

Epidemiology of hepatitis B in pregnant Iranian women: a systematic review and meta-analysis

Gholamreza Badfar¹ · Masoumeh Shohani² · Marzieh Parizad Nasirkandy³ · Akram Mansouri⁴ · Ghobad Abangah⁵ · Shoboo Rahmati⁶ · Sanaz Aazami⁷ · Ali Soleymani⁸ · Milad Azami⁹

Received: 14 May 2017 / Accepted: 21 August 2017
© Springer-Verlag GmbH Austria 2017

Abstract Perinatal transmission is one of the most common routes of hepatitis B virus (HBV) transmission. This study aims to identify the epidemiological features of HBV among pregnant Iranian women. This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. Two authors independently searched several online databases without time limit until May 2017. The databases include Magiran, Iranmedex, SID, Medlib, IranDoc, Scopus, PubMed, Science Direct, Cochrane, Web of Science and Google Scholar. The data were analyzed based on a random-effects model using Comprehensive Meta-Analysis software version 2. Thirty-seven studies were included in the meta-analysis. The prevalence of HBV among pregnant Iranian women was 1.18% (95% CI: 0.09%–1.53%). The prevalence of HBV among pregnant women living in urban and rural areas was 1.60% (95% CI: 0.06%–4.30%) and 1.70% (95% CI: 0.09%–3.2%), respectively. The prevalence of HBV among housewives and working pregnant women was 4.3% (95% CI: 1.4%–12.5%) and 1.2% (95% CI: 0.02%–5.8%), respectively. The risk of

developing an HBV infection was significantly associated with illiteracy ($p = 0.013$), abortion ($p = 0.001$), blood transfusion ($p < 0.001$) and addicted spouse ($p = 0.045$). However, no significant relationship was observed between HBV infection and urbanization ($p = 0.65$), occupation ($p = 0.37$), history of surgery ($p = 0.32$) or tattooing ($p = 0.69$). Vaccination coverage (receiving at least a single dose) in pregnant women was 9.8% (95% CI: 5.3%–17.5%). The prevalence of HBV among pregnant women is lower than in the general population of Iran. HBV vaccination coverage was low among pregnant Iranian women. Therefore, health policy-makers are recommended to enforce immunization programs for HBV vaccination among high-risk pregnant women.

Introduction

Hepatitis B is one of the most common infectious diseases worldwide [1]. According to the World Health Organization (WHO) in 2012, approximately 2 billion people are infected by HBV, more than 240 million suffer from chronic liver

Handling editor: Michael A. Purdy.

✉ Milad Azami
MiladAzami@medilam.ac.ir

Gholamreza Badfar
gh_badfar@yahoo.com

¹ Department of Pediatrics, Behbahan Faculty of Medical Sciences, Behbahan, Iran

² Department of Nursing, Faculty of Allied Medical Sciences, Ilam University of Medical Sciences, Ilam, Iran

³ Women's Reproductive Health Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

⁴ School of Nursing and Midwifery, Ahvaz Jundishapour University of Medical Science, Ahvaz, Iran

⁵ Department of Gastroenterology, Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran

⁶ Student Research Committee, Ilam University of Medical Sciences, Ilam, Iran

⁷ Faculty of Nursing and Midwife, Ilam University of Medical Sciences, Ilam, Iran

⁸ Faculty of Medicine, Dezful University of Medical Sciences, Dezful, Iran

⁹ Student Research Committee, Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran

disease, and 600,000 deaths occur each year due to acute and chronic liver dysfunction [2, 3]. Iran is considered to be a low-endemic country in terms of HBV [4]. Perinatal transmission is one of the most common routes of transmission [5]. HBV screening of pregnant women has been recommended by WHO [6]. The risk of developing HBV among children born to women with HBsAg⁺ (hepatitis B surface antigen) and HBeAg⁺ (hepatitis B virus early antigen) status is 70–90% or more, and over 85% of them become chronic carriers [7]. In addition, cirrhosis and hepatocellular carcinoma leads to death in 25% of these children [7].

Preventing HBV transmission from mother to child is only possible when the disease is diagnosed during pregnancy or before delivery. Therefore, the key elements for controlling the infection and establishing prevention programs for this disease include epidemiological patterns, prevalence, and the risk factors.

Previous studies have assessed the prevalence and risk factors of HBV in pregnant Iranian women [9–13]. However, the results were not consistent among the different studies, and thus, a systematic review and meta-analysis seems necessary.

In meta-analysis, as the number of studies and sample size increases, the confidence interval becomes smaller, and therefore, the results become more reliable [14–16]. Therefore, the present study aims to investigate the epidemiological features of HBV among pregnant women through a systematic review and meta-analysis.

Materials and methods

Study protocol

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines [16]. Two authors independently screened the databases and determined which studies were eligible for inclusion. Disagreements were resolved by a third researcher.

Search strategy

Two authors independently searched Iranian and international databases, including Iranmedex, Magiran, SID (Scientific Information Database), IranDoc, Medlib, Scopus, PubMed, Science Direct, Cochrane, Web of Science and also Google Scholar search engine, to identify potentially relevant studies. Languages were restricted to English and Persian. There was no time limit until May 2017. Our search included MeSH keywords “Epidemiology”, “Prevalence”, “Hepatitis”, “Pregnant women”, “Pregnancy”, “Gestational”, “Hepatitis B Surface Antigens”, “Vaccination”, “Vaccines” and “Risk Factors”. Moreover, we reviewed the

references of the selected articles to identify further relevant studies.

Definitions

The target population included studies whose subjects were pregnant women. The criterion for defining HBV infection was disease diagnosis in patients with positive blood test results in an enzyme-linked immunosorbent assay (ELISA) [17, 18].

Inclusion and exclusion criteria

The inclusion criteria in this study were investigations of the epidemiology of HBV among pregnant Iranian women published in either Persian or English. The exclusion criteria were non-random sampling methods, studies irrelevant to the topic, studies on animals, editorials, case reports, interventions, and reviews.

Quality assessment of identified studies

Two authors independently screened the identified studies according to the STROBE checklist [19]. STROBE consists of 22 sections that evaluate studies in terms of sampling method, measurement, statistical analysis, and study objectives. Each item includes 0 to 2 points. A score of 16 was chosen as the cutoff point to choose studies for final inclusion, and any disagreement was resolved by a third researcher.

Data extraction

Two authors (Milad Azami, Shoboo Rahmati) independently extracted the data using a pre-prepared checklist. The checklist included the author's name, date of publication, place, type of study, year of study, overall HBV prevalence, HBV prevalence based on place of residence and occupation, vaccination, HBsAg⁺ and potential risk factors for HBV in pregnant women.

Statistical analysis

Binomial distribution was used to estimate the prevalence of HBV in each study. Pooled odds ratios (OR) were used to measure the effects for potential risk factors of HBV (if the factor was mentioned in two studies or more) in cross-sectional and case-control studies. We used Cochran's Q test and I² index to assess heterogeneity. If the *p*-value of the I² index was >50% and the Q test value was <0.05, heterogeneity was assumed and a random effects model was used. If heterogeneity was not found, a fixed effects model was adopted [20, 21]. Subgroup analysis was performed to find

the source of heterogeneity in HBV prevalence. Sensitivity analysis was carried out to assess the stability of the data. Publication bias was assessed using Egger and Begg's tests [22]. We used meta-regression to investigate the relationship between prevalence of HBV and year of study. Data were analyzed through meta-analysis based on the random effects model using Comprehensive Meta-Analysis software version 2 (Biostat, Englewood, NJ, USA). $p < 0.05$ was considered statistically significant.

