Review Article

A Systematic Review and Meta-analysis on the Prevalence of HBsAg in Health Care Workers from Eastern Mediterranean and Middle Eastern Countries

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Abstract

Background: The present study aimed to determine the prevalence of HBsAg in Health Care Workers (HCWs) in Eastern Mediterranean Region Office (EMRO) and Middle Eastern countries from 2000 to 2016. **Methods:** In a meta-analysis study, the databases of PubMed, ISI, Ovid, Scopus, Google Scholar, and Persian databases were searched for relevant articles on the prevalence of HBsAg in HCWs in EMRO and Middle Eastern countries. Homogeneity was assessed based on Cochran's Q-test results. **Results:** A total of 43 articles (110,179 people) were included. The pooled prevalence of HBsAg in HCWs of EMRO and Middle East countries was found 2.77% (95%CI: 2.64-2.83). The specific prevalence of HBsAg was 2.84% (95% CI: 2.6-3.11) in EMRO and 2.22% (95%CI: 2.13-2.31) in Middle Eastern countries. The highest and lowest prevalence rates of HBsAg among HCWs for countries with more than one study were 6.85% (95% CI: 5.74%–8.16%) in Sudan and 1.00% (95% CI: 0.94%–1.07%) in Turkey, respectively. The trends of HBsAg prevalence among HCWs decreased from 2000 to 2016. **Conclusions:** Based on the World Health Organization classification of HBV prevalence, intermediate HBsAg prevalence rates were detected in HCWs of EMRO and Middle East countries during 2000–2016.

Keywords: *Eastern Mediterranean, health care workers, hepatitis B, meta-analysis, Middle East, prevalence*

Introduction

The prevalence of personnel's exposure to Hepatitis B Virus (HBV) is related to the prevalence and endemicity of the disease in general population, as 90% of such infections occur in Asia and Africa.[1-4] Of the 35 million healthcare workers (HCWs) in the world, 3 million are annually exposed to blood-borne pathogens, including 2 million to HBV, 0.9 million to hepatitis C, and 170000 to HIV.[5]

Due to the availability of HBV vaccine, the incidence of the disease and HBV-related mortality has reduced. In 1982, Centers for Disease Control and Prevention (CDC) recommended that all HCWs be vaccinated against HBV. Although acute and chronic cases of HBV infection are rare in vaccinated HCWs, those who fail to respond positively to the vaccine continue to be susceptible to infection.[6-8] According to CDC, vaccination of HCWs has reduced the incidence of new HBV cases in the United States by five-fold from 2,08,000 in 1980 to 38,000 in 2010.[9]

The World Health Organization (WHO) estimates the prevalence of HBV in the Eastern Mediterranean Regional Office (EMRO) 4.3 million, indicating its high prevalence in this region.[10] WHO categorizes the prevalence of HBV as low (<2%), medium (2% to 8%), and high (>8%).[11] The prevalence of HBV in EMRO and many Middle Eastern countries in different age groups has been reported low-medium, and high in some cases.[12,13] Many studies have investigated the prevalence of HBsAg in HCWs in EMRO and the Middle East, and have found a different pattern for the prevalence of this disease. In a study conducted in Sudan, the prevalence of HBsAg in HCWs was reported 16%.[14] The spread of HBV in HCWs in these regions is such that the prevalence of HBsAg has been reported 4.7% in Pakistan,[15] 1% in Morocco,[16] and 0.2% in Iran.[17] Understanding the prevalence of some infections such

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as HBsAg may provide useful information for health policymakers to consider the best preventive measures for HCWs in different societies.

Available review studies on HBsAg prevalence in EMRO and Middle Eastern countries have focused on blood donors, pregnant women and children.[18-20] In addition, single studies conducted so far on the prevalence of HBsAg in HCWs in EMRO and Middle Eastern countries have shown different prevalence rates in different areas. As there is no comprehensive study on the prevalence of HBsAg in HCWs of EMRO and Middle Eastern countries in different years, especially after the initiation of the vaccination program in 1992 in these regions[21], a meta-analysis and review study therefore appears beneficial. Hence, the present study was conducted to determine the prevalence of HBsAg in HCWs in EMRO and Middle Eastern countries from 2000 to 2016.

