

Progress and Unfinished Business: Hepatitis B in the United States, 1980-2019

Danae Bixler, MD, MPH

Division of Viral Hepatitis



Disclaimer

The findings and conclusions in this presentation are those of the author and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Topics

- **Overview**
 - Viral hepatitis
 - Signs, symptoms
- **Progress related to vaccination**
- **Unfinished business**
- **National Initiatives**
 - Recent recommendations to change adult vaccination and screening policies
- **Resources**



Hepatitis B Basics



Symptoms of Acute Hepatitis

Systemic	Gastrointestinal	Jaundice
<ul style="list-style-type: none">• Fever• Fatigue• Loss of appetite• Joint pain	<ul style="list-style-type: none">• Nausea• Vomiting• Abdominal pain• Diarrhea	<ul style="list-style-type: none">• Yellow skin and eyes• Dark urine• Clay-colored bowel movements

Asymptomatic Hepatitis B

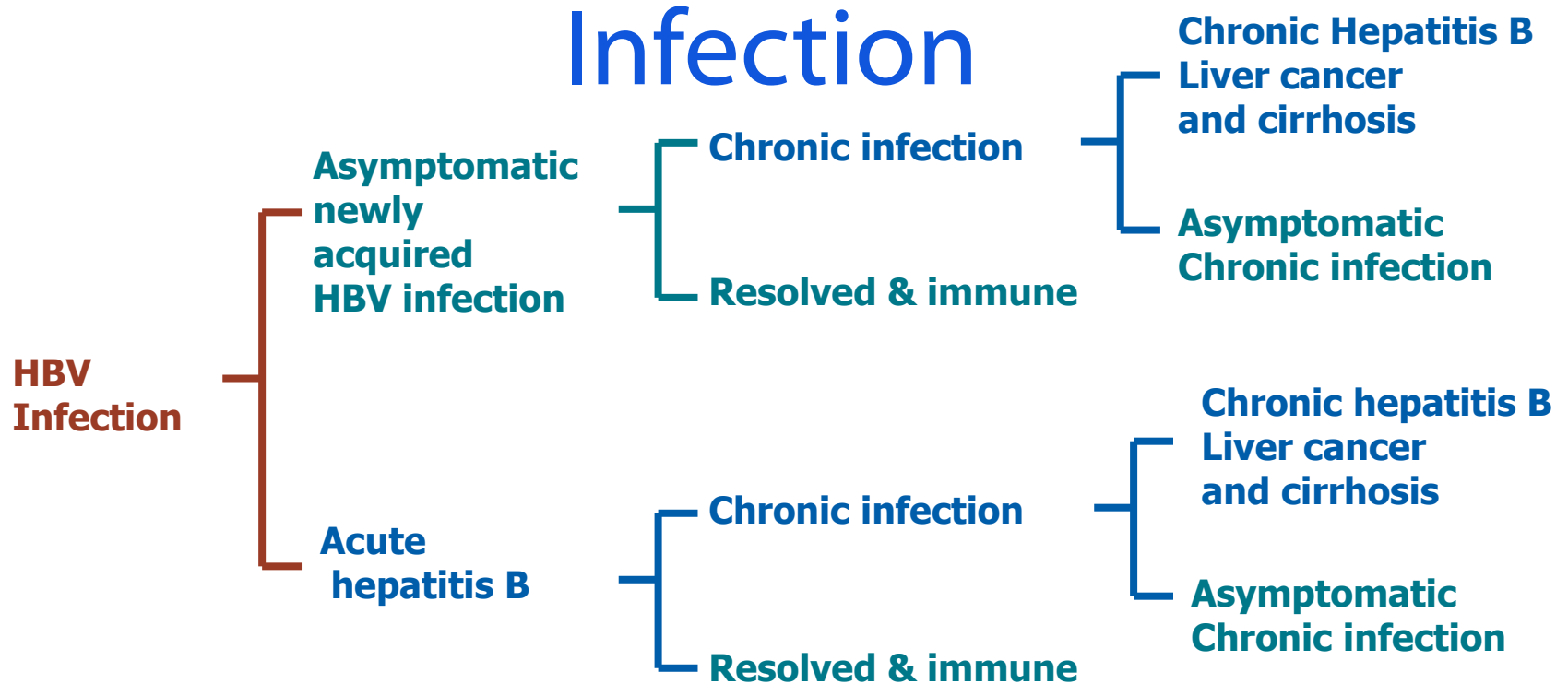
- Most children < 5 years
- Immunosuppressed adults
- 50-70% of persons \geq 5 years

