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Trends in Prevalence and Characteristics of Resolved and Current Hepatitis B Among US-Born Persons: National Health and Nutrition Examination Survey, 2001–2018

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Abstract

Background.—After decades of decline, US acute hepatitis B incidence flattened since 2011. In persons aged ≥40 years and in jurisdictions affected by the opioid crisis, there is an increase in new cases. Data suggest new infections are occurring among US-born persons.

Methods.—We used National Health and Nutrition Examination Survey data during 2001–2018 to examine changes in total antibody to hepatitis B virus core antigen (anti-HBc) prevalence in US-born persons. During 2013–2018, the distribution of characteristics was examined.

Results.—During 2001–2006, 2007–2012, and 2013–2018, anti-HBc prevalence was 3.5%, 2.5%, and 2.6% among US-born persons, respectively. This corresponded to 5.7 (range, 4.8–6.6) million US-born persons with resolved or current HBV infection during 2013–2018, including 344 600 persons aged 6–29 years. The largest increase and highest prevalence was among persons who reported injection drug use (IDU), which increased from 35.3% during 2001–2006 to 58.4% during 2013–2018 ($P = .07$).

Conclusions.—Anti-HBc prevalence among US-born persons remained flat during the most recent period, coinciding with a doubling of prevalence among persons reporting IDU. These data are consistent with acute hepatitis B surveillance trends, showing increasing incidence in subpopulations where prevention could be strengthened.

Keywords

hepatitis B virus; hepatitis B core antibody; prevalence; injection drug use; US born

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In the 3 decades following release of hepatitis B vaccine in 1981, the incidence of acute hepatitis B in the United States decreased approximately 91%, from 9.6/100 000 in 1982 to 0.9/100 000 population in 2011 [1]. Since 2011, the trend in overall acute hepatitis B incidence has remained flat, although it has increased among persons aged ≥40 years and subnationally in jurisdictions that have reported an increase in cases related to injection drug use (IDU) and sexual transmission [1-3], coinciding with an increase in acute hepatitis C incidence [1] and drug overdose deaths [4]. These subpopulations include persons who should have received hepatitis B vaccine based on existing guidelines, either based on risk behaviors or the result of the adolescent catch-up strategy [5-7]. Although unpublished acute hepatitis B surveillance data reporting country of birth are largely incomplete and limited to a minority of jurisdictions, those data suggest that most reported cases occurred among US-born persons (Centers for Disease Control and Prevention [CDC], unpublished data).

Among HBV-infected adults, born before routine vaccination for hepatitis B was added to the immunization schedule for children and adolescents, approximately 95% recover completely and do not become chronically infected. Many are asymptomatic or have mild infection and never know that they were infected. After acute hepatitis B virus (HBV) infection, persons develop total antibody to HBV core antigen (anti-HBc), which typically remains detectable for the duration of life. Anti-HBc is rarely false positive; therefore, population-based assessment of anti-HBc is the best means of determining the prevalence of HBV exposure in a population and, indirectly, of examining the effectiveness of hepatitis B vaccination efforts. In these respects, information derived from acute hepatitis B case surveillance has shortcomings, the most prominent of which is not accounting for asymptomatic infections [8, 9]. Furthermore, although acute and chronic hepatitis B cases are submitted by most states to the national surveillance system, cases of resolved HBV infection are not [10, 11].

To our knowledge, recent studies have not described characteristics among anti-HBc–positive US-born persons. Earlier hepatitis B prevalence National Health and Nutrition Examination Survey (NHANES) publications examined trends in prevalence of anti-HBc in the overall US population and among demographic subpopulations, which included US-born persons; however, characteristics of anti-HBc–positive US-born persons were not further described [12, 13]. Given the epidemiologic shifts indicated by acute hepatitis B surveillance data during the past decade [1], we sought to determine whether these changes were supported by similar shifts in the epidemiology of anti-HBc among US-born persons nationally. Identification of population subgroups with comparatively higher anti-HBc prevalence (or with unfavorable trends thereof) should also identify missed opportunities for vaccination and enable prevention programs to intensify hepatitis B vaccination efforts accordingly. We therefore analyzed data from the NHANES for three 6-year time periods during 2001–2018 to describe the epidemiology and trends in the prevalence of anti-HBc among US-born persons.

METHODS

Data Source and Survey Design

We used public-use NHANES data obtained from the CDC National Center for Health Statistics (NCHS) website [14]. NHANES is a series of comprehensive cross-sectional surveys of the health and nutrition status of US noninstitutionalized civilian population; approximately 10 000 persons are examined per 2-year cycle. Using a complex, stratified, multistage probability sampling survey design, NHANES data are representative of the US population. Information is collected using standardized household interviews, physical examinations, and tests of biologic samples. All NHANES participants would have provided written informed consent. Our study period included data collected during 2001–2018. CDC determined this secondary analysis of existing deidentified data did not require institutional review board approval.