Methods

Sources of data

In the present study, a search was conducted in titles and/or abstracts of articles published from January 1st 2000 to December 31st 2016, in the following databases: Pubmed, ISI, Science Direct, Ovid, Scopus, and Google Scholar. At this stage, the number of articles found in each database, and then the final numbers of articles were recorded. The year 2000 was used because it was some years after the beginning of vaccination program in 1992 that the efficiency of Hepatitis B vaccine may be more likely observed. The search was conducted using different combinations of words sought by researchers and also Mesh words as follows: "epidemiology," "prevalence," "HBV," "hepatitis b virus," "HBsAg," and "Healthcare workers," along with the names of the E and M countries, including: Afghanistan, Bahrain, Cyprus, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, Turkey, United Arab Emirates, and Yemen.

Moreover, using the above keywords in English and Farsi, Iranian databases including Scientific Information Database, Iran Medex, Magiran, and Medlib, Pakistan's comprehensive database (PakMediNet), and WHO EMRO journal and Hepatitis Monthly journal were also used for the search. Sensitivity of search was assessed through review of repeated articles. If the full text of an article was not found, it was requested from the corresponding author through an email, and if no response was received from the corresponding author, the abstract of the article was used. Articles lacking the desired information were excluded.

Selection of articles

Full texts of English or Farsi articles were included if they were cross-sectional and contained specific information about the prevalence of HBsAg in HCWs in EMRO and Middle Eastern countries. Studies conducted on the general population were also included if they contained HCWs as a subgroup. Exclusion criteria affected the following studies: 1) All studies except for cross-sectional studies; 2) Not reporting the prevalence of HBsAg clearly and reporting the general prevalence of HBV (given the present study objective, which was an assessment of only HBsAg prevalence in HCWs); 3) reporting vague data and results. Author's name or journal had no effect on the choice of articles. The prevalence of HBsAg in EMRO and Middle Eastern countries is reported separately for member countries in Table 1.

Data extraction

The quality of articles was assessed by 2 authors. The first author (M.B) conducted the process of data extraction to find eligible studies. The second author (S.M.A) (not involved in the search process) carefully assessed the quality of articles. Next, the present study authors held a meeting to discuss relevant questions before critical assessment of articles. Blinding and assigning tasks were carried out during the selection of articles. Following the final assessment, selected articles and required data, namely first author's name, publication year, country's name, sample size, the percentage of participating men, and prevalence of HBsAg, and Standard Error (SE) were recorded and entered into Excel. SE was found using Cochran test. Duplicated findings were removed using EndNote X6 software (Thomas Reuters, Carlsbad, CA, USA).

Statistical analysis

Homogeneity was assessed based on Cochran's Q-test results. However, since this test may fail to exactly identify true homogeneity, it was complemented with Higgins and Thompson's I^2. "metaprop" command was then used to apply a random effects model based on the significance of the Cochran's test and a large I^2 value. By using metaprop, no studies with 0% or 100% proportions were excluded from the meta-analysis. Furthermore, study specific and pooled confidence intervals always were within admissible values and avoid confidence intervals exceeding the 0 to 1 range.[22] Data aggregation and production of the pooled estimates were performed using the above-mentioned methods. Forest plots with descriptions of the findings were then developed to describe the results and calculate the point estimations and 95% confidence intervals (CIs). Publication bias was assessed through the funnel plot. Funnel plot asymmetry was further tested using Begg and Egger's methods. Stata 11.0 (Stata Corp, College Station, TX, USA) was used for all statistical analyses.