Results

Search results

Searching online databases identified 364 studies. After careful consideration for inclusion and exclusion criteria

and quality assessment (using the STROBE checklist), 37 studies were included in the meta-analysis (Fig. 1).

Characteristics of the included studies

The 37 studies were published in 1990-2016, and included 71,550 pregnant Iranian women. Ten, two, five and nine studies were conducted in central, eastern, northern and southern Iran, respectively, and the ELISA technique was used in all studies for HBV diagnosis. The mean age of the pregnant women was estimated to be 25 years. Table 1 shows the details of the studies in this meta-analysis.

The overall prevalence of HBV

The prevalence of HBV among pregnant women in Iran was 1.18% (95% confidence interval [CI]: 0.09%-1.53%) and the heterogeneity index was $I^2 = 99.06$ ($p < 0.0001$). The lowest

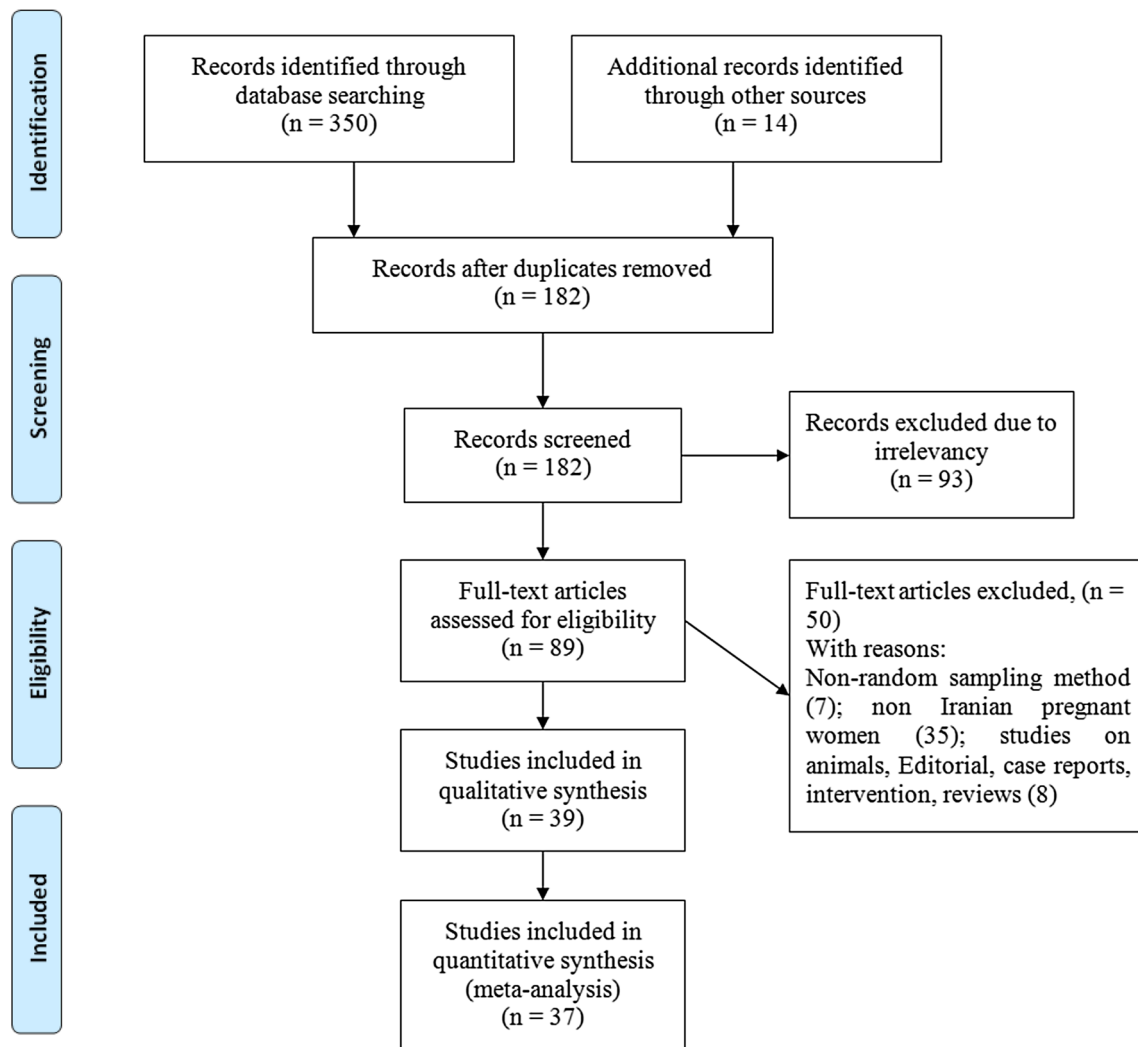


Fig. 1 Study selection process

Table 1 Detail of studies included into this meta-analysis

References	First author, publication year	Place	Year of study	Sample size	Age (mean \pm SD)	Diagnostic criteria	Hepatitis B prevalence (%)	Vaccination coverage (%)
[8]	Yadegari D, 1998	Zanjan	1996	600	24.5 \pm 5.6	HBsAg	1	
[9]	Aminzadeh Z, 2004	Rafsanjan	2003	600	26.2 \pm 5.3	HBsAg	1.3	1
[10]	Moradi B, 2003	Tehran	1999	339		HBsAg	4.71	
[11]	Ghalenoe M, 2003	Kerman	1996	232	25.37 \pm 5.0	HBsAg	2.58	
[12]	Sharifi M, 2000	Qazvin	2000	323		HBsAg	3.4	
[13]	Aali B. Sh, 1998	Kerman	1997	1002	26.52 \pm 5.8	HBsAg	2.3	
[23]	Mirghaforvand M, 2007	Tabriz	2006	187		HBsAg	3.2	
[24]	Salimi S, 2014	Ardebil	2009	9321		HBsAg	1.7	
[25]	Sarifi-halat B, 2005	Zahedan	2002	200	21 \pm 5.0	HBsAg	6.5	
[26]	Tabasi Z, 2003	Kashan	2002	2000	24.65 \pm 6.2	HBsAg	0.35	
[27]	Motazakker M, 2014	Orumieh	2011	368	25.9 \pm 5.5	HBsAg	0.80	
[28]	Cheraghali F, 2011	Gorgan	2008	1553		HBsAg	1	
[29]	kavosi A, 2015	Aqqala	2010	1057		HBsAg	1.6	
[30]	Mohammad Jaffari R, 2004	Ahvaz	1998	120	28.9 \pm 5.0	HBsAg	1.7	5.8
[31]	Mobaien A, 2014	Zanjan	2011	1317	26.7 \pm 5.8	HBsAg	0.40	8.6
[32]	Behjati Ardekani R, 2000	Yazd	2000	1904		HBsAg	0.84	
[33]	Mohebbi SR, 2011	Lorestan	2007	827	26.1 \pm 5.4	HBsAg	0.70	
[34]	Motamedifar M, 2012	Shiraz	2009	238		HBsAg	0.85	22.8
[35]	Ahmadi M, 2011	Isfahan	2009	1078	26.1 \pm 4.9	HBsAg	0.50	12.5
[36]	Jalali P, 1999	Hamedan	1998	1000		HBsAg	1.2	
[37]	Hassanjan Roshan M. 1994	Babol	1994	1456		HBsAg	2	
[38]	Ebrahim Pour S, 1993	Tabriz	1988	460		HBsAg	2.17	
[39]	Ahansaz M, 2000	Gorgan	1999	246		HBsAg	1.21	
[40]	Nasirazin B, 2000	Tehran	1999	1000		HBsAg	1.7	
[41]	Aghighi M, 2000	Tehran	1995	1429		HBsAg	4	
[42]	Ryazi Z, 2007	Torbat Heydarieh	2004	1830		HBsAg	1.2	
[43]	Moradi HR, 2000	Tehran	1998	1000		HBsAg	1.7	
[44]	Sahaf F, 2007	Tabriz	2006	680		HBsAg	2.5	
[45]	Shoghli A, 2015	Seven provinces	2011	5261	27.8 \pm 5.0	HBsAg	1.21	
[46]	Dehghani Zahedani M, 2010	Bandar Abbas	2008	680		HBsAg		28.1
[47]	Afzali H, 2015	Kashan	2012	768	24.65 \pm 4.0	HBsAg	1.56	
[48]	Yahyapour Y, 2011	Amol	2005	6442		HBsAg	0.16	
[48]	Yahyapour Y, 2011	Amol	2004	5939		HBsAg	0.40	
[48]	Yahyapour Y, 2011	Amol	2006	6315		HBsAg	0.40	
[48]	Yahyapour Y, 2011	Amol	2008	6057		HBsAg	0.51	
[48]	Yahyapour Y, 2011	Amol	2007	6488		HBsAg	0.62	
[49]	Bayani M, 2016	Babol	2014	1065		HBsAg	0.18	
[50]	Kheiri L, 2015	Dehloran	2011	850		HBsAg	0.59	

