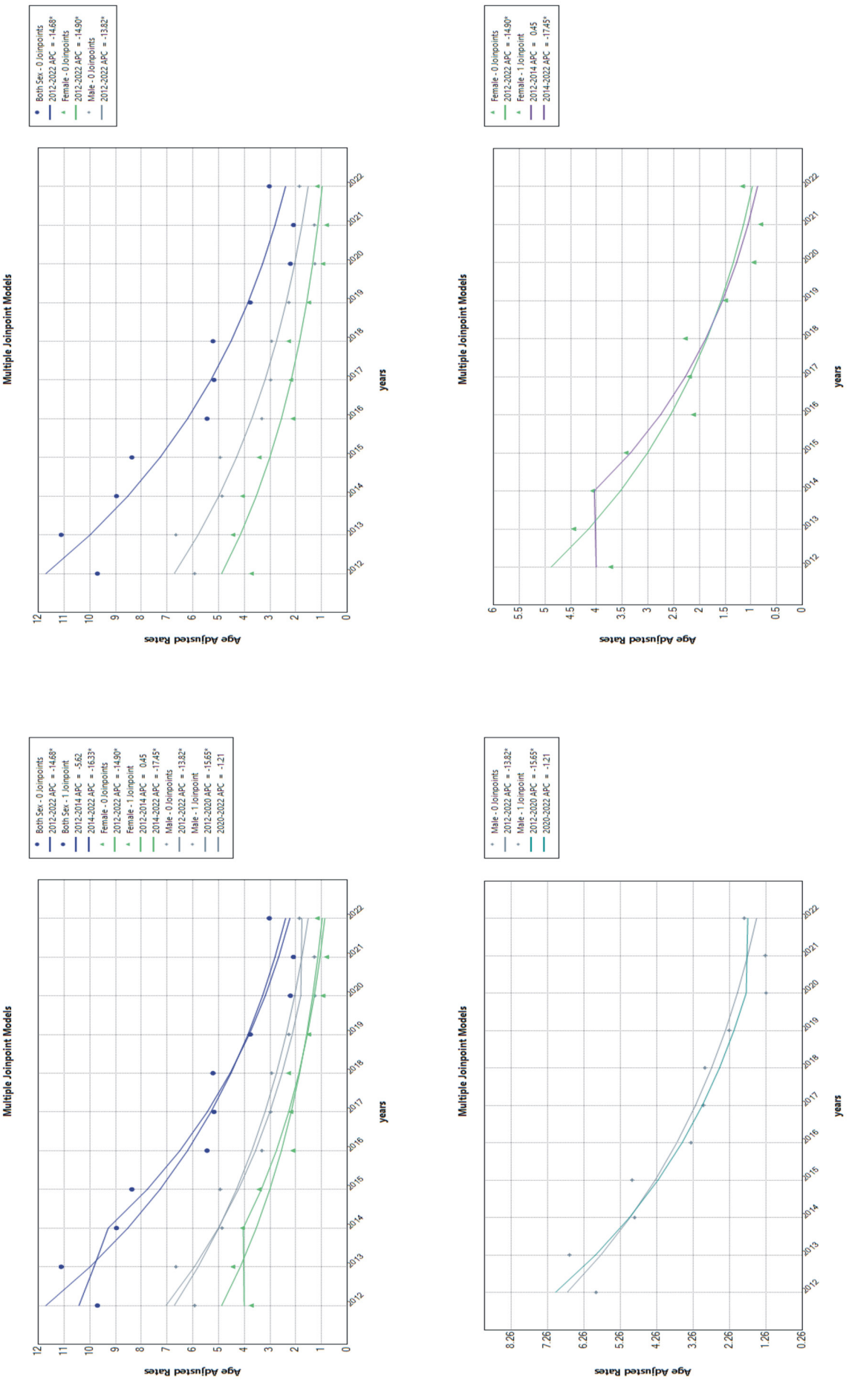

Figure 2 Changes in hepatitis B incidence in Iraq by gender, 2012–2022

Table 3 **Annual and average annual percentage change in incidence of hepatitis B by age and gender**