Results

Initially, using titles and/or abstracts, a total of 4626 articles were found, of which, 854 articles potentially related to the

Table 1: The description of studies in EMRO and Middle East countries that met our eligibility criteria

Countries	Authors' names	Pub. year	Samples size	HBsAg Positive (No)	HBsAg Prevalence (%)
Iran (E & M)	Asefzade, M	2004	270	3	1.1
	Azarhoosh, R	2006	300	3	1
	Bayani, M	2014	527	4	0.75
	Binesh, F	2015	431	1	0.23
	Salmanzadeh, SH	2016	188	4	2.1
	Kamangar, E	2003	285	3	1.05
	Salari, M	2006	406	5	1.23
	Amini-Ranjbar, S	2008	83	8	9.6
	Ghorbani, Gh	2010	112	3	2.6
	Alavian, S.M	2008	83	0	0
	Sharifi, M	2008	77	0	0
	Baba Mahmoodi, F	2000	183	3	1.6
	Khosravani, A	2012	222	0	0
	Mokhayeri, H	2016	462	7	1.52
	Torkzaban, P	2009	123	4	3.5
	Yarmohammadi, M	2010	191	0	0
	Ranjbar, M	2001	130	1	0.77
Iraq (E & M)	Al-Mashhadani, J. I	2009	1656	89	5.37
	Hussein, N. R	2015	192	1	0.52
	Hamied, L	2010	375	25	6.66
Libya (E & M)	Elzouki, A. N	2014	601	11	1.83
	Ziglam, H	2013	2705	31	1.1
Morocco (E)	Djeriri, K	2008	276	3	1
	Souly, K	2016	601	19	3.16
Pakistan (E)	Abdul Qayyum, F	2012	1891	27	1.4
	Aziz, S	2002	250	6	2.4
	Memon, M. S	2007	380	18	4.7
	Saqib, Sh	2016	500	3	0.6
Palestine (E & M)	Astal, Z	2004	399	11	2.75
Sudan (E)	Elduma, A. H	2011	245	12	4.9
	Elmukashfi, T. A	2012	843	51	6.04
	Elmukashfi, T. A	2016	385	62	16.1
	Nail, A	2008	211	5	2.4
Saudi Arabia (E & M)	Alqahtani, J. M	2014	300	1	0.33
Turkey (M)	Fatma, E. T	2015	91185	2462	2.7
	Ozsoy, M. F	2003	702	21	3
	Bosnak, V. K	2013	199	1	0.5
	Guven, R	2006	571	2	0.35
	Erden, S	2003	109	7	6.4
	Irmak, Z	2010	147	1	0.68
	Kosgeroglu, N	2004	595	16	2.68
	Tozun, N	2015	245	3	1.23
Yemen (E & M)	Shidrawi, R	2004	543	54	9.9
Pooled Estimate*	-	-	110179	2991	2.77 (2.64-2.83)≤

*Pooled estimate by random-effects Meta analyses≤95% confidence interval (in brackets); (E: EMRO countries; M: Middle East countries; E & M: All countries from two regions)

study objectives were selected. Next, 491 repeated articles were excluded and 363 articles relating to the prevalence of HBV in EMRO and Middle Eastern countries remained. Taking into account the study objectives, 54 articles that reported the prevalence of HBV in HCWs were chosen. Given the importance of quality of articles, 11 articles that lacked inclusion criteria were excluded. A short report article,[23] one article for reporting the results in 2 separate journals,[24] and another for using self-reporting style for the prevalence of HBsAg[25] were also excluded. In one of the excluded articles, the prevalence was reported 3.3%, found by dividing number of HBsAg positive (3 people) into total number of personnel (110 people), whereas the prevalence should have been reported 2.72%, therefore it

was excluded due to vague results.[26] A further 7 articles were excluded for failing to report HBsAg in HCWs clearly, and citing the prevalence of HBV.[27-33] Eventually, 43 articles that clearly reported the prevalence of HBsAg remained for analysis [Figure 1].