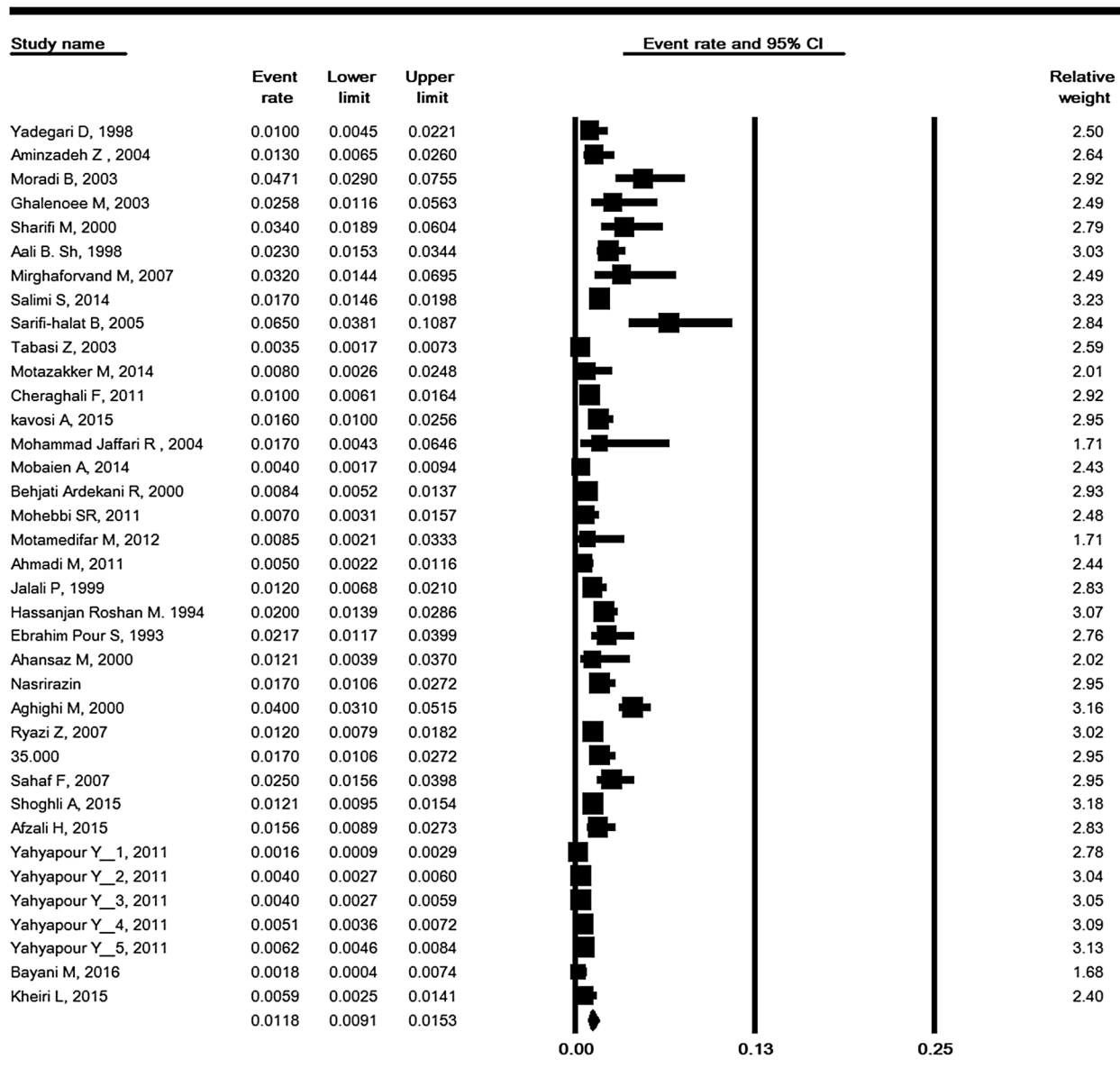
prevalence was reported in the city of Amol (Yahyapour et al.), with 0.16%, and the highest prevalence was reported in the city of Zahedan, with 6.5% (Sharifi et al.) (Fig. 2).

Sensitivity analysis

Removing any single study did not affect the combined results for HBV prevalence (Fig. 3).

Subgroup analysis based on region and province

Table 2 and Figure 4 show the geographical distribution of HBV among pregnant women in Iran. As shown in Table 2, the lowest prevalence was found in northern Iran (0.69% [95% CI: 0.42%-1.12%]), and the highest prevalence was found in eastern Iran (2.8% [95% CI: 0.52%-13.7%]).



Meta Analysis

Fig. 2 Forest plot of prevalence of HBV infection among pregnant Iranian women according to the random-effects model