Variable	APC 2012–2022 (%)	95% CI	AAPC 2012–2022 (%)	95% CI	*P*	AAPC 2018–2022 (%)	95% CI	*P*
Age group								
0–4 years	3.6	-15.8 to 27.7	14.6	-32.2 to 7.7	0.181	-43.8 *	-63.8 to -12.8	0.025
5–14 years	-2.1	-12.9 to 10.2	5.4	-14.4 to 29.9	0.619	1.4	-33.2 to 53.9	0.947
15–44 years	6.4	-8.1 to 23.3	1.5	-14.2 to 20.1	0.862	-24.1	-45.3 to 5.4	0.075
> 45 years	10.3	-4.4 to 24.9	11.5	-6.2 to 32.6	0.217	-2.6	-18.8 to 16.9	0.735
Gender								
Male	-13.8 *	-19.0 to -10.0	-13.3 *	-21.7 to -4.0	0.006	-9.4	-29.2 to 3.9	0.442
Female	-14.9 *	–21.8 to -9.4	-14.2 *	-22.2 to -5.3	0.002	-17.4 *	-23.9 to -10.4	0.001
Both genders	-14.7 *	-21.4 to -9.4	-14.4 *	-22.2 to -5.9	0.001	-16.5 *	-22.4 to -10.0	0.001

Age-specific patterns

Among children aged 0–4 years, the pronounced decrease in incidence from 2017 to 2022 suggests strengthened infant immunisation and maternal screening. The earlier increase, observed between 2012 and 2017, may have resulted from inconsistent coverage or gaps in maternal hepatitis B screening. Similar patterns have been reported in countries like Saudi Arabia and Morocco, where vaccination coverage and screening for maternal hepatitis B have significantly reduced early childhood transmission *(14–16)*.

Among the 15–44 years age group, incidence increased from 2012 to 2016 before decreasing sharply. This pattern suggests a delayed but substantial impact of hepatitis B control measures, such as adult immunisation and expanded detection efforts *(17)*. These findings highlights the importance of vaccination campaigns in reducing adult transmission and the sustained benefits of national immunisation programmes.

Gender-specific patterns

The consistent decrease in hepatitis B incidence among males from 2012 to 2020 reflects the effectiveness of targeted prevention efforts, notably awareness campaigns and immunisation strategies. However, the stabilisation observed from 2020 to 2022 suggests the need to address emerging gaps in programme coverage or outreach, particularly among adult men.

Among females, incidence decreased steadily throughout the study period. This trend highlights the impact of gender-responsive interventions, including targeted health education and maternal immunisation programmes. Similar patterns have been reported in Islamic Republic of Iran and Türkiye, where such strategies have supported hepatitis B control *(18–20)*.

Global context

Comparative studies from Jordan and Egypt – countries with similar demographic and epidemiological profiles – report comparable trends, with national immunisation programmes driving decreases in incidence *(21,22)*.

The overall decrease in hepatitis B incidence aligns with WHO hepatitis B elimination targets, which prioritise universal birth dose, routine childhood immunisation, and catch-up vaccination for high-risk populations (23,24). These findings contribute to global evidence supporting the impact of vaccination programmes and integrated public health strategies in reducing viral hepatitis burden.

Study limitations

This study had several limitations. First, the analysis was limited to age and gender, limiting the assessment of other important risk factors, such as geographic disparities. Future research should incorporate additional dimensions, such as socioeconomic status, urban-rural residence, and behavioural risk factors, to provide a more nuanced understanding of hepatitis B transmission. Longitudinal studies are needed to assess the sustained impact of immunisation and screening programmes and to inform the design of more targeted public health interventions.

Conclusion

This study presents a comprehensive analysis of hepatitis B incidence trends in Iraq from 2012 to 2022, showing a significant overall decrease, with age- and gender-specific variations. The findings indicate the effectiveness of national immunisation programmes in reducing hepatitis B transmission, while also identifying gaps that warrant targeted attention. To sustain progress, policymakers should prioritise improvements in vaccination coverage among high-risk groups and strengthening maternal screening and immunisation services. Enhanced public health education and awareness campaigns may further reduce transmission, especially in underserved areas. These targeted strategies are essential to maintain progress and achieve long-term hepatitis B control in Iraq. This research offers relevant insights for public health decision-makers and can inform hepatitis B control efforts in in Iraq and similar contexts.

