

Prevalence of Hepatitis B Surface Antigen Among Refugees Entering the United States Between 2006 and 2008

David B. Rein,¹ Sarah B. Lesesne,¹ Ann O'Fallon,² and Cindy M. Weinbaum³

The Centers for Disease Control and Prevention recommends hepatitis B surface antigen (HBsAg) testing to identify chronic hepatitis B virus infection for foreign-born persons from countries or regions with HBsAg prevalence of $\geq 2\%$. However, limited data exist to indicate which countries meet this definition. To address this data gap, we estimated the HBsAg prevalence among refugees entering the United States between 2006 and 2008. We contacted state refugee health coordinators and asked them to report the number of refugees, country of origin, and HBsAg prevalence among refugees screened in their jurisdiction during the most recently available 12-month period prior to August 2008. We pooled data across jurisdictions and calculated the prevalence for any country with more than 30 refugees entering the United States, and where this level of data was not available by country, continents were considered. Of the 47 jurisdictions contacted, we received basic information from 31, with nine jurisdictions reporting HBsAg prevalence by country of origin applicable to 31,980 refugees (approximately 42% of refugees entering the United States during the observation period). We estimated an HBsAg prevalence of 2.8% (95% confidence interval 2.6%-3.0%) for refugees overall. Of the 37 countries with 30 or more refugees entering the United States, 25 had a prevalence of $\geq 2\%$. Prevalence was highest among refugees from Africa and Southeast Asia, and lowest among refugees from the Middle East and South/Central America. In the eight countries for which we had comparison data, six had lower HBsAg prevalence than in 1991. (HEPATOLOGY 2009;51:000-000.)

Chronic hepatitis B virus (HBV) infection is the most common worldwide cause of chronic liver disease and its related sequelae of decompensated cirrhosis of the liver and hepatocellular carcinoma. The World Health Organization estimates that as many as 350 million people are currently chronically infected with HBV.¹ Because chronic HBV infection may be asymptomatic for years before developing into clinically evident illness, many individuals with chronic infections are likely unaware of their infection.

Serologic testing for hepatitis B surface antigen (HBsAg) can identify persons with chronic HBV infection. Serologically identified patients can be treated with safe and effective antiviral therapies, and household and sexual contacts of infected patients can be vaccinated to prevent secondary infections.²

The Centers for Disease Control and Prevention recently expanded its HBsAg testing recommendations to include all individuals born in regions of the world with an HBV prevalence of 2.0% or greater, a definition that is thought to encompass more than half of the world's population.^{3,4} It has been shown that for foreign-born United States populations, HBsAg seroprevalence corresponds to HBV endemicity in the country of origin; however, few updated estimates of the prevalence of chronic HBV infection in the United States by country of origin have been published in the last 21 years. Currently, the most frequently relied upon source of such data is a compilation of screening results from refugees who entered the United States between 1979 and 1991.⁵ Our study replicated and expanded upon these earlier results using data collected between 2006 and 2008.

Abbreviations: CI, confidence interval; HBsAg, hepatitis B surface antigen; HBV, hepatitis B virus.

From ¹RTI International, Atlanta, GA; the ²Association of Refugee Health Coordinators, Minnesota Department of Health, St. Paul, MN; and the ³Division of Viral Hepatitis, Centers for Disease Control and Prevention, Atlanta, GA.

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Address reprint requests to: David B. Rein, RTI International, 2951 Flowers Road, Suite 119, Atlanta, GA 30341. E-mail drein@rti.org; fax: 770-234-5030.

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Methods

One of the authors (A. O.) attempted to contact all United States jurisdictions that have an active refugee health coordinator (45 states, New York City, and two Nebraska jurisdictions) and asked them to provide information about their HBsAg screening activities. Specifically, we asked them to report whether they systematically screened any refugees in the past 12 months and, if so, to report the total number of refugees screened, their country of origin, and the number or proportion who were positive for HBsAg by country of origin. Coordinators who did not initially respond were contacted up to three additional times. Areas were asked to report data from the most recently available 12-month continuous period prior to August 2008. Across all areas, this resulted in data collected from refugees who entered the United States between 2006 and 2008.