Features of articles

A total of 43 articles were found from member countries of EMRO and Middle East that reported the prevalence of HBsAg in HCWs, and included a sample of 110179 people. Of these articles, 17 had been conducted in Iran,[17,34-49] 3 in Iraq,[50-52] 2 in Libya,[53,54] 2 in Morocco,[16,55] 4 in Pakistan,[15,56-58] 1 in Palestine,[59] 1 in Saudi Arabia,[60] 4 in Sudan,[14,61-63] 8 in Turkey,[64-71] and 1 in Yemen.[72]

General prevalence of HBsAg in HCWs in Eastern Mediterranean and Middle Eastern countries

Based on the data obtained from 10 countries and using random effect model, the pooled prevalence of HBsAg in HCWs was found 2.77% (95%CI: 2.64-2.83) [Table 1]. The specific prevalence of this index was found 2.84% (95%CI: 2.6-3.11) in Eastern Mediterranean countries and 2.22% (95%CI: 2.13-2.31) in Middle Eastern countries [Figures 2 and 3].

Total HBsAg prevalence in children of Eastern Mediterranean and Middle Eastern by country

The prevalence of HBsAg among HCWs of EMRO/Middle East countries in detailed is presented in Table 1. In addition, the combined prevalence of HBsAg in countries with at least 2 papers found in searches is available in Table 2.

Cumulative HBsAg prevalence in children of Eastern Mediterranean and Middle Eastern countries

Using random effect model, cumulative method indicates that the trends of HBsAg prevalence among HCWs decreased from 2000 to 2016 [Figure 4].

Risk of publication bias in included studies

To show publication bias, funnel plots and Egger's statistical tests were used. They indicate the lack of publication bias in this study ($P = 0.3$) [Figure 5].

Discussion

The present study was conducted to determine the prevalence of HBsAg in HCWs in Eastern Mediterranean and Middle Eastern countries between 2000 and 2016. According to the results obtained, the combined prevalence of HBsAg in HCWs in the above regions was 2.77%. This showed descending trend in the prevalence of HBsAg in HCWs in EMRO and Middle Eastern countries from 2000 to 2016.

According to WHO report, mean frequency of occupational injuries in HCWs varies from one area to another (for instance, injuries caused by sharp objects vary from

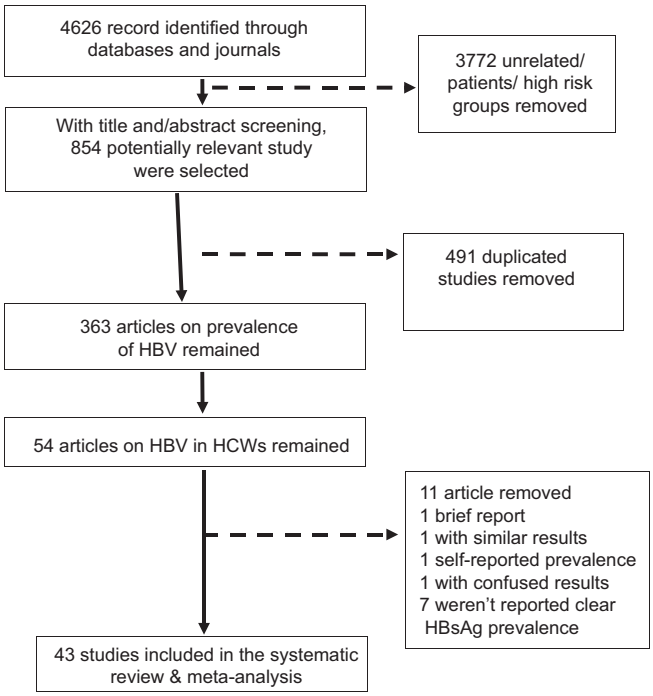

Figure 1: Follow diagram of systematic review and meta-analysis of HBsAg prevalence in health care workers of EMRO and Middle East regions

Table 2: The combined prevalence of HBsAg in countries with at least 2 available papers

Countries	Prevalence	Confidence Intervals
Iran	1.38	1.06-1.79
Iraq	4.37	3.59-5.3
Libya	1.27	0.94-1.71
Morocco	2.5	1.66-3.76
Pakistan	2.07	1.62-2.64
Sudan	6.85	5.74-8.16
Turkey	1	0.94-1.07