Study Population and Measures

The study population was limited to participants aged 6 years or older because anti-HBc testing was restricted to this age group. Characteristics of interest included age group, sex, race/ethnicity, education level, marital status, annual family income, type of health insurance coverage, ever IDU, ever being a man who had sex with another man (MSM), number of lifetime sexual partners, and hepatitis A immunity status.

Definitions for Self-Reported Measures

Participants who reported being born in 1 of the 50 US states or Washington DC were classified as US born. Race/ethnicity was grouped into non-Hispanic (NH) white, NH black, Hispanic, and NH other categories. The NH other race/ethnicity category included NH persons of races other than white and black, including NH persons with multiple races. Because NH Asian persons were oversampled during 2011–2018, they were separated from the NH other race/ethnicity group in the 2013–2018 analysis. In NHANES, ever IDU was assessed for participants aged 20–59 years during 2001–2006, participants aged 20–69 years during 2007–2008, and participants aged 18–69 during 2009–2018. MSM history was determined among male participants aged 20–59 years during 2001–2006, aged 20–69 years during 2007–2008, and aged 18–69 years during 2009–2016. Number of lifetime sexual partners was assessed for participants aged 18–69 years during 2013–2016.

Laboratory Testing

Resolved or current hepatitis B was determined by a positive anti-HBc result. Of persons with a positive anti-HBc result, current hepatitis B was determined by a positive hepatitis B surface antigen (HBsAg) result, and resolved hepatitis B was determined by a positive anti-HBs result and negative HBsAg result. Isolated anti-HBc was defined by a positive anti-HBc result in the absence of anti-HBs and HBsAg. Hepatitis A immunity was determined by a positive total hepatitis A virus antibody (anti-HAV). All viral hepatitis laboratory testing was performed using VITROS Immunodiagnostic products, and the need for retesting was determined using signal to cutoff results defined by standard testing protocols [15].

Statistical Analyses

We used the NHANES survey sampling design variables and full sample weight variables calculated for the study periods to produce nationally representative estimates and corresponding 95% confidence intervals (CIs). Anti-HBc prevalence estimates were calculated for three 6-year time periods (2001–2006, 2007–2012, and 2013–2018) to assess for changes over time among US-born persons overall and by selected characteristics. These years were chosen as they were the most recent data from continuous NHANES and could be grouped equally into 3 time periods for trend analyses. The Cochran-Mantel-Haenszel test for trend was used to determine statistical significance of trends in the estimated anti-HBc prevalence. In a subanalysis, the Rao-Scott χ^2 test was used to determine statistical significance of the overall anti-HBc prevalence among US-born persons from 2007–2012 to 2013–2018. We calculated weighted proportion estimates of sociodemographic characteristics, risk behaviors, and hepatitis A immunity status during the most recent time period of 2013–2018 to provide a more relevant and current assessment and description of anti-HBc–positive persons by US birthplace status. The Wald χ^2 test was used to assess for statistical differences in characteristics between US-born resolved or current HBV-infected persons and non-US–born resolved or current HBV-infected persons. The estimated number of persons with resolved or current hepatitis B was obtained by multiplying the weighted anti-HBc prevalence estimate during the most recent of the 3 time periods (ie, 2013–2018) by the NHANES population totals during 2013–2018 (n = 218 744 264 US-born and 41 685 369 non-US–born persons).

For all analyses, P values <.05 were considered statistically significant. Results were reviewed for statistical reliability [16, 17]. Data management was performed using SAS version 9.4 (SAS Institute). Statistical analyses were performed using SAS-Callable SUDAAN release 10.0 (Research Triangle Institute).

RESULTS

Trends in the Estimated Anti-HBc Prevalence Among US-Born Persons in the United States During 2001–2018

The estimated overall anti-HBc prevalence among US-born persons declined from 3.5% (95% CI, 3.1%−4.0%) during 2001–2006 to 2.5% (95% CI, 2.2%–2.9%) during 2007–2012 and 2.6% (95% CI, 2.2%–3.0%) during 2013–2018 (P = .002); however, it did not noticeably change between the periods of 2007–2012 and 2013–2018 (P = .79; Table 1). During 2013–2018, the most recent time period of the study, 545 out of 1292 (42.2%) anti-HBc–positive participants were US born, corresponding to an anti-HBc prevalence of 2.6% (95% CI, 2.2%–3.0%) and representing approximately 5.7 (range, 4.8–6.6) million US-born persons with resolved or current HBV infection (Table 2). In contrast, 747 (57.8%) anti-HBc–positive persons were non-US born, corresponding to an anti-HBc prevalence of 11.4% (95% CI, 9.6%–13.5%) and representing approximately 4.8 (range, 4.0–5.6) million non-US–born persons with resolved or current hepatitis B.