Prevalence of HBV infection based on place of residence and occupation

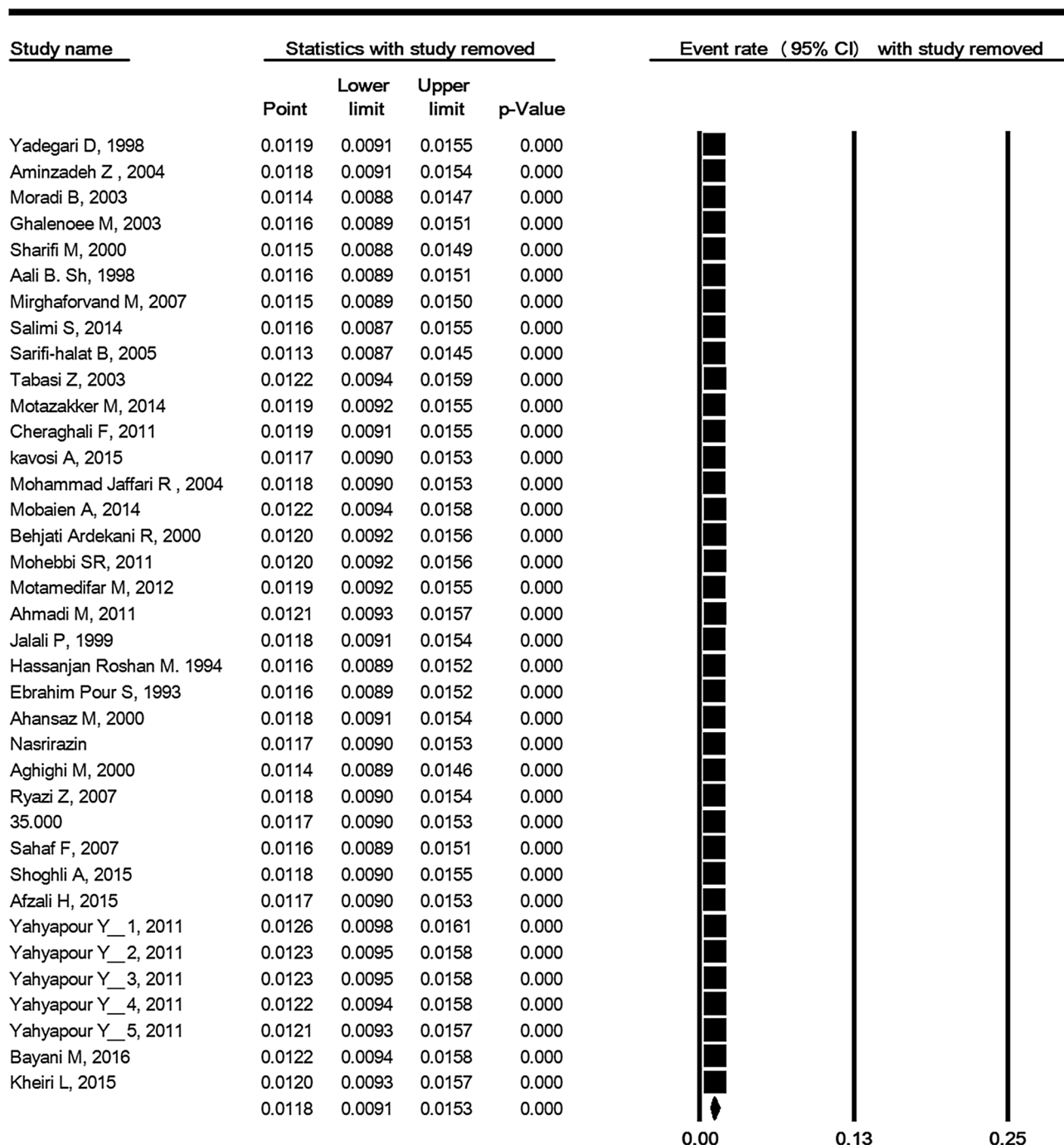
The prevalence of HBV infection among pregnant women living in urban and rural areas was 1.60% (95% CI: 0.06%-4.30%) and 1.70% (95% CI: 0.09%-3.2%), respectively (p -value for difference = 0.96). The prevalence of HBV among housewives and working pregnant women was 4.3% (95% CI: 1.4%-12.5%) and 1.2% (95% CI: 0.02%-5.8%), respectively (p -value for difference = 0.37) (Table 2).

Hepatitis B vaccination coverage and HBsAb⁺

Six studies examined vaccination coverage and reported that 9.8% (95% CI: 5.3%-17.5%) of pregnant women had received at least a single dose of HBV vaccine. The prevalence of HBsAb⁺ in pregnant Iranian women was 43.3% (95% CI: 33.3%-53.9%). (Fig. 5).

Risk factors for hepatitis B in pregnant women

The risk of developing an HBV infection was significantly associated with illiteracy ($p = 0.013$), abortion



Meta Analysis

Fig. 3 Sensitivity analysis of the prevalence of HBV infection among pregnant Iranian women according to the random-effects model

($p = 0.001$), blood transfusion ($p < 0.001$) and addicted spouse ($p = 0.045$). However, no significant relationship was observed between HBV infection and urbanization ($p = 0.65$), occupation ($p = 0.37$), history of surgery ($p = 0.32$) or tattooing ($p = 0.69$) (Table 3).

Meta-regression

In order to assess the relationship between the prevalence of HBV and the year in which the study was performed, we used meta-regression model (Fig. 6). Our results revealed a

Table 2 Subgroup analysis of HBV prevalence based on region, province, place of residence, and occupation

Variables	Studies (<i>N</i> ^a)	Sample (N)	Heterogeneity		95% CI ^b	Overall (%)
			<i>I</i> ²	<i>p</i> -value		
Region						
Center	10	9841	90.84	< 0.0001	0.92–2.73	1.59
East	2	2030	95.78	< 0.0001	0.52–13.7	2.8
North	5	2190	0	0.42	0.42–1.12	0.69
South	9	6289	72.15	< 0.0001	0.75–1.87	1.18
Test for subgroup differences: <i>Q</i> = 15.39, <i>df</i> (<i>Q</i>) = 5, <i>p</i> = 0.009						
Province						
Khuzestan	1	120	–	–	0.43–6.46	1.7
Mazandaran	7	33762	91.67	< 0.0001	0.27–0.83	0.47
Golestan	3	2856	0	0.403	0.92–1.76	1.27
Ardebil	1	9321	–	–	1.46–1.98	1.7
Ilam	1	850	–	–	0.25–1.41	0.59
Hamedan	1	1000	–	–	0.68–2.10	1.20
Isfahan	3	3846	82.44	0.003	0.25–1.77	0.67
Kerman	3	1834	12.27	0.32	1.44–2.92	2.05
Lorestan	1	827	–	–	0.31–1.57	0.70
Western Azerbaijan	1	368	–	–	0.26–2.48	0.80
Qazvin	1	323	–	–	1.89–6.04	3.40
Fars	1	236	–	–	0.21–3.33	0.85
East Azarbaijan	3	1327	74.90	< 0.0001	1.79–1.82	2.50
Tehran	4	3768	84.49	< 0.0001	1.64–4.61	2.76
Khorasan Razavi	1	1830	–	–	0.79–1.82	1.20
Yazd	1	1904	–	–	0.52–1.37	0.84
Sistan and Baluchestan	1	200	–	–	0.381–100	6.50
Zanjan	2	1917	57.80	0.124	0.26–1.57	0.64
Seven Provinces	1	5261	–	–	0.95–1.54	1.21
Test for subgroup differences: <i>Q</i> = 0.291, <i>df</i> (<i>Q</i>) = 3, <i>p</i> = 0.96						
Place of residence						
Urban	9	12322	96.41	< 0.0001	0.06–4.30	1.60
Rural	10	4309	82.42	< 0.0001	0.09–3.2	1.70
Rate ratio of urban to rural: 1.21(95% CI 0.53–2.76, <i>p</i> = 0.65)						
Occupation						
Housewives	8	12014	98.93	< 0.0001	1.4–12.5	4.3
Working	8	1923	70.87	0.001	0.02–5.8	1.2
Rate ratio of housewives to working: 2.31 (95% CI 0.36–14.49, <i>p</i> = 0.37)						

^aNumber^bConfidence interval

significantly decreasing trend, and the *p*-value was less than 0.0001 for the study year.

Publication bias

Figure 7 shows a funnel plot of HBV prevalence. The Egger and Begg's tests results were *p* = 0.09 and *p* = 0.06, suggesting the absence of a publication bias

Discussion

The present meta-analysis investigated the prevalence of HBV among pregnant Iranian women based on geographical region, province, occupation, place of residence, and study year. We also estimated the odds ratio of HBV risk factors.