0.2% to 4.7% per worker per year).[73] The annual HCWs exposure to HBV is 6%, which includes 66000 HCWs worldwide.[74] The present study only investigated the prevalence of HBsAg in HCWS, and studies that reported the general prevalence of hepatitis B without including HBsAg index were excluded. Thus, the prevalence obtained in the present study is expected to be less than the general prevalence of hepatitis B in HCWs. It seems that the prevalence of HBsAg in HCWS in EMRO and Middles Eastern countries is greater than that found in children (2.73%) and blood donors in these regions.[18,19] Moreover, the frequency pattern of hepatitis B varies across other Asian countries. The prevalence of HBV in 2 separate studies conducted in India was reported 3.2% and 0.4%,[75,76] and 2.4% in South Korea.[77] In African countries, 3 studies conducted in Nigeria reported the prevalence of this infection 1.1%, 4.35% and 13%,[78-80] and 2.9% in Rwanda,[81] 8.1% in Uganda,[82] and 6.32% in Cameroon,[83] and the prevalence of HBV in HCWs in these studies can be said to be higher compared to that reported in the

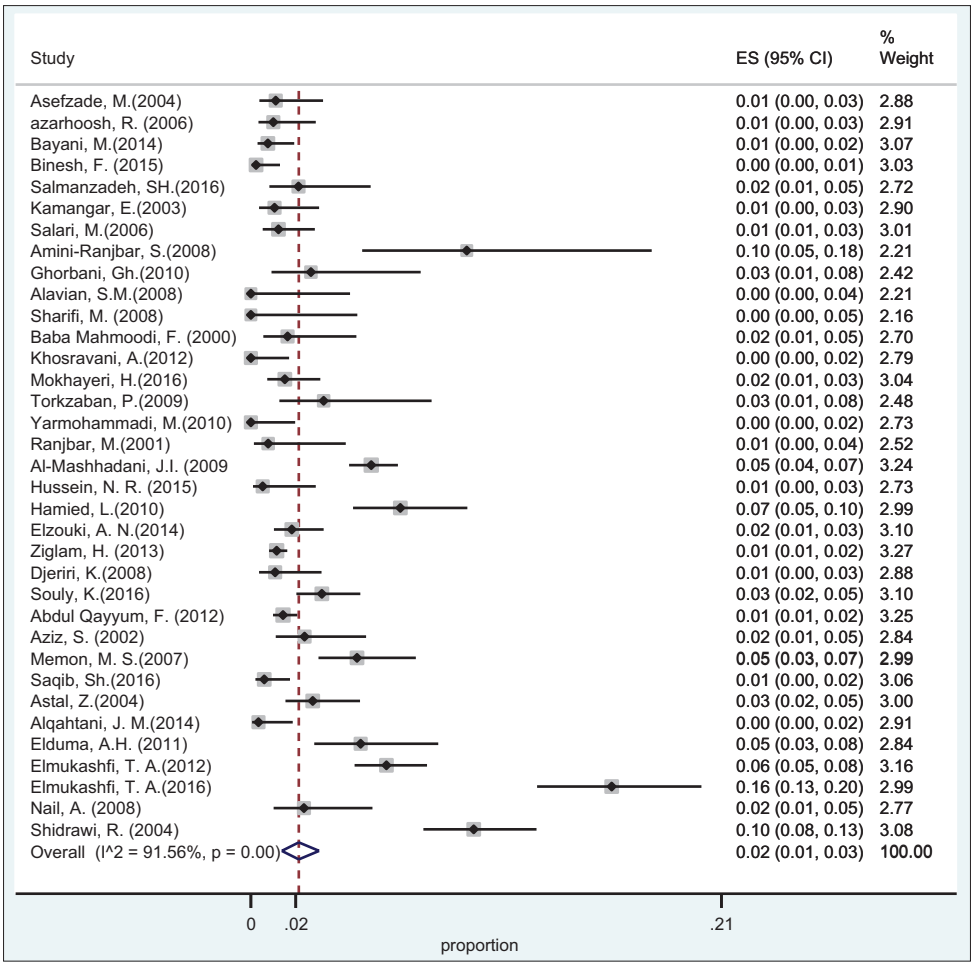

Figure 2: Forest plot of HBsAg prevalence in health care workers from Eastern Mediterranean countries