A significant increase in the estimated anti-HBc prevalence was observed for US-born persons aged 60–69 years, from 3.6% (95% CI, 2.8%–4.7%) during 2001–2006 and 3.7%

(95% CI, 2.8%–4.9%) during 2007–2012 to 5.8% (95% CI, 4.7%–7.1%) in 2013–2018 (P = .005; Table 1). Although not statistically significant, the largest increase in the anti-HBc prevalence was observed among US-born persons with an IDU history from 35.3% (95% CI, 24.8%–47.6%) during 2001–2006 and 32.7% (95% CI, 19.9%–48.8%) during 2007–2012 to 58.4% (95% CI, 39.5%–75.1%) during 2013–2018 (P = .07). US-born persons with an IDU history had the highest anti-HBc prevalence when compared to all US-born persons and other US-born subgroups.

During 2013–2018, the highest anti-HBc prevalence occurred among US-born persons with lifetime IDU (58.4%) or MSM (12.9%) histories, those of NH black race/ethnicity (6.6%), and persons aged 60–69 years (5.8%) (Table 1).

The estimated anti-HBc prevalence among US-born persons aged 6–29 years was 0.7% (95% CI, .5%–1.0%) during 2001–2006, 0.7% (95% CI, .5%–1.0%) during 2007–2012, and 0.5% (95% CI, .3%–0.8%) during 2013–2018 (Table 1). This represented approximately 344 600 (range, 229 700–612 600) US-born persons during 2013–2018. Although the estimated anti-HBc prevalence among US-born NH black persons significantly declined, it was the highest compared to other race/ethnicity groups during all 3 time periods and was 3.1 times higher than the prevalence among NH white persons during 2013–2018 (6.6% vs 2.1%).

Distribution of Characteristics Among Anti-HBc–Positive US-Born Persons During 2013–2018

Of anti-HBc–positive US-born persons, 71.2% had resolved infection, 24.7% were isolated anti-HBc, and 4.1% had current infection. Anti-HBc–positive US-born persons were predominantly male, NH white, married/cohabitating, privately insured, had ≥2 lifetime sexual partners, and anti-HAV negative. Median age was 58.3 years.

When compared to anti-HBc–positive non-US–born persons, anti-HBc–positive US-born persons were more frequently aged 60–69 years (29.1% vs 18.9%), NH white (58.1% vs 11.0%), NH black (31.2% vs 16.1%), NH other (5.0% vs 1.3%), never married (18.6% vs 8.2%), widowed/divorced/separated (31.4% vs 18.0%), earned an annual family income of <$20 000 (34.2% vs 20.3%), had IDU histories (11.7% vs 0.1%), had ≥10 lifetime sexual partners (45.4% vs 19.7%), and anti-HAV negative (57.7% vs 10.3%) (P < .05 for all comparisons; Table 2).

DISCUSSION

This study sought to determine whether epidemiologic shifts in national acute hepatitis B incidence, which appear to have been affected by increases in IDU, were supported by similar shifts in HBV exposure prevalence (ie, anti-HBc positivity) among US-born persons. Using a US-representative sample of US-born persons, we observed a decrease in estimated anti-HBc prevalence from the period of 2001–2006 to that of 2007–2012, which corroborated previous NHANES analyses that documented similar decreases among US-born persons during earlier years from 1988–1994 to 2007–2012 [12, 13] as well as declining acute hepatitis B incidence [18]. The decrease in new infections in these earlier years were mostly attributable to implementation of the comprehensive national strategy to

vaccinate persons at risk of HBV infection beginning in 1982 and all infants and catch-up vaccination for children and adolescents beginning in 1991 [7, 19].