Chronic Hepatitis B (CHB)

Among persons with acute hepatitis B, CHB develops in:

- 90% of infants
- 25%–50% of children 1–5 years of age
- 5% of adults

Natural History of HBV



Treatment of CHB

- **Antiviral medications**
 - E.g., entecavir, tenofovir (indefinite)
- **Treatment objectives**
 - HBeAg (-)
 - HBV DNA undetectable
 - ALT normal
 - Prevent morbidity / mortality
 - HBsAg seroclearance

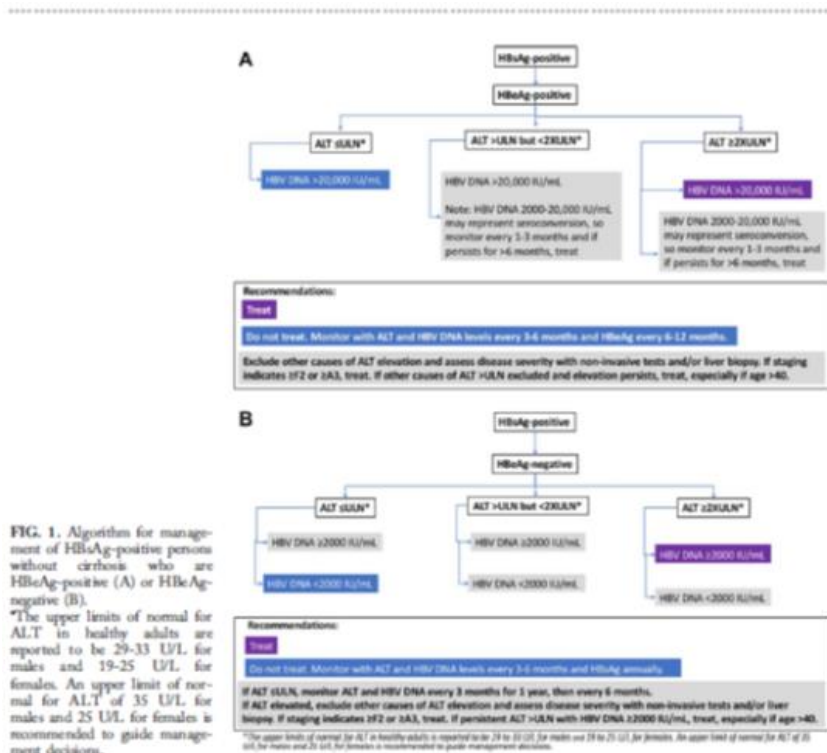


FIG. 1. Algorithm for management of HBeAg-positive persons without cirrhosis who are HBeAg-positive (A) or HBeAg-negative (B).
*The upper limits of normal for ALT in healthy adults are reported to be 29-33 U/L for males and 19-25 U/L for females. An upper limit of normal for ALT of 35 U/L for males and 25 U/L for females is recommended to guide management decisions.

Monitoring and evaluating CHB patients

- **If *not* on treatment: Should the patient be treated?**
 - ALT, HBV DNA, HBeAg
 - Evaluate for fibrosis
- **If *on* treatment: Is the patient responding to therapy?**
 - ALT, HBV DNA, HBeAg, Anti-Hbe, quantitative HBsAg
- **Patients with cirrhosis or risk factor: Has the patient developed HCC?**
 - US +/- AFP every 6 months

Terrault, *Hepatology*, 2018; 67:1560.