The results showed that the prevalence of HBV according to 37 studies with a total sample size of 71,550 pregnant Iranian women was 1.18%. The reported prevalence

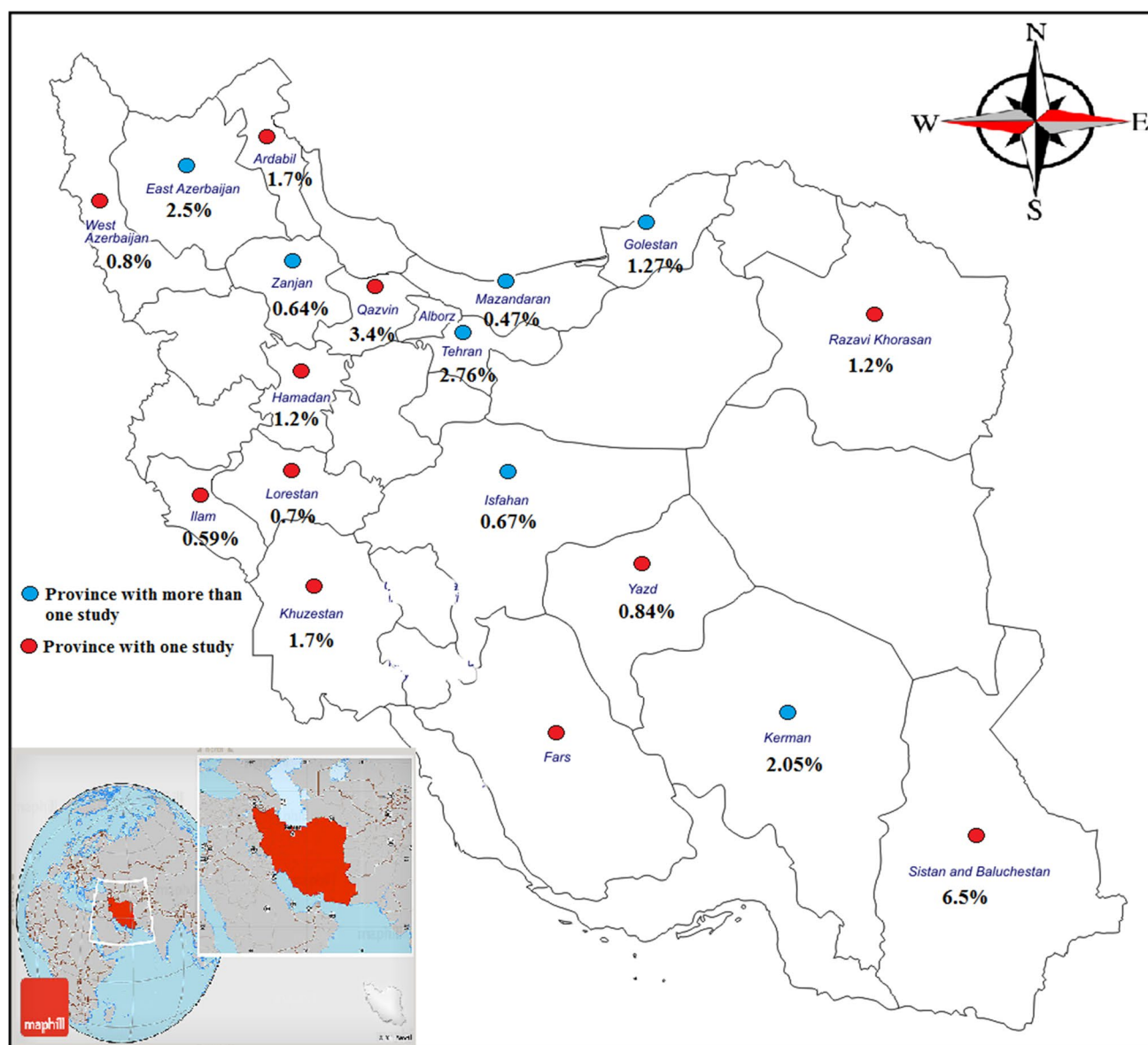


Fig. 4 Geographical distribution of prevalence of HBV infection in pregnant Iranian women

of HBV in different countries varies from less than 1% to 13.1% [51–56].

Previous systematic reviews have reported that the prevalence of HBV was 3.2% among opioid-addicted individuals, 0.08% among blood donors, 0.6% among health personnel and 3% among the total Iranian population [57–59]. These results might possibly be attributed to religious and cultural beliefs, having a single sexual partner, and the low number of opioid-addicted women in Iran [60]. A meta-analysis by Azami et al. [58] revealed that the prevalence of HBV infection among Iranian men was two times higher than in women. One of the most extensive studies that investigated HBV among pregnant Iranian women in seven provinces reported a prevalence of 1.21% [48]. A previous

systematic review showed that HBV vaccination coverage among high-risk groups of nurses, physicians, and dentists was 77.2%, 73.1% and 76%, respectively [61–63]. In another systematic review, the efficacy of HBV vaccination in Iranian people was reported to be over 90% [64, 65]. The present results indicate that the HBV vaccination coverage with at least a single-dose injection and HBsAb⁺ status among pregnant Iranian women was 9.8% and 43.3%, respectively. Therefore, increasing HBV vaccination coverage among pregnant Iranian women is recommended.

The results of assessing the relationship between HBV prevalence and the time of the study revealed a descending pattern in which HBV prevalence decreased over time from 1994 to 2015. This descending triangle pattern might

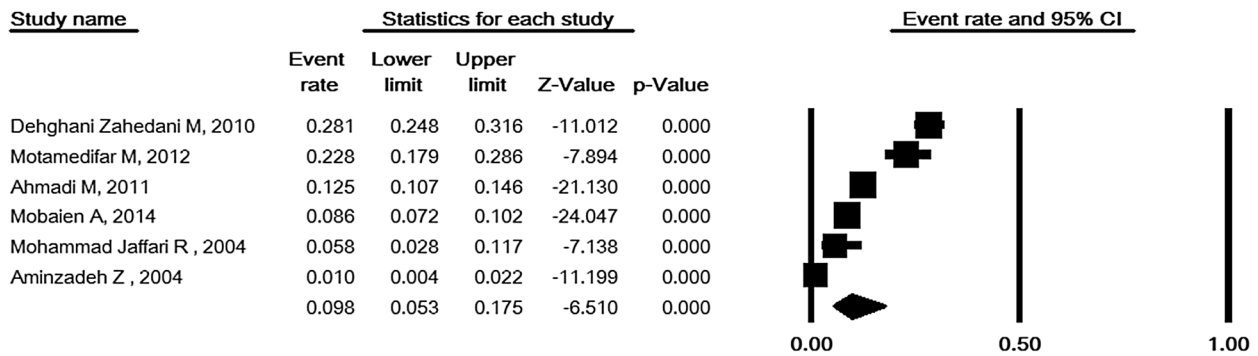
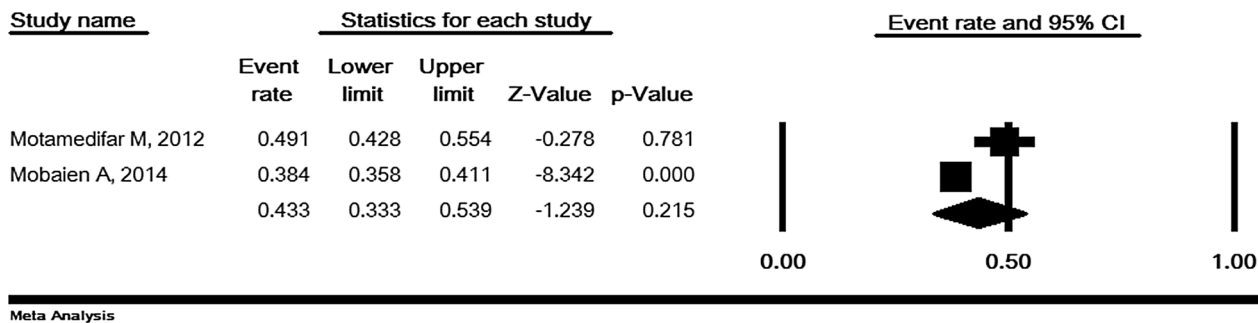
A**B**

Fig. 5 HBV vaccination coverage with at least a single-dose injection (a) and HBsAb⁺ status (b) according to the random-effects model

Table 3 The odds ratio for the risk of developing HBV in pregnant women

Variable	No. of studies (N)	No. of positive cases	No. of cases	Positive control	Control	Heterogeneity		95% CI	Odds ratio (OR)	p-value
						p-value	I ²			
Illiteracy	8	24	1377	90	10127	0.010	61.92	1.28-8.79	3.36	0.013
Abortion	6	47	2696	50	5564	0.45	0	1.30-2.95	1.96	0.001
Blood transfusion	7	13	322	71	7677	0.002	71.07	2.32-11.46	5.16	<0.001
Surgery	5	20	1478	42	5402	0.15	40.27	0.69-2.98	1.44	0.32
Tattoo	5	4	172	54	3401	0.024	64.53	0.25-7.69	1.40	0.69
Addicted spouse	2	7	149	18	1534	0.076	68.31	1.03-28.46	5.43	0.045

be due to screening programs for diagnosing HBsAg⁺ individuals.