Between the periods of 2007–2012 and 2013–2018, however, we found that the decline in anti-HBc prevalence among US-born persons had ceased. This shift in prevalence has important public health implications. First, our data mirrors the flattened acute hepatitis B incidence trend observed from case-based surveillance data since 2011 [18], suggesting that acute infections were primarily among US-born persons. Indeed, unpublished acute hepatitis B surveillance data suggest that most reported cases occurred among US-born persons (CDC, unpublished data). Next, the halt in decreasing prevalence and incidence levels after decades of decline occurred concurrently with the increase in acute hepatitis C incidence [1] and drug overdose deaths [4], suggesting that a rise in IDU may be the principal contributing factor. To support this explanation, analyses of acute hepatitis B case surveillance data have detected increases in jurisdictions that have reported an increase in cases related to IDU and sexual transmission [1, 2, 9]. Furthermore, our study demonstrated that US-born persons with an IDU history had the most pronounced increase and the highest anti-HBc prevalence. These infections represent cases that could have been prevented through routine hepatitis B vaccination, especially in settings where services are provided for persons who inject drugs such as syringe services programs, correctional facilities, behavioral health providers, sexually transmitted infection clinics, emergency departments, and substance use disorder treatment facilities.

We determined that approximately 344 600 (range, 229 700–612 600) US-born persons aged 6–29 years were anti-HBc positive during 2013–2018. Under the comprehensive strategy to prevent hepatitis B in the United States [5], these individuals should have received hepatitis B vaccination universally during infancy (beginning in 1991) or through the catch-up strategy during adolescence (beginning in 2005) [7]. There are a few possible explanations for this finding, which include not being vaccinated, being a nonresponder to vaccination, and experiencing a breakthrough infection.

Our study found a higher number of US-born persons than non-US–born persons who were anti-HBc positive (5.7 [range, 4.8–6.6] million vs 4.8 [range, 4.0–5.6] million, respectively). In contrast, many NHANES-based studies have documented a higher total number of non-US–born persons than US-born persons were HBsAg positive. For persons born in HBV-endemic countries, infection likely occurred during infancy and most of these infections are expected to progress to chronic hepatitis B. However, for US-born persons, infection likely occurred during adulthood and most of these infections are expected to resolve.

The significant increase in anti-HBc prevalence we found among US-born persons aged 60–69 years could be attributable to a cohort effect related to baby boomers (ie, persons born during 1945–1965), aging and being increasingly counted in the 60–69 year age group over the 3 time periods. Baby boomers have been found to have the highest hepatitis C prevalence [20]. Because HBV can be similarly transmitted via the percutaneous route, high transmission among baby boomers could have occurred during the 1960s to 1980s concurrent with high rates of hepatitis C transmission before the availability of the hepatitis B vaccine in 1981 [19] and before the advent of universal infection control precautions for

human immunodeficiency virus (HIV), HBV, and other bloodborne pathogens in health care settings in 1988 [21].

One study that examined the relationship of anti-HBc positivity in donor blood and the development of non-A, non-B hepatitis during 1973–1980 concluded that 11.9% of recipients who received anti-HBc–positive blood developed non-A, non-B hepatitis compared to 4.2% of recipients who received anti-HBc–negative blood [22]. The Transfusion-Transmitted Viruses Study Group similarly reported a significant association between donor anti-HBc–positive status and recipient non-A, non-B hepatitis [23]. The implication of these 2 studies was that anti-HBc–positive adults in that era were often also positive for antibody to hepatitis C virus (anti-HCV). To examine this phenomenon with respect to our study cohort, we did a post hoc analysis examining the anti-HCV prevalence among anti-HBc–positive US-born persons aged 60–69 years (the age group which experienced a significant anti-HBc prevalence increase over time) to assess whether there had be a similar increase in anti-HCV prevalence over time. Although the anti-HCV prevalence trend was not statistically significant, we found it had increased from 17.0% during 2001–2006 to 29.1% during 2007–2012 and 40.9% during 2013–2018. This increase mirrors the increase in anti-HBc prevalence among US-born persons aged 60–69 years and corroborates findings from the 2 earlier studies that found an association between anti-HBc positivity and development of non-A, non-B hepatitis.

A more recent NHANES study that examined anti-HBc positivity among persons with an IDU history during 2001–2016 did not include persons aged 60–69 years; however, it documented that about 80% were born during 1945–1965 [24]. We also found that during 2013–2018, anti-HBc prevalence was highest among US-born persons aged 60–69 years when compared to other age groups. In earlier analyses of anti-HBc prevalence trends using NHANES data, the oldest age group also had the highest anti-HBc prevalence [12, 13]. This finding suggests that older, unvaccinated individuals with risk behavior histories have had more cumulative years of potential HBV exposure.

Although the trend in anti-HBc prevalence among US-born NH black persons significantly decreased during our overall study period, it remained approximately 3 times higher than that of US-born NH white persons. However, this difference has narrowed from earlier NHANES sample periods [25], which may attest to benefits of hepatitis B vaccination initiatives among children.