present study. Studies conducted in European countries have reported a different range of prevalence of hepatitis B in HCWs, but generally the prevalence in Europe is less than that reported in the present study; for example, 1.2% in Poland,[84] 0.5% in Greece,[85] and 1.47% in Bosnia,[86] yet, 8.1% in Albania.[87] The difference in the prevalence of HBsAg in HCWs can also be seen in other parts of the world. Two studies conducted in Brazil reported the prevalence of HBV 0.8% and 0.35%, which is much lower than in the present study.[88,89]

The present study showed a descending trend in the prevalence of HBsAg in HCWs in EMRO and Middle Eastern countries from 2000 to 2016. Before WHO guidelines for vaccination of children in 1992, 6 (27%) out of 22 EMRO countries implemented the program of three doses of hepatitis B vaccine for children, then, 17 (77%) countries in 2000, and all EMRO member countries in 2013 implemented children vaccination program. Clearly, with increasing vaccination cover of general population in the regional countries, vaccination cover for other risk groups will also increase and infection rate will be reduced.[90] Given their occupational conditions and their exposure to sharp objects, hepatitis B vaccination of HCWs is strongly recommended, but this does not apply to everywhere. According to a study conducted by Pruss-Ustun *et al*. (2005), reginal estimate of hepatitis B vaccination cover in HCWs in early 2000's varies from 18% to 77%.[91] Hepatitis B vaccination cover of HCWs in reported studies conducted in the last 10 years was 84% in Iran,[92] 74% in Pakistan,[30] 63.3% in Saudi Arabia,[93] 78.1% in Libya,[54] and 72% in Turkey,[70] indicating somewhat improved vaccination cover in these countries. Generally, with the increasing vaccination cover in EMRO and Middle Eastern countries in risk groups like HCWs, a descending trend of HBV infection can be anticipated.

In the present study, one of the limitations was a low number of studies found in relation to the number of countries in this region. This problem was alleviated by including studies that were conducted on the general population and reported the prevalence of HBsAg in HCWs. In the present study, attempts were made to include the prevalence of HBsAg in HCWs in published articles, and student and university theses were not included. Lack of data for some countries may decrease the generalizability of findings for EMRO/Middle East regions. It is needed to search local databases for countries