Perinatal, infant and childhood vaccination programs in high prevalence settings¹⁻⁴

Health impact for children and adolescents:

- Reduced the incidence of acute hepatitis B¹
- Reduced prevalence of CHB^{3,4}
- Reduced diagnoses of hepatocellular carcinoma^{2,3,5}

1 McMahon BJ, Lancet. 1987; 2 (8568): 1134-6. Doi:10.1016/s0140-6736(87)91557-1.

2 McMahon BJ, Hepatology. 2011; 54 (3): 801-7. doi:10.1002/hep.24442.

3 Ni YH, Ann Intern Med. 2001; 135 (9): 796-800. doi:10.7326/0003-4819-135-9-200111060-00009.

4 Park NH, Intervirology. 2010; 53 (1): 20-8. doi:10.1159/000252780.

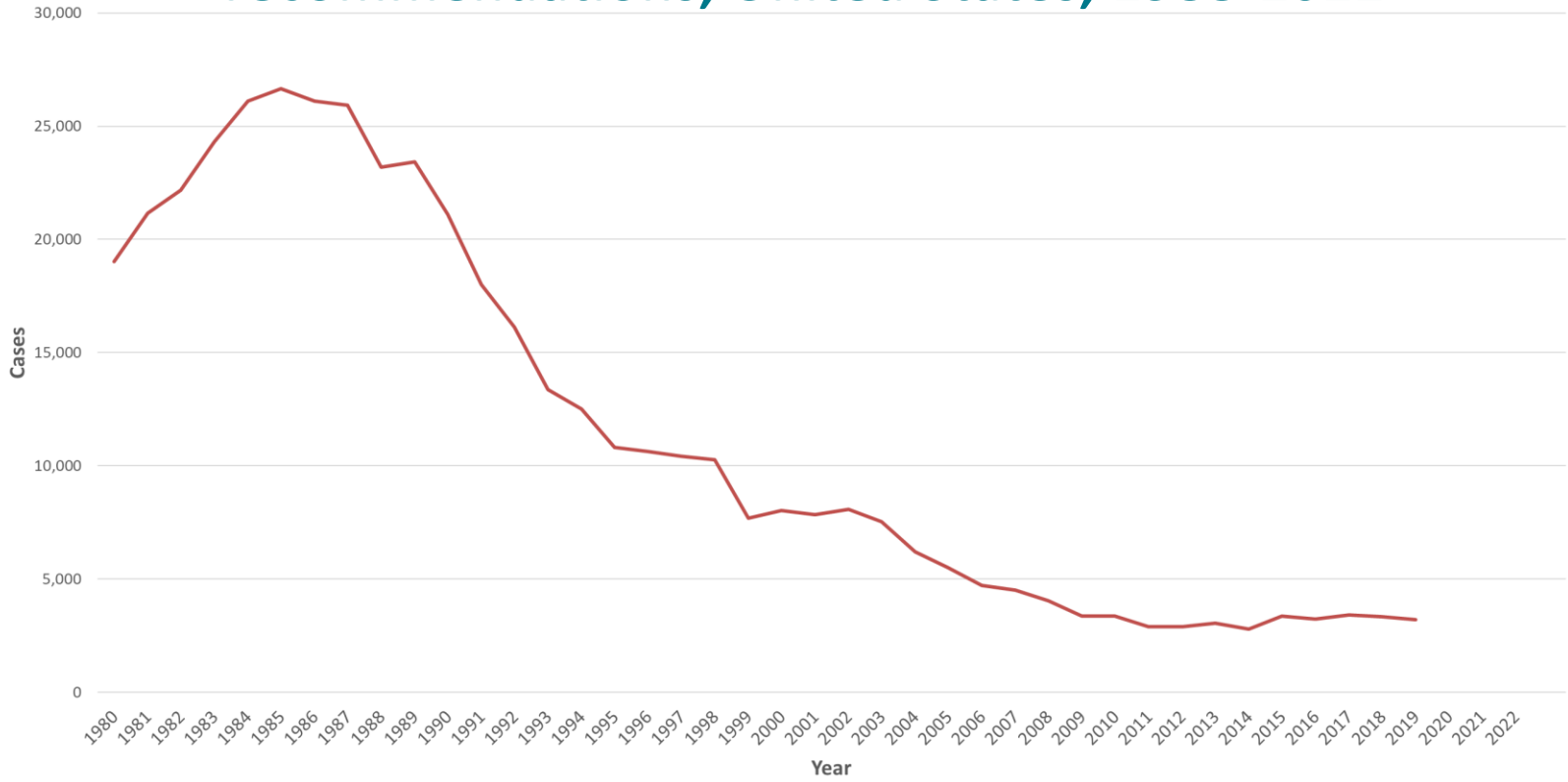
5 Chang MH, N Engl J Med. 1997; 336 (26): 1855-9. doi:10.1056/nejm199706263362602.