There are limitations to consider when interpreting NHANES data [12, 13, 24, 26], the most important of which is that NHANES sampling frame does not include persons experiencing homeless, incarcerated, hospitalized, nursing home residents, active-duty military, and Native Americans living on reservations [27]. Persons belonging to these groups might have a higher prevalence of high-risk behaviors and anti-HBc positivity. Next, assessment of risk behavior histories is done through a self-reported questionnaire, which potentially can lead to participants not reporting or falsely reporting their risk behaviors. We found that 36.9%, 52.1%, and 53.2% of anti-HBc–positive US-born participants had a missing/don’t know/refused response for the assessment of IDU history, MSM history, and number of lifetime sexual partners, respectively. The degree of unknown responses to these risk

behavior questions were similarly high among all NHANES participants (ie, US born and non-US born). Furthermore, due to the small number of anti-HBc–positive persons with an IDU history sampled in NHANES, we were unable to detect statistical significance in the increasing anti-HBc prevalence among US-born persons with an IDU history during the study period. Despite this, the anti-HBc prevalence among US-born persons with an IDU history doubled and was the most pronounced in the study. Finally, because NHANES is a cross-sectional survey, temporality between risk behaviors and anti-HBc positivity cannot be determined and incidence of infection cannot be measured. Therefore, caution should be used when interpreting results. Despite these limitations, this study extensively examined the distribution of characteristics and trends in the seroprevalence of anti-HBc positivity using a nationally representative sample of US-born persons, and encompasses an important juncture in US HBV epidemiology.

In summary, although anti-HBc prevalence among US-born persons decreased during the initial phase of our study period, it remained flat during the most recent period, providing data to support observed increasing or flat incidence rates among subpopulations where hepatitis B prevention efforts should be targeted. This increase corroborates acute hepatitis B surveillance data since 2011, supporting observations that the most pronounced increase in prevalence has occurred among persons with IDU histories. Improved provider screening, especially in high-impact settings, for drug use behaviors is a US Preventive Services Task Force recommendation [28] and will identify adults who are at risk for HBV infection. In these settings, hepatitis B preventive services should be integrated with the screening and treatment for other infectious diseases. At the national surveillance level, inclusion of country of birth for all cases of hepatitis B should be considered to inform the understanding and characterization of the evolving epidemiology of infection.

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Table 1.

Prevalence of Anti-HBc Positivity Among US-Born Persons Aged 6 Years or Older, by Selected Characteristics and 6-Year Time Intervals, United States NHANES 2001–2018

Characteristic	Time Period						
	2001–2006		2007–2012		2013–2018		
	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	*P* Value[a]
Overall	693/18 761	3.5 (3.1–4.0)	569/17 209	2.5 (2.2–2.9)	545/16 243	2.6 (2.2–3.0)	.002*
Age group, y							
Age known	18 761 (100.0%)		17 209 (100.0%)		16 243 (100.0%)		
6–29	62/9926	0.7 (.5–1.0)	41/7635	0.7 (.5–1.0)	34/7549	0.5 (.3–0.8)	.17
30–39	74/1684	3.1 (2.4–4.1)	45/1888	1.7 (1.2–2.3)	31/1676	1.1 (.7–1.7)	<.001*
40–49	144/1775	5.6 (4.5–6.9)	83/1830	3.0 (2.3–4.1)	47/1566	2.1 (1.5–3.1)	<.001*
50–59	128/1494	6.7 (5.2–8.5)	136/1759	5.2 (4.0–6.6)	127/1651	5.3 (4.0–70)	.23
60–69	97/1611	3.6 (2.8–4.7)	144/1851	3.7 (2.8–4.9)	184/1812	5.8 (4.7–71)	.005*
70+	188/2271	6.4 (5.1–8.0)	120/2246	4.0 (3.3–4.8)	122/1989	4.3 (3.4–5.4)	.02*
Sex							
Sex known	18 761 (100.0%)		17 209 (100.0%)		16 243 (100.0%)		
Male	395/9062	4.3 (3.7–4.9)	312/8575	2.8 (2.4–3.3)	330/7994	3.2 (2.7–3.7)	.008*
Female	298/9699	2.9 (2.4–3.4)	257/8634	2.2 (1.8–2.7)	215/8249	2.0 (1.6–2.6)	.02*
Race/ethnicity							
Race/ethnicity known	18 761 (100.0%)		17 209 (100.0%)		16 243 (100.0%)		
Non-Hispanic white	244/9181	2.7 (2.3–3.1)	182/8553	1.9 (1.6–2.4)	162/7172	2.1 (1.7–2.6)	.048*
Non-Hispanic black	371/5341	9.5 (8.4–10.8)	312/4471	6.7 (6.0–74)	296/4233	6.6 (5.7–77)	<.001*
Hispanic	58/3666	1.6 (1.0–2.6)	52/3318	1.6 (1.2–2.2)	47/3293	1.2 (.8–1.7)	.26
Non-Hispanic other	20/573	5.8 (3.3–10.0)	23/867	3.0 (1.9–4.9)	40 /1545	2.6 (1.8–3.9)	.06
Education level[c]							
Education level known	12 149 (56.7%)		12 724 (64.7%)		11 693 (62.1%)		
High school or less	414/5986	5.1 (4.4–5.9)	316/6019	3.8 (3.2–4.5)	284/4784	4.2 (3.4–5.1)	.11
Some college or higher	242/6163	3.3 (2.7–3.9)	237/6705	2.3 (1.9–2.8)	248/6909	2.3 (1.9–2.8)	.01*