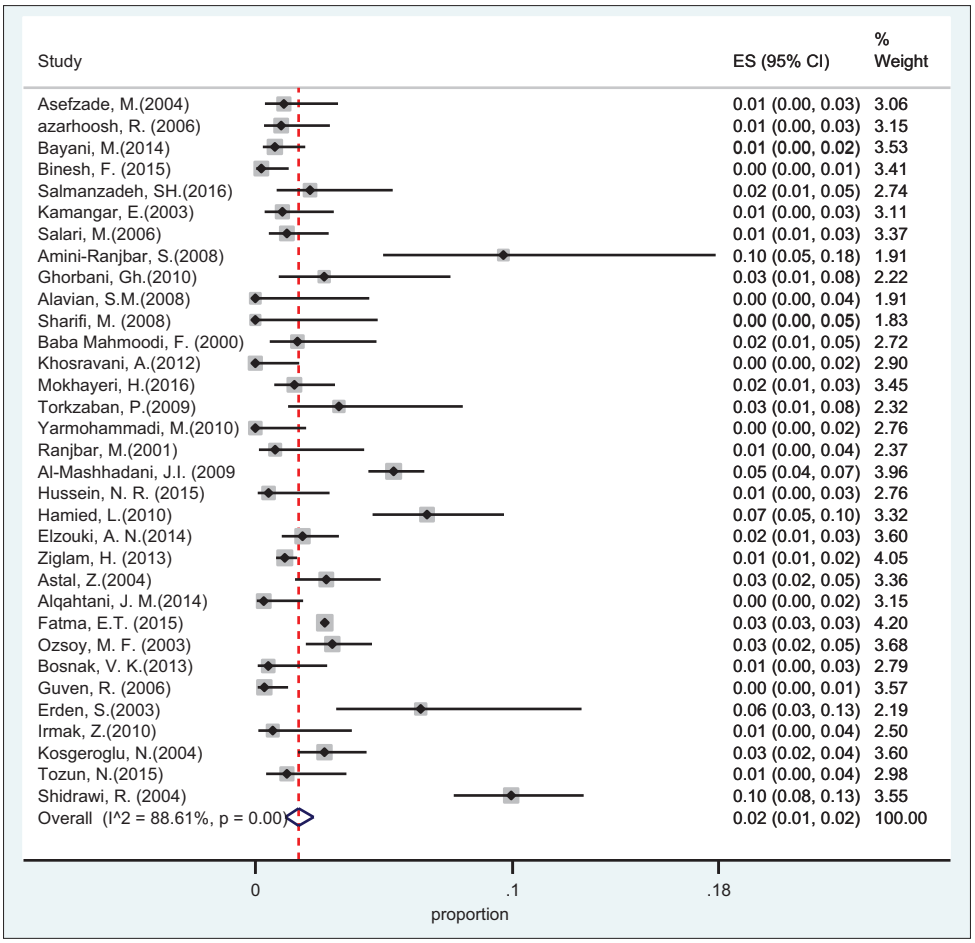

Figure 3: Forest plot of HBsAg prevalence in health care workers from Middle East countries

without any findings in future studies. It seems that there several factors that may change the pattern of HBsAg prevalence in different regions such as education and income. High (Yemen and Sudan) or low (Saudi Arabia or Turkey) prevalence of HBsAg may refers to equity in access to health care in some EMRO/Middle East countries. For example, one study showed that the status of Hepatitis B vaccination wasn't acceptable between a group of HCWs in Sudan and only less than one third of them had received all doses of vaccine,[94] while the other study in Saudi Arabia revealed that more than 70% of HCWs received HBV vaccine.[95]

Another limitation related to the absence of separate reports of prevalence of HBsAg in HCWs by age and gender, and therefore the prevalence in age and gender groups could not be reported in the present study. The strength of the present study was in its high search sensitivity for finding relevant articles, where all related keywords were used in the search.

Conclusions

According to the WHO classification, the prevalence of HBsAg in HCWs in EMRO and Middle Eastern countries (2.77%) between 2000 and 2016 was at a moderate level. Among the articles found, the lowest prevalence of HBsAg in HCWs was in Saudi Arabia, and the highest in Yemen. However, given the absence of more studies on the prevalence of HBsAg in HCWs in these countries, further related studies in these and other EMRO and Middle Eastern countries that had no related studies should be conducted. Data collected showed a descending trend in the prevalence of HBV in HCWs between 2000 and 2016. Improving vaccination cover of HCWs and completing their vaccination history is recommended for further reduction in this infection index.

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Conflicts of interest

There are no conflicts of interest.