The risk of developing an HBV infection was significantly associated with illiteracy, abortion, blood transfusion and having an addicted spouse ($p < 0.05$). However, no significant relationship was observed between HBV infection and urbanization, occupation, history of surgery, or tattooing ($p > 0.05$). Similarly, Ephraim et al. [66] found no significant

relationship between HBV and history of surgery or tattooing. Likewise, Akani et al. [67] reported no significant relationship between HBV and history of surgery, tattoos, blood transfusion or circumcision.

There are several limitations in this study that need to be addressed. The first limitation was the lack of enough sensitivity to systematic and combination Search in Iranian databases. Second, there was inadequate data to identify an

Fig. 6 Meta-regression of HBV prevalence among pregnant women according to time of study. The circles represent overall study weights

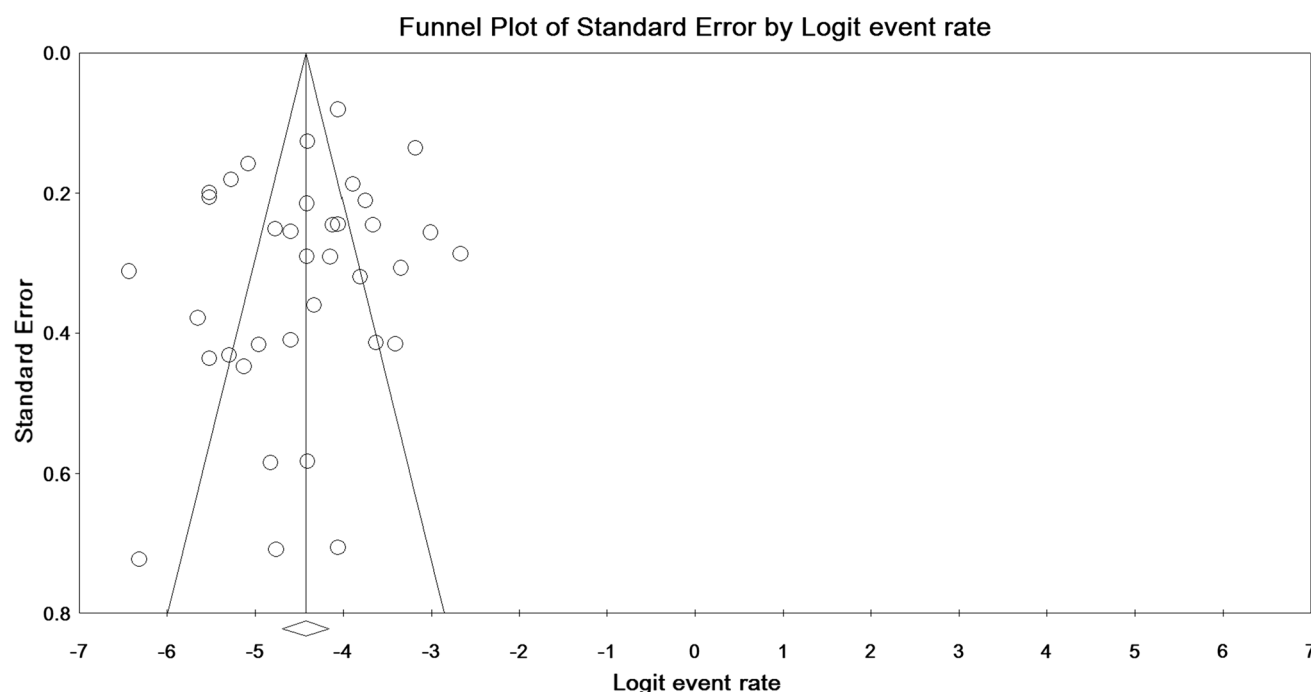
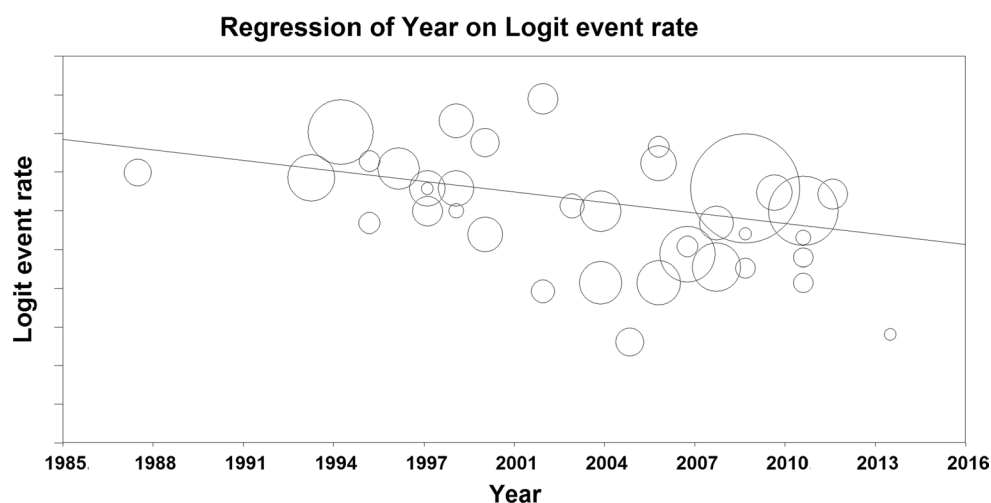


Fig. 7 Funnel plot to assess the publication bias

age pattern of HBV infection in Iranian databases. The third limitation was that majority of studies included in the current meta-analysis did not report the gestational age, which prevented us from assessing the pattern of HBV infection during pregnancy. Finally, we were not able to find information regarding the number of sexual partners or family history of jaundice.

Conclusion

The prevalence of HBV among pregnant women is lower than in the general population of Iran. HBV vaccine coverage is low among pregnant Iranian women. The risk of developing HBV is associated with illiteracy, abortion, blood transfusion and having an addicted spouse.

Author Contributions Gholamreza Badfar and Milad Azami designed the study. All authors performed data collection and data extraction. Milad Azami performed statistical analysis. All authors reviewed and approved the final version of the manuscript.

Compliance with ethical standards

Funding This study was funded in Behbahan Faculty of Medical Sciences.