Characteristic	Time Period						
	2001–2006		2007–2012		2013–2018		
	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	*P* Value[a]
Marital status[c]							
Marital status known	16 660 (777%)		12 729 (64.8%)		11 698 (62.1%)		
Never married	129/6332	2.4 (1.8–3.3)	106/2552	3.2 (2.4–4.3)	106/2541	2.8 (2.3–3.3)	.41
Married/cohabitating	326/7309	3.5 (3.0–4.0)	239/7025	2.3 (2.0–2.8)	234/6307	2.4 (1.9–3.0)	.003*
Widowed, divorced, separated	225/3019	5.7 (4.7–6.8)	208/3152	4.2 (3.6–5.0)	191/2850	4.8 (4.0–5.6)	.19
Annual family income							
Annual family income known	20 422 (95.3%)		18 372 (93.5%)		17 353 (92.2%)		
<$20 000	281/5900	5.1 (4.3–6.1)	203/4829	3.7 (3.0–4.5)	208/3928	5.1 (4.2–6.2)	.88
$20 000–$34 999	148/4176	4.0 (3.3–4.9)	108/3938	2.8 (2.1–3.6)	118/3473	3.1 (2.3–4.2)	.12
$35 000–$54 999	99/3857	2.5 (2.0–3.1)	88/3137	2.0 (1.5–2.6)	61/3216	1.8 (1.2–2.7)	.14
$55 000–$74 999	52/2285	2.2 (1.5–3.2)	49/1999	1.6 (1.0–2.4)	40/1894	1.6 (1.0–2.4)	.24
$75 000+	79/4204	2.1 (1.5–2.8)	80/4467	1.6 (1.2–2.1)	76/4842	1.4 (1.0–2.0)	.11
Health insurance							
Health insurance known	21 099 (98.5%)		19 570 (99.6%)		18 699 (99.3%)		
Private	307/12 130	2.4 (2.0–2.9)	254/10 309	1.9 (1.6–2.3)	209/9338	1.8 (1.5–2.2)	.02*
Medicare only	161/2033	6.2 (4.9–77)	112/1757	4.7 (3.6–6.0)	145/1737	5.7 (4.6–72)	.65
Medicaid	63/2715	3.3 (2.5–4.4)	67/2826	2.4 (1.7–3.3)	71/3815	2.4 (1.6–3.5)	.19
Other government	31/1295	3.6 (2.4–5.2)	43/1626	2.3 (1.5–3.6)	44/1702	2.0 (1.3–3.1)	.07
No coverage or single service provider	117/2926	4.6 (3.6–5.7)	92/3052	2.8 (2.0–3.9)	75/2107	3.0 (2.1–4.3)	.03*
Injection drug use history[b]							
Injection drug use history known	6404 (34.1%)		8733 (50.7%)		8286 (51.0%)		
Ever injection drug use	35/91	35.3 (24.8–476)	16/34	32.7 (19.948.8)	40/75	58.4 (39.5–75.1)[d]	.07
Never injection drug use	300/6313	3.7 (3.2–4.4)	345/8699	2.7 (2.3–3.1)	304/8211	2.5 (2.1–3.0)	.002*
MSM history[b,c]							
MSM history known	3831 (31.2%)		4229 (49.3%)		2824 (35.3%)		
Ever an MSM	43/155	279 (19.9–377)	40/233	13.3 (8.9–19.5)	31/186	12.9 (74–21.4)	.01*
Never an MSM	153/2676	4.1 (3.3–5.1)	151/3996	2.4 (1.9–2.9)	127/2638	2.7 (2.2–3.4)	.006*