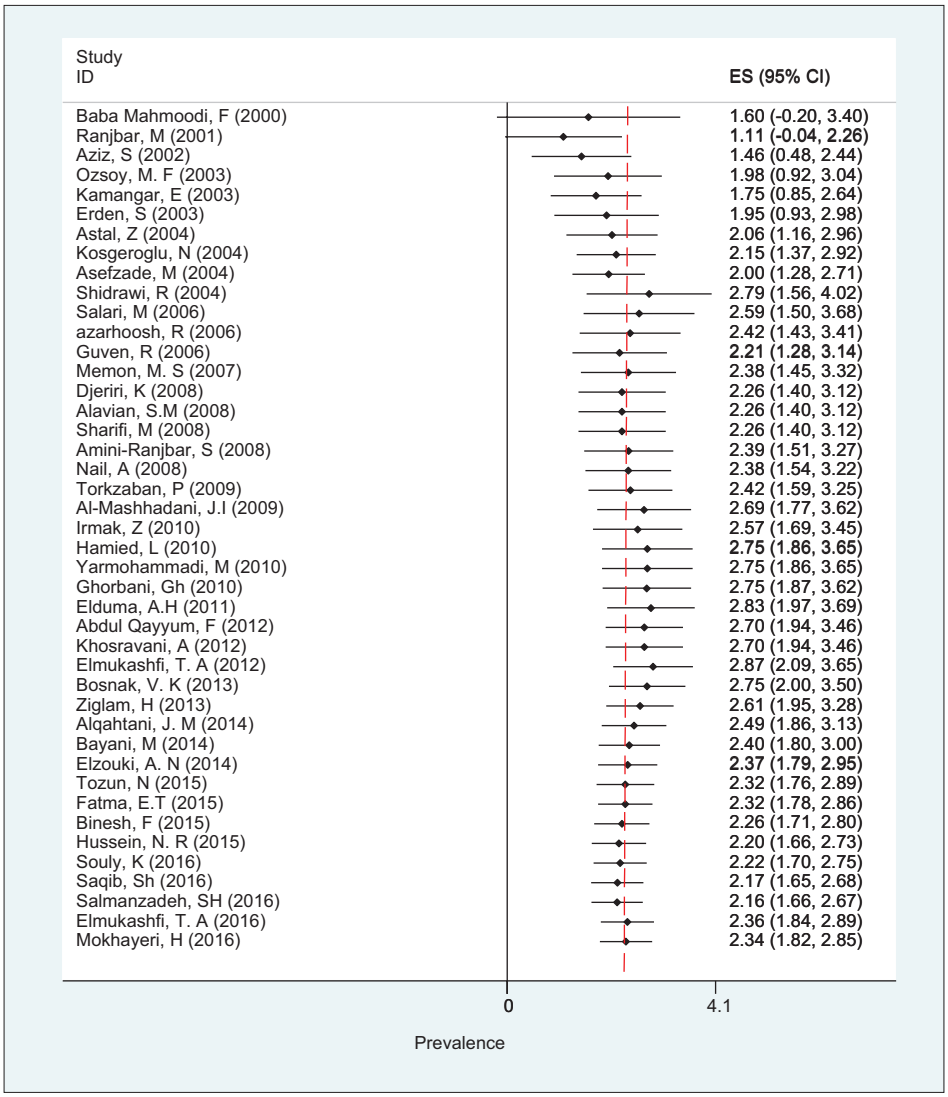

Figure 4: Forest plot of cumulative HBsAg prevalence in health care workers from Eastern Mediterranean and Middle East countries

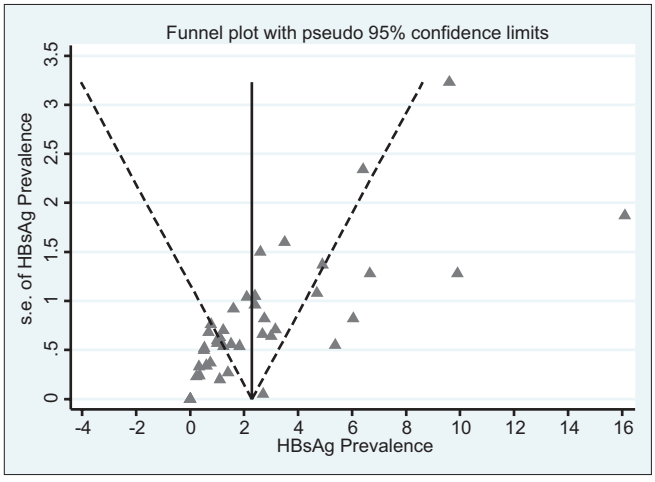

Figure 5: Funnel plots for the analysis of HBsAg prevalence in health care workers from EMRO and Middle East countries

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