We pooled information from across jurisdictions about refugees from the same country of origin. Using these data, we estimated the prevalence of HBsAg among refugees from each country of origin by dividing the number of HBsAg-positive refugees by the total number tested. We also pooled data and estimated prevalence by continent. Several jurisdictions provided numerical count data regarding the total number of refugees screened combined with proportional data about the countries of origin and the HBsAg prevalence observed among refugees from each country of origin. For these jurisdictions, we estimated the number of refugees tested and the number of HBsAg-positive refugees from each country by multiplying the total number of refugees screened by the proportion screened from each country, then multiplied that number by the proportion screened from that country of origin who were HBsAg-positive. We present our results for countries from which we estimate that 30 or more refugees were tested. We calculated 95% confidence intervals (CIs) for each prevalence rate using the Wilson procedure with a correction for continuity.⁶

Results

Of the 47 jurisdictions we attempted to contact, 31 responded with at least some information and 16 states did not respond, for a 66% response rate. Of the 31 areas that responded, 28 reported that they systematically screened at least some groups of refugees for hepatitis B, whereas three areas reported that hepatitis B testing was not part of the refugee health screening process. Of these 28, 20 were able to provide a count of the total number of refugees screened, and 13 were able to provide an estimate of the overall prevalence among all refugees screened; of these 13, nine areas were able to provide data by country of origin. The 20 areas that provided data on the number of refugees screened screened a total of 42,303 refugees in the preceding 12 months, which is

approximately 55% of the total number of refugees arriving in the United States in 2008. The nine areas that provided data by country of origin screened 31,980 refugees, or approximately 42% of refugees arriving in the United States in 2008. Screened refugees with country of origin data originated from 44 countries and 11 continental subregions across four continents.

Of the 31,980 refugees with complete country of origin data, 891 (2.8%; 95% CI 2.6%–3.0%) tested positive for HBsAg. This rate varied by continent, continental region, and country of origin (Table 1). We observed the highest HBsAg prevalence among refugees from Africa (8.1%) (95% CI 7.2%–9.0%), followed by Asia (4.8%) (95% CI 4.4%–5.3%), eastern Europe (2.6%) (95% CI 1.6%–4.2%), and South/Central America and the Caribbean (1.0%) (95% CI 0.9%–1.2%).

In Africa, the highest prevalence was observed in refugees from Eritrea (15.5%) (95% CI 7.1%–25.4%), although this country's sample was limited to only 39 individuals; the lowest prevalence was observed in refugees from Burundi (3.0%) (95% CI 1.1%–7.4%). In Asia, the highest prevalence was observed in refugees from Myanmar (12.4%) (95% CI 11.1%–13.4%), whereas no refugees from Azerbaijan, Nepal, or Bhutan tested positive for HBsAg. Prevalence in European countries ranged from 0.08% (95% CI 0.1%–5.1%) in Russia to 5.9% (95% CI 3%–10.6%) in Moldova. Among refugees from South American and Central American countries and countries in the Caribbean, prevalence was below 2.0%, with the exception of Haitian refugees, whose prevalence was 2.6% (95% CI 1.6%–4%). The higher rate for Haiti is consistent with a recent Centers for Disease Control and Prevention Global AIDS Program estimate of HBsAg prevalence taken in antenatal clinics among 15- to 49-year-old child-bearing Haitian women for whom the prevalence was 4.7% in 2004 and 4.8% in 2007.

Prevalence varied a great deal within continents and even within continental subregions. For example, the HBsAg prevalence among refugees from the three countries of the Horn of Africa (Eritrea, 15.5%; Ethiopia, 9.1%; and Somalia, 8.3%) was significantly higher ($P < 0.01$) than the HBsAg prevalence among refugees from the five other countries in Eastern Africa, where rates ranged from 3.0% in Burundi to 5.9% in Rwanda. Similarly, when we combined data by region, refugees from Southeast Asia (Myanmar, Malaysia, Thailand, Vietnam, and Laos) had a combined prevalence of 10.5%, whereas refugees from East Asia (China and Tibet) had a lower combined prevalence of 6.1%. Compared with other regions, variation in prevalence was very high in eastern European countries where the overall prevalence (2.6%)

Table 1. HBsAg-Positive Prevalence Among Refugees Entering US States from 2006 to 2008 by Continent, Region, and Nationality