Characteristic	Time Period						
	2001–2006		2007–2012		2013–2018		
	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	No. Anti-HBc Positive/ Sample Size	Weighted % (95% CI)	*P* Value[a]
Hepatitis A immunity status (anti-HAV)							
Hepatitis A immunity known	18 761 (100%)		16 999 (98.8%)		16 077 (99.0%)		
Anti-HAV positive	376/6079	5.8 (4.9–6.8)	253/6653	3.1 (2.6–3.7)	286/8064	2.9 (2.5–3.4)	<.001*
Anti-HAV negative	317/12 682	2.7 (2.4–3.2)	278/10 346	2.1 (1.8–2.5)	257/8013	2.4 (1.9–3.0)	.29

Unless otherwise noted, data are among US-born persons aged 6 years or older who have selected characteristics stratified by time interval, United States, NHANES 2001–2018. *P <.05.

Abbreviations: anti-HAV, hepatitis A virus antibody; anti-HBc, total HBV core antibody; anti-HBs, hepatitis B surface antibody; CI, confidence interval; HBsAg, hepatitis B surface antigen; MSM, men who have sex with other men; NHANES, National Health and Nutrition Examination Survey.

[a]Cochran-Mantel-Haenszel test for trend.

[b]Education level and marital status were assessed for persons aged 20+ years. Injection drug use history was assessed for persons aged 20–59 years during 2001–2006, persons aged 20–69 years during 2007–2008, and persons aged 18–69 years during 2009–2018. MSM history was assessed for males aged 20–59 years during 2001–2006, aged 20–69 years during 2007–2008, and aged 18–69 years during 2009–2016.

[c]NHANES 2017–2018 data not available.

[d]Not statistically reliable.

Table 2.

Distribution of Characteristics Among Anti-HBc–Positive Persons by US Birthplace Status, United States NHANES 2013–2018

Characteristics	Anti-HBc Positive US-Born		Anti-HBc Positive Non-US–Born		*P* Value[a]
	Sample Size, No. (%)	Weighted % (95% CI)	Sample Size, No. (%)	Weighted % (95% CI)	
Overall	545	2.6 (2.2–3.0)	747	11.4 (9.6–13.5)	
Age group, y					<.001*
Age known	545 (100.0)	…	747 (100.0)	…	
6–29	34	6.1 (3.7–10.1)	37	6.8 (4.8–9.6)	
30–39	31	5.3 (3.5–8.0)	80	15.4 (11.9–19.8)	
40–49	47	10.9 (75–15.7)	132	18.6 (14.9–23.0)	
50–59	127	30.7 (23.8–38.5)	169	24.7 (20.2–29.7)	
60–69	184	29.1 (24.5–34.2)	195	18.9 (15.5–22.7)	
70+	122	17.8 (14.4–21.8)	134	15.5 (12.6–19.0)	
Median age, y	58.27		53.31		.001
Sex					.16
Sex known	545 (100.0)	…	747 (100.0)	…	
Male	330	59.6 (53.1–65.8)	396	54.9 (50.7–59.0)	
Female	215	40.4 (34.2–46.9)	351	45.1 (41.0–49.3)	
Race/ethnicity					<.001*
Race/ethnicity known	545 (100.0)	…	747 (100.0)	…	
Non-Hispanic white	162	58.1 (51.4–64.5)	21	11.0 (5.0–22.6)	
Non-Hispanic black	296	31.2 (25.7–374)	114	16.1 (11.5–22.1)	
Hispanic	47	5.0 (3.3–75)	145	19.0 (14.5–24.4)	
Non-Hispanic Asian	9	0.7 (.3–1.3)	457	52.5 (44.3–60.5)	
Non-Hispanic other	31	5.0 (3.3–77)	10	1.3 (.7–2.5)	
Education level[b]					.90
Education level known	532 (97.6)	…	736 (98.5)	…	
High school or less	284	49.1 (41.3–56.9)	384	49.6 (42.2–571)	
Some college or higher	248	50.9 (43.1–58.7)	352	50.4 (42.9–578)	
Marital status[b]					<.001*