Conflict of interest All authors declare that there is no conflict of interest.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

References

- World Health Organization. Geographic pattern of hepatitis B prevalence, 1997. <http://www.who.int/vaccines/surveillance/graphics/htmls/hepbrev.htm>.
- Hepatitis B (2012). <http://www.who.int/mediacentre/factsheets/fs204/en>. Last cited on 2012 Nov 20
- Hepatitis B Vaccines. WER 2009; 84: 405–20. <http://www.who.int/entity/wer/2009/wer8440>
- Alavian SM, Fallahian F, Lankarani KB (2007) The changing epidemiology of viral hepatitis B in Iran. *J Gastrointest Liver Dis* 16(403):6
- Kolawole OM, Wahab AA, Adekanle DA, Sibanda T, Okoh AI (2012) Seroprevalence of hepatitis B surface antigenemia and its effects on hematological parameters in pregnant women in Osogbo, Nigeria. *Virol J* 9:317
- Jonas MM (2009) Hepatitis B and pregnancy: an underestimated issue. *Liver Int* 29(Suppl 1):133–139
- Batayneh N, Bdour S (2002) Risk of perinatal transmission of hepatitis B virus in Jordan. *Infect Dis Obstet Gynecol* 10(3):127–132
- Yadegari D, Doaei Sh (1998) A study of prevalence and epidemiological factors at the Hepatitis B in the pregnancy women referral at to Zanjan hospitals. *Jo J Zanjan Univ Med Sci* 6(25):64–71
- Aminzadeh Z, Shabani Shahrabaky Z, Gachkar L, Sayyadi Anari A, Aminzadeh Z, Sayyadi Anari AR (2004) Frequency of HBsAg positive in pregnant women Rafsanjan in the year 2003. *J Rafsanjan Univ Med Sci* 3(2):126–133
- Moradi B, Ghazizade Sh (2003) Prevalence of HBsAg in pregnant women referred to prenatal clinic of Imam Khomeini in 1999. [Dissertation]. Tehran University of Medical Sciences, Tehran
- Ghalenoe M, Aali SH (2003) Evaluation of serum HBsAg positive in pregnant women referred to laboratory in Kerman. [Dissertation]. Kerman University of Medical Sciences, Kerman
- Sharifi M, Assefzade M, Lalouha F, Ishtiaq B (2000) Detecting carriers of HBsAg among pregnant women in Qazvin Blood Transfusion Center from 2000 to 2001. In: Proceeding of the 1Th Iranian Congress Virology, Tehran
- Aali BSh (1998) The prevalence of HBsAg among pregnant women referred to Kerman maternity hospitals in 1997. *J Kerman Univ Med Sci* 6(2):89–96
- Azami M, Nasirkandy MP, Mansouri A, Darvishi Z, Rahmati S, Abangah G et al (2017) Global prevalence of *Helicobacter pylori* infection in pregnant women: a systematic review and meta-analysis study. *IJWHR* 5:30–36
- Mansouri A, Norouzi S, YektaKooshali MH, Azami M (2017) The relationship of maternal subclinical hypothyroidism during pregnancy and preterm birth: a systematic review and meta-analysis of cohort studies. *IJOGI* 19(40):69–78
- Moher D, Liberati A, Tetzlaff J, Altman DG (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *J Clin Epidemiol* 62(10):1006–1012
- Mast EE, Margolis HS, Fiore AE, Brink EW, Goldstein ST, Wang SA et al (2005) A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP) part 1: immunization of infants, children, and adolescents. *MMWR Recomm Rep* 54:1–31
- Mast EE, Weinbaum CM, Fiore AE, Alter MJ, Bell BP, Finelli L et al (2006) A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP) Part II: immunization of adults. *MMWR Recomm Rep* 55:1–33
- Von Elm E, Altman DG, Egger M et al (2007) The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet* 370(9596):1453–1457
- Ades AE, Lu G, Higgins JP (2005) The interpretation of random-effects meta-analysis in decision models. *Med Decis Mak* 25(6):646–654
- Borenstein M, Hedges LV, Higgins JPT, Rothstein HR (2010) A basic introduction to fixed-effect and random-effects models for meta-analysis. *Res Synth Methods* 1(2):97–111
- Sterne JAC, Egger M (2001) Funnel plots for detecting bias in meta-analysis: Guidelines on choice of axis. *J Clin Epidemiol* 54(10):1046–1055
- Mirghaforvand M, Montazam SH, Rafie A (2007) Study of prevalence and contributing factors of hepatitis b among pregnant women referred to laboratory of health center of bonab. *J Urmia Nurs Midwifery Fac* 5(3):122–127
- Salimi S, Alijahan R, Nakhoshtin B, Hazrati S (2014) Prevalence of HBsAg+ cases and its associated factors in pregnant women referred to health centers of Ardabil District in 2009. *J Health*. 5(3):248–258
- Sarifi-halat B, Kaikha F, Sane-Moghaddam S, Alavi-Naeini R, Metanat M, Khademi R (2005) Epidemiological study of Hepatitis B surface antigen in pregnant women in Zahedan. *Zahedan J Res Med Sci* 7(2):119–124
- Tabasi Z, Mir Hosseini F, Mousavi SGA, Ghafouri L (2003) HBsAg in parturients referring to gynecologic clinics in Kashan, 2002. *KAUMS J (FEYZ)*. 7(3):35–41
- Motazakker M, Shokat Nagadeh M, Khalili F, Shayeri B (2014) Hepatitis B Virus infection among pregnant women attending Health Care Centers of Urmia. *J Guilan Univ Med Sci* 23(89):45–50
- Cheraghali F, Yazarloo S, Behnampour N, Azarhoush R (2011) Frequency of HBsAg in pregnant women in Gorgan, Iran. *J Gorgan Uni Med Sci*. 13(4):84–90
- Kavosi A, Vizvari P, Mohammadi Gh, Jouybari L, Sanagu A (2015) Seroprevalence of positive HBsAg and its associated factors in pregnant women referred to Health Centers of Agh-Ghala City in 2010–2012. *IJOGI* 18(149):8–16
- Mohammad Jaffari R, Saadati N, Vaziri Esfarjani Sh, Soorani Yan Cheshmeh A (2004) A survey of the frequency of HBsAg+ status in pregnant women attending health centers in Ahwaz. *Payesh Health Monit* 3(3):237–243
- Mobaeni A, Mohammadian F, Mazloomzadeh S, Esmaeilzadeh A, Sorouri Zanjani R, Savabi S et al (2014) Seroprevalence of Hepatitis B virus among pregnant women referred to Healthcare Centers of Zanjan. *J Zanjan Univ Med Sci* 22(93):96–104