Funding: None.

Conflicts of interest: None declared.

Analyse sur 10 ans de l'incidence de l'hépatite B en Iraq

Résumé

Contexte : L'infection par le virus de l'hépatite B est un problème de santé publique mondial majeur, avec des variations régionales et nationales qui nécessitent une analyse spécifique au contexte.

Objectif : Évaluer les tendances, y compris les variations selon l'âge et le sexe, de l'incidence du virus de l'hépatite B en Iraq pour la période 2012-2022.

Méthodes : Nous avons analysé les données de surveillance nationale de 2012 à 2022 sur les cas confirmés d'infection par le virus de l'hépatite B dans toutes les tranches d'âge en Iraq. La régression Joinpoint a été utilisée pour estimer le pourcentage de variation annuelle de l'incidence ainsi que la moyenne pour ce paramètre.

Résultats : L'incidence annuelle a reculé, passant de 9,7 pour 100 000 habitants en 2012 à 3,5 en 2022. L'incidence était constamment plus élevée chez les hommes ; cependant, la régression Joinpoint a montré une diminution significative chez les hommes (–13,8 %) et les femmes (–14,9 %). La baisse la plus faible (–41,1 %) a été enregistrée après 2017 chez les enfants âgés de zéro à quatre ans. L'incidence dans la tranche d'âge de cinq à 14 ans a atteint un pic en 2014, puis a diminué par la suite (–10,8 %). Chez les personnes dont l'âge est compris entre 15 et 44 ans, l'incidence a augmenté jusqu'en 2016, puis a considérablement baissé (–18,9 %). Chez les personnes âgées de plus de 45 ans, l'incidence a suivi une tendance à la hausse jusqu'en 2015 puis s'est stabilisée.

Conclusion : Des interventions spécifiques à l'âge et au sexe sont nécessaires pour renforcer la lutte contre l'hépatite B et la prévention de cette maladie en Iraq.

تحليل مدته عشر سنوات لمعدل الإصابة بالتهاب الكبد B في العراق

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الخلاصة

الخلفية: تُمثِّل العدوى بفيروس التهاب الكبد B شاغلاً رئيسيًّا من شواغل الصحة العالمية، مع وجود اختلافات إقليمية ووطنية تتطلب تحليلاً مُحدَّد السياق.

الأهداف: هدفت هذه الدراسة الى تقييم الاتجاهات، بما فيها الاختلافات العمرية والجنسانية، فيما يتعلق بمعدل الإصابة بفيروس التهاب الكبد B في العراق في الفترة من 2012 إلى 2022.

طرق البحث: أجرينا تحليلاً لبيانات الترصُّد الوطني للفترة من عام 2012 إلى عام 2022 بشأن حالات مؤكدة للإصابة بفيروس التهاب الكبد B في جميع الفئات العمرية في العراق. واستُخدم انحدار Joinpoint لتقدير النسبة المئوية السنوية للتغير في معدل الإصابة ومتوسط النسبة المئوية السنوية للتغير في معدل الإصابة.

النتائج: انخفض معدل الإصابة السنوي من 9.7 لكل 100000 نسمة في عام 2012 إلى 3.5 في عام 2022. وكان معدل الإصابة أعلى باستمرار بين الذكور، ولكن أظهر انحدار Joinpoint انخفاضًا كبيرًا في معدل الإصابة بين الذكور (٪13.8–) والإناث (٪14.9–). وحدث أدنى انخفاض (٪41.1–) بعد عام 2017 بين من تتراوح أعمارهم بين 0 و4 سنوات. وبلغ معدل الإصابة في الفئة العمرية 14–5 سنة ذروته في عام 2014، ثم انخفض بعد ذلك (٪10.8–). وفي الأفراد الذين تتراوح أعمارهم بين 15 و44 سنة، ارتفع معدل الإصابة حتى عام 2016، ثم انخفض انخفاضًا كبيرًا (٪18.9–). وفي الأفراد الذين تزيد أعمارهم على 45 سنة، ارتفع معدل الإصابة حتى عام 2015 ثم استقر.

الاستنتاجات: هناك حاجة إلى تدخلات تراعي العمر ونوع الجنس لتعزيز الوقاية من التهاب الكبد B ومكافحته في العراق.

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