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Characteristics	Anti-HBc Positive US-Born		Anti-HBc Positive Non-US–Born		*P* Value[a]
	Sample Size, No. (%)	Weighted % (95% CI)	Sample Size, No. (%)	Weighted % (95% CI)	
Marital status known	531 (974)	…	737 (98.7)	…	
Never married	106	18.6 (14.8–23.1)	51	8.2 (6.4–10.5)	
Married/cohabitating	234	50.0 (44.9–55.1)	541	73.8 (70.0–773)	
Widowed, divorced, separated	191	31.4 (272–36.0)	145	18.0 (14.9–21.6)	
Annual family income					.02
Annual family income known	503 (92.3)	…	619 (82.9)	…	
<$20 000	208	34.2 (271–42.2)	145	20.3 (16.1–25.2)	
$20 000–$34 999	118	19.8 (15.5–25.1)	114	17.1 (13.3–21.7)	
$35 000–$54 999	61	13.9 (9.8–19.2)	134	19.4 (15.7–23.7)	
$55 000–$74 999	40	8.1 (5.2–12.6)	76	12.8 (9.0–179)	
$75 000+	76	23.9 (176–31.6)	190	30.5 (22.2–40.2)	
Health insurance					.03*
Health insurance known	544 (99.8)	…	743 (99.5)	…	
Private	209	48.1 (40.5–55.7)	334	44.4 (39.5–49.5)	
Medicare only	145	19.4 (15.5–24.0)	145	15.9 (12.5–19.9)	
Medicaid	71	12.1 (8.4–173)	65	8.3 (6.0–11.5)	
Other government	44	6.7 (4.3–10.1)	56	8.6 (6.5–11.3)	
No coverage or single service provider	75	13.8 (9.4–19.7)	143	22.8 (175–29.1)	
Injection drug use history[b]					.001*
Injection drug use history known	344 (63.1)	…	461 (61.7)	…	
Ever injection drug use	40	11.7 (6.7–19.6)	1	0.1 (.0–.6)	
Never injection drug use	304	88.3 (80.4–93.3)	460	99.9 (99.4–100.0)	
MSM history[b,c]					.02*
MSM history known	158 (479)		180 (45.5)		
Ever an MSM	31	28.3 (15.7–45.6)	7	6.6 (2.3–172)	
Never an MSM	127	71.7 (54.4–84.3)	173	93.4 (82.8–977)	
Number of lifetime sexual partners[b,c]					.002*
Number of lifetime sexual partners known	255 (46.8)	…	318 (42.6)	…	
0–1	21	12.0 (5.3–25.1)	113	33.1 (274–39.4)	

Characteristics	Anti-HBc Positive US-Born		Anti-HBc Positive Non-US–Born		*P* Value[a]
	Sample Size, No. (%)	Weighted % (95% CI)	Sample Size, No. (%)	Weighted % (95% CI)	
2–9	118	42.5 (33.9–51.6)	154	47.2 (40.5–54.0)	
>10	116	45.4 (36.1–55.1)	51	19.7 (13.1–28.5)	
Hepatitis B status					
Hepatitis B status known	541 (99.3)		743 (99.5)		.003*
Current infection, HBsAg positive	23	4.1 (2.5–6.6)	79	10.6 (8.3–13.3)	
Resolved infection, HBsAg negative and anti-HBs positive	380	71.2 (65.0–76.6)	522	71.2 (66.2–75.8)	
Isolated anti-HBc, HBsAg negative and anti-HBs negative	138	24.7 (19.8–30.4)	142	18.2 (14.2–23.0)	
Hepatitis A immunity status, anti-HAV					<.001*
Hepatitis A immunity known	543 (99.6)	…	738 (98.8)	…	
Anti-HAV positive	286	42.3 (36.3–48.6)	659	89.7 (872–91.8)	
Anti-HAV negative	257	57.7 (51.4–63.7)	79	10.3 (8.2–12.8)	

Unless otherwise noted, data are among persons aged 6 years or older who were anti-HBc positive, stratified by US place of birth status, United States, NHANES 2013–2018. *P <.05.

Abbreviations: anti-HAV, hepatitis A virus antibody; anti-HBc, total HBV core antibody; anti-HBs, hepatitis B surface antibody; CI, confidence interval; HBsAg, hepatitis B surface antigen; MSM, men who have sex with other men; NHANES, National Health and Nutrition Examination Survey.

[a]Wald χ^2 test to assess differences in characteristics between US-born and foreign-born anti-HBc–positive persons.

[b]Education level and marital status were assessed for persons aged 20+ years. Injection drug use history was assessed for persons aged 20–59 years during 2001–2006, persons aged 20–69 years during 2007– 2008, and persons aged 18–69 years during 2009–2018. MSM history was assessed for males aged 20–59 years during 2001–2006, aged 20–69 years during 2007–2008, and aged 18–69 years during 2009–2016. Number of lifetime sexual partners was assessed for persons aged 20–59 years during 2001–2006, persons aged 20–69 years during 2007–2008, and persons aged 18–69 years during 2009–2016.

[c]NHANES 2017–2018 data not available.