32. Behjati Ardekani R, Sharifi N, Mjibiban M (2000) The prevalence of HBsAg-positive in 1904 pregnant women attending obstetrics and gynecology clinics in Yazd. . [Dissertation]. Sadoughi Yazd University of Medical Sciences, Yazd
33. Mohebbi SR, Sanati A, Cheraghpour K, Rostami Nejad M, Shalmani HM, Zali M (2011) Hepatitis C and Hepatitis B virus infection: epidemiology and risk factors in a large cohort of pregnant women in Lorestan, West of Iran. *Hepat Mon* 11(9):736–739
34. Motamedifar M, Amini E, Talezadeh Shirazi P, Sar-vari J (2012) The prevalence of HBsAg and HBsAb among pregnant women referring to Zeynabiyeh Hospital, Shiraz Iran. *Shiraz E Med J* 13(4):187–196
35. Ahmadi M, Toghyani R, Shahidi Sh, Izadi M, Merasi M, Agdak P et al (2011) Prevalence of HBsAg and high-risk behaviors in pregnant women referring to Urban Health Centers in Isfahan province. *IJNMR* 16(1):47–54
36. Jalali P, Rabie S, Falah M (1999) Frequency of HbsAg+ among pregnant women in Hamadanin 1998. [Dissertation]. Hamadan University of Medical Sciences, Hamadan
37. Hassanjan Roshan M (1994) Rate Hepatitis B in Babol pregnant women in 1994. *Nabz* 9(6):28–31
38. Ebrahim Pour S, Khosh Nejad F, Naziri S (1993) Study of HBsAg at the time of delivery in pregnant women in Gynecology Hospital of Tabriz, 1987–89. *Med J Tabriz Univ Med Sci* 27(19):3–15
39. Ahansaz M, Bojari (2000) Evaluation of HBsAg positive in pregnant women referring to prenatal ward Dezyani hospital in Gorgan in the first half of 1999. [Dissertation]. Iran University of Medical Sciences, Tehran
40. Nasri Razin B, Family A (2000) Prevalence of hepatitis B virus surface antigen and facilitating factors for the creation thousands of pregnant women referring to hospital in Mirza Koochak Khan and Iranian Blood Transfusion Organization. In: *Proceeding of the 9th congress of infectious diseases*, Tehran, December
41. Aghighi M, Aghighi Z (2000) Study of HBsAg positive cases in pregnant women referring to gynecology clinic during 1995–2000. In: *Proceeding of the 9th congress of infectious diseases*, Tehran, December
42. Ryazi Z, Mahmoud Yaghoobi M (2007) Prevalence of hepatitis B in referring to the maternity ward of no home dei hospital Torbat-Heidaryeh in the first half of 2004. In: *Proceeding of the 9th congress of infectious diseases*, Tehran, October
43. Moradi HR, Razin B, Khataee A, Talebia A (2000) Frequency of hepatitis B surface antigen (HBsAg) and facilitating factors studied 1,000 pregnant referred to blood transfusion organization. [Dissertation]. Shahid Beheshti University of Medical Sciences, Tehran
44. Sahaf F, Tanomand A, Montazam H, Sany AA (2007) Sero-prevalence of Hepatitis C, Hepatitis B and HIV and co-infections among pregnant women: a retrospective study in 2006 at Malekan City, Iran. *J Res Med Sci* 1:138–141
45. Shoghli A, Nabavi SM, Alavian SM et al (2014) Hepatitis B surface antigen prevalence in pregnant women: a cross-sectional survey in Iran. *Int J Prev Med* 5(Suppl 3):S213–S218
46. Dehghani Zahedani M, Azinfar A, Mahouri K, Mehrdad S (2010) The identification of related risk factors of thyroid disorder in an Iranian pregnant population. *Iran J Endocrinol Metab* 12(4):352–358
47. Afzali H, Momen Heravi M, Moravveji SA, Poorrahnama M (2015) Prevalence of Hepatitis B surface antigen in pregnant women in Beheshti Hospital of Kashan, Isfahan. *Iran Red Crescent Med J* 17(7):e20598
48. Yahyapour Y, Karimi M, Molaei H-R, Khoddami E, Mahmoudi M (2011) Active-passive immunization effectiveness against Hepatitis B virus in children born to HBsAg positive mothers in Amol, North of Iran. *Oman Med J* 26(6):399–403. doi:10.5001/omj.2011.103
49. Bayani M, Biazar T, Hasanjani Roushan M, Bayani F, Siadati S (2016) The effect of Hepatitis B vaccination at birth on reducing the prevalence of Hepatitis B surface antigen among rural pregnant women in Babol, Iran. *J Babol Univ Med Sci* 18(1):7–10
50. Kheiri L, Makvandi S (2015) The prevalence of Hepatitis B surface antigen (HBsAg) and its influencing factors in pregnant women referring to Healthcare Centers of Dehloran, Iran in 2011–2012. *J Midwifery Reprod Health* 3(3):424–429
51. Ofori-Asenso R, Agyeman AA (2016) Hepatitis B in Ghana: a systematic review & meta-analysis of prevalence studies (1995–2015). *BMC Infect Dis* 16:130
52. Bayo P, Ochola E, Oleo C, Mwaka AD (2014) High prevalence of hepatitis B virus infection among pregnant women attending antenatal care: a cross-sectional study in two hospitals in northern Uganda. *BMJ Open* 4(11):e005889
53. Luuse A, Dassah S, Lokpo S, Ameke L, Noagbe M, Adatara P et al (2016) Sero-prevalence of Hepatitis B surface antigen amongst pregnant women attending an Antenatal Clinic, Volta Region, Ghana. *J Public Health Africa* 7(2):584
54. Murad EA, Babiker SM, Gasim GI, Rayis DA, Adam I (2013) Epidemiology of hepatitis B and hepatitis C virus infections in pregnant women in Sana'a, Yemen. *BMC Pregnancy Childbirth* 13(1):127
55. Kirbak ALS, Ng'ang'a Z, Omolo J, Idris H, Usman A, Mbabazi WB (2017) Sero-prevalence for Hepatitis B virus among pregnant women attending antenatal clinic in Juba Teaching Hospital, Republic of South Sudan. *Pan Afr Med J* 26:72
56. Dionne-Odom J, Mbah R, Rembert NJ et al (2016) Hepatitis B, HIV, and syphilis seroprevalence in pregnant women and blood donors in Cameroon. *Infect Dis Obstet Gynecol* 2016:4359401
57. Porolajal J, Majdzadeh R (2009) Prevalence of chronic Hepatitis B infection in Iran. *IRJE* 4(3 and 4):1–8
58. Sayehmiri K, Azami M, Darvishi Z, Nikpay S, Borji M (2016) The prevalence of hepatitis B infection in health care workers in Iran—a systematic review and meta-analysis. *Iran J Public Health* 45(2):7
59. Mohammadi Z, Keshtkar A, Egtesad S, Jeddian A, Pourfatholah AA, Maghsudlu M et al (2016) Epidemiological profile of Hepatitis B Virus Infection in Iran in the past 25 years; a systematic review and meta-analysis of general population studies. *Middle East J Dig Dis* 8(1):5–18
60. Molijn MHJ, Van der Linden JM, Ko LK, Gorgels J, Hop W, Van Rhenen DJ (1997) Risk factors and anti-HBc reactivity among first-time blood donors. *Vox Sang* 72(4):207–210
61. Sayehmiri K, Azami M, Nikpey S, Borji M, Sayehmiri F (2015) Hepatitis B vaccination coverage in health personnel of Iran: a systematic review and meta-analysis study. *IRJE* 11(3):1–10
62. Azami M, Borji M, Ghanbari F, Nikpay S, Sayehmiri K (2015) Hepatitis B vaccination coverage of physicians and nurses in Iran: a systematic review and meta-analysis study. *J Birjand Univ Med Sci* 22(4):304–315
63. Azami M, Sayehmiri K, Darvishi Z, Sayehmiri F (2015) Hepatitis B vaccination coverage among dentists in Iran: a systematic review and meta-analysis study. *Hepat Mon* 15(83):37
64. Azami M, Nikpey S, Pakzad I, Sayehmiri K (2016) Effects of immunization to hepatitis B vaccine in Iranian health staff: a systematic review and meta-analysis study. *Koomesh* 17(4):789–795
65. Azami M, Hafezi Ahmadi MR, Sayehmiri K (2017) Hepatitis B vaccination efficacy in Iranian healthcare workers: a meta-analysis study. *Hepat Mon* 17(1):e37781
66. Ephraim R, Donko I, Sakyi SA, Ampong J, Agbodjakey H (2015) Seroprevalence and risk factors of Hepatitis B and Hepatitis C infections among pregnant women in the Asante Akim North Municipality of the Ashanti region, Ghana; a cross sectional study. *Afr Health Sci* 15(3):709–713
67. Akani CI, Ojule AC, Oporum HC, Ejilemele AA (2005) Sero-prevalence of hepatitis B surface antigen (HBsAg) in pregnant women in Port Harcourt, Nigeria. *Niger Postgrad Med J* 12(4):266–270