Region	No. Screened	No. HBsAg-Positive (%)	95% CI
Africa	3,028	246 (8.1)	7.2-9.0
Eastern Africa	2,242	169 (7.5)	6.0-8.5
Eritrea	39	6 (15.5)	7.1-25.4
Ethiopia	438	40 (9.1)	6.8-16.6
Somalia	1,253	104 (8.3)	6.9-9.7
Rwanda	34	2 (5.9)	1.5-18.1
Kenya	121	5 (4.1)	1.7-8.9
Tanzania	224	7 (3.1)	1.5-6.1
Burundi	132	4 (3.0)	1.1-7.4
Uganda	2	*	*
Central Africa	191	8 (4.2)	2.1-7.7
Democratic Republic of Congo	32	2 (6.2)	1.6-19.0
Cameroon	38	2 (5.3)	1.3-16.6
Congo	121	4 (3.3)	1.2-8.0
Northern Africa	64	6 (9.4)	4.3-17.1
Sudan	44	3 (6.8)	2.2-16.8
Egypt	20	*	*
Western Africa	531	63 (11.8)	9.3-14.1
Liberia	433	53 (12.2)	9.4-14.7
Guinea	39	2 (5.2)	1.3-16.4
Sierra Leone	27	*	*
Togo	18	*	*
Ivory Coast	8	*	*
Mauritania	6	*	*
Asia	8,920	432 (4.8)	4.4-5.3
Eastern Asia	386	25 (6.5)	4.4-9.0
Tibet	149	10 (6.8)	3.7-11.2
China	232	13 (5.6)	3.3-8.9
North Korea	4	*	*
Southeastern Asia	3,300	347 (10.5)	9.5-11.4
Myanmar	2,436	301 (12.4)	11.1-13.4
Malaysia	34	3 (8.8)	2.9-20.6
Thailand	555	34 (6.1)	4.4-8.1
Vietnam	231	7 (3.2)	1.6-6.2
Laos	44	1 (2.3)	0.3-13.4
South-Central Asia	3,822	48 (1.3)	1.0-1.7
Afghanistan	60	3 (5.0)	1.6-13.0
Uzbekistan	122	4 (3.3)	1.2-7.9
Iran	3,629	40 (1.1)	0.8-1.5
Kazakhstan	11	*	*
Western Asia	1,412	12 (0.8)	0.5-1.5
Iraq	1,230	7 (0.6)	0.3-1.2
Turkey	78	1 (1.3)	0.2-8.2
Armenia	74	1 (1.4)	0.2-8.5
Jordan	24	*	*
United Arab Emirates	6	*	*
Europe	574	15 (2.6)	1.6-4.2
Eastern Europe	574	15 (2.6)	1.6-4.2
Moldova	135	8 (5.9)	3.0-10.6
Belarus	57	2 (3.5)	0.9-11.9
Ukraine	250	4 (1.6)	0.6-4.0
Russia	131	1 (0.8)	0.1-5.1
South/Central America and Caribbean	19,156	198 (1.0)	0.9-1.2
South America	476	4 (0.8)	0.3-2.2
Columbia	334	3 (0.9)	0.3-2.7
Venezuela	142	1 (0.7)	0.1-4.7
Caribbean	18,680	194 (1.0)	0.9-1.2
Haiti	659	17 (2.6)	1.6-4.0
Cuba	18,021	177 (1.0)	0.8-1.1
Total	31,980	891 (2.8)	2.6-3.0

*Prevalence estimates from countries with fewer than 30 refugees have been suppressed. However, regional estimates include refugees from all countries.

Table 2. Comparison of HBsAg Rates Among Refugees from Eight Countries of Origin in 1991 and 2008

Country	1991 Prevalence (%)	2008 Prevalence (%)
Afghanistan	4.1	5.0
Ethiopia	9.4	9.1
Iran	2.4	1.1
Iraq	13.0	0.6
Laos (Hmong, other)*	15.5,11.7	2.3
Russia	1.5	0.8
Thailand	14.2	6.1
Vietnam	13.8	3.2

*The 1991 prevalence for Laos was reported in the literature for the Hmong and for other Laotians without a single population-wide estimate.

[range, 0.8%-5.9%]) was dissimilar to most of the rates seen in each of the four countries that made up the region.

We were able to compare the prevalence of HBsAg observed among refugees in 2007-2008 with the rates observed among refugees between 1979 and 1991⁵ for eight countries (Table 2). Of those eight countries, two (Afghanistan and Ethiopia) each had approximately the same prevalence of HBsAg in 2007-2008 as in 1979 to 1991. The other six countries (Iran, Iraq, Laos, Russia, Thailand, and Vietnam) saw substantial declines in prevalence.

Discussion

The global burden of hepatitis B remains considerable. We observed an overall prevalence in excess of 2.0% among refugees arriving in the United States from other countries. However, of the eight countries for which we could compare current estimates to estimates reported in 1991, six saw substantial declines in prevalence. Nevertheless, prevalence estimates of chronic hepatitis B infection among refugees entering the United States is generally in concordance with countries considered by the Centers for Disease Control and Prevention to be at high risk of chronic hepatitis B infection.

We calculated the highest prevalence among refugees from Eritrea, Liberia, and Myanmar. Our estimate of 12.4% (95% CI 11.1%-13.4%) for Myanmar was similar to a World Health Organization white paper that cited a prevalence of 10%-12% among the general Myanmar population and a prevalence up to 20% in some specialized populations, such as those along the Chinese border.⁷ Our estimates from refugees entering from Iran and Cuba (the two countries that contributed the greatest number of refugees) were also similar to previously reported though earlier estimates: for Iran, 1.1% (95% CI 0.8%-1.5%) compared with a 2003 estimate of 1.7%⁸; and for Cuba, 1.0% (95% CI 0.8%-1.1%) compared with a 1992 estimate of 1.0%.⁹ Although a recent systematic literature review of HBsAg seroprevalence found marginally but consistently higher rates by country compared with our estimates, these differences are likely ex-

plained by that study's inclusion of older seroprevalence studies.¹⁰

Refugees may differ in several respects from the general population in ways that might affect their risk of HBV infection. For example, the circumstances that lead to refugee status (such as fleeing from violence or imprisonment) may be related to increased risks of infection with HBV. Counteracting this effect, refugees may also be of higher socioeconomic status because they have the resources and opportunity to leave their country of origin.¹¹ Their higher status could potentially lessen the likelihood of HBV infection, because prevalence has been shown to be inversely related to socioeconomic status.¹²

Our data are also limited by a lack of information about patients' age and sex, which could be an important limitation in interpreting the study results. However, four of the nine areas (representing 69.1% of the refugees included in our results) that supplied data for this study were subsequently also able to provide age information. Compared with the age distribution of the world's population, refugees from these four areas were less likely to be between the ages of 0 and 19, more likely to be between the ages of 20 and 39, and roughly equally likely to be age 40 or older. Specifically, 22.8% of refugees for whom we have data were between the ages of 0 and 19, 48.3% were between the ages of 20 and 39, and 29.9% were ages 40 or older, compared with 35.9%, 31.2%, and 32.9% for the same age groups worldwide.¹³ Assuming this age distribution is representative of all refugees in our sample, the prevalence rates reported here may potentially be somewhat higher than worldwide rates, because seroprevalence tends to increase with age and because the sample tested in this study is slightly older on average than the world population from which the refugees were drawn.

The quality of data varied by state. Whereas some states provided exact screening results, others provided only the number screened from each area and the prevalence observed from each area. The self-reported nature of these latter data potentially introduced some degree of error into our estimates. However, concern about this limitation is minimized by the fact that the estimates produced by this study correspond with comparable estimates from the literature for those countries where such estimates are available.

Our research yielded estimates of the prevalence of HBsAg among refugees entering the United States between 2006 and 2008. Although the estimates reported here can be used to inform policy that requires information on the regional and country-specific prevalence of HBsAg in the absence of other data, they should be used cautiously. Refugee prevalence may differ from the prevalence among the general population in ways that are presently not quantified or well understood, and the direction of these differences is likely to vary by country. Nevertheless, given the often inconsistent

and sporadic availability of country-specific estimates of the prevalence of HBsAg, we feel our estimates provide additional information for policy makers to consider.

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