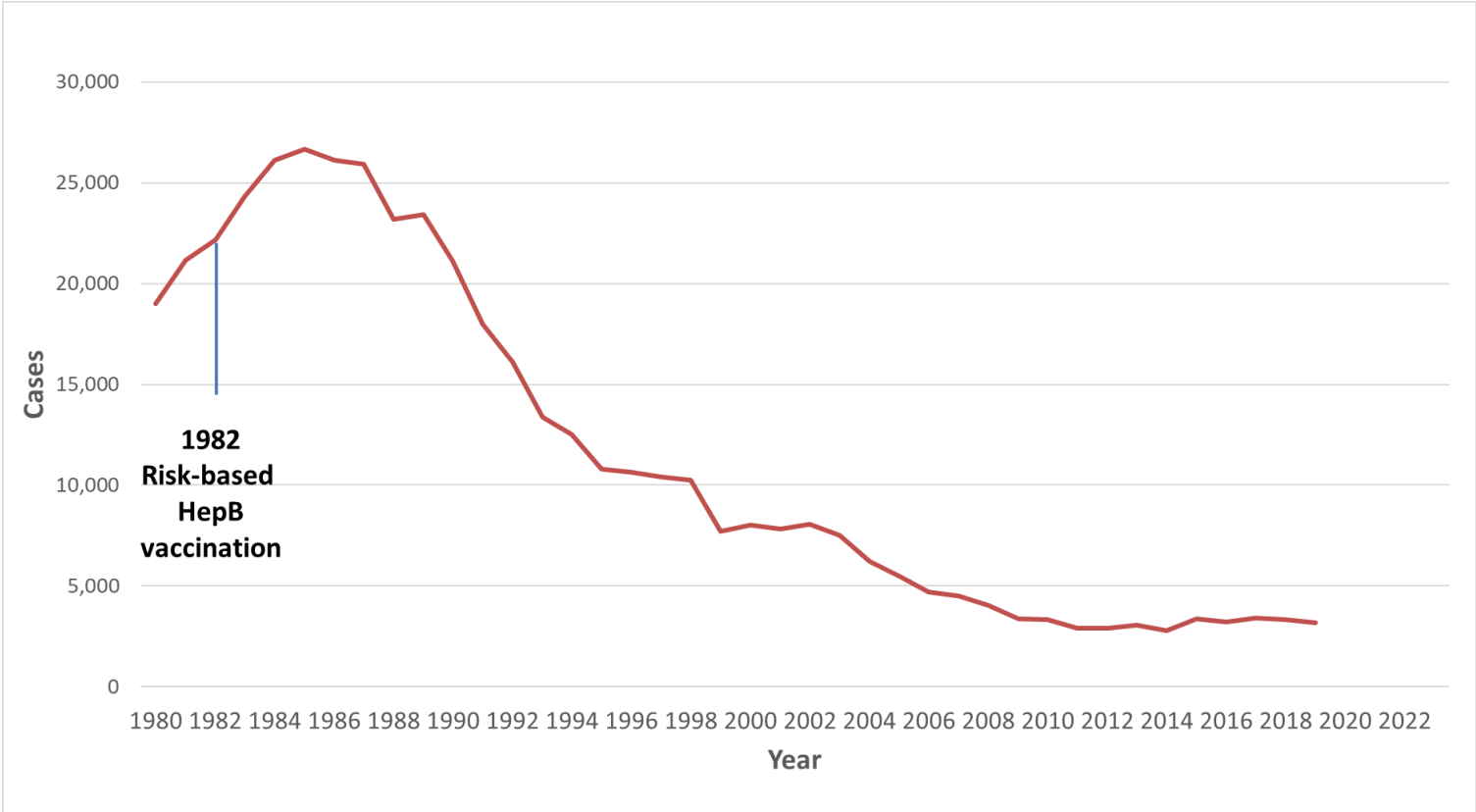
Progress related to vaccination

1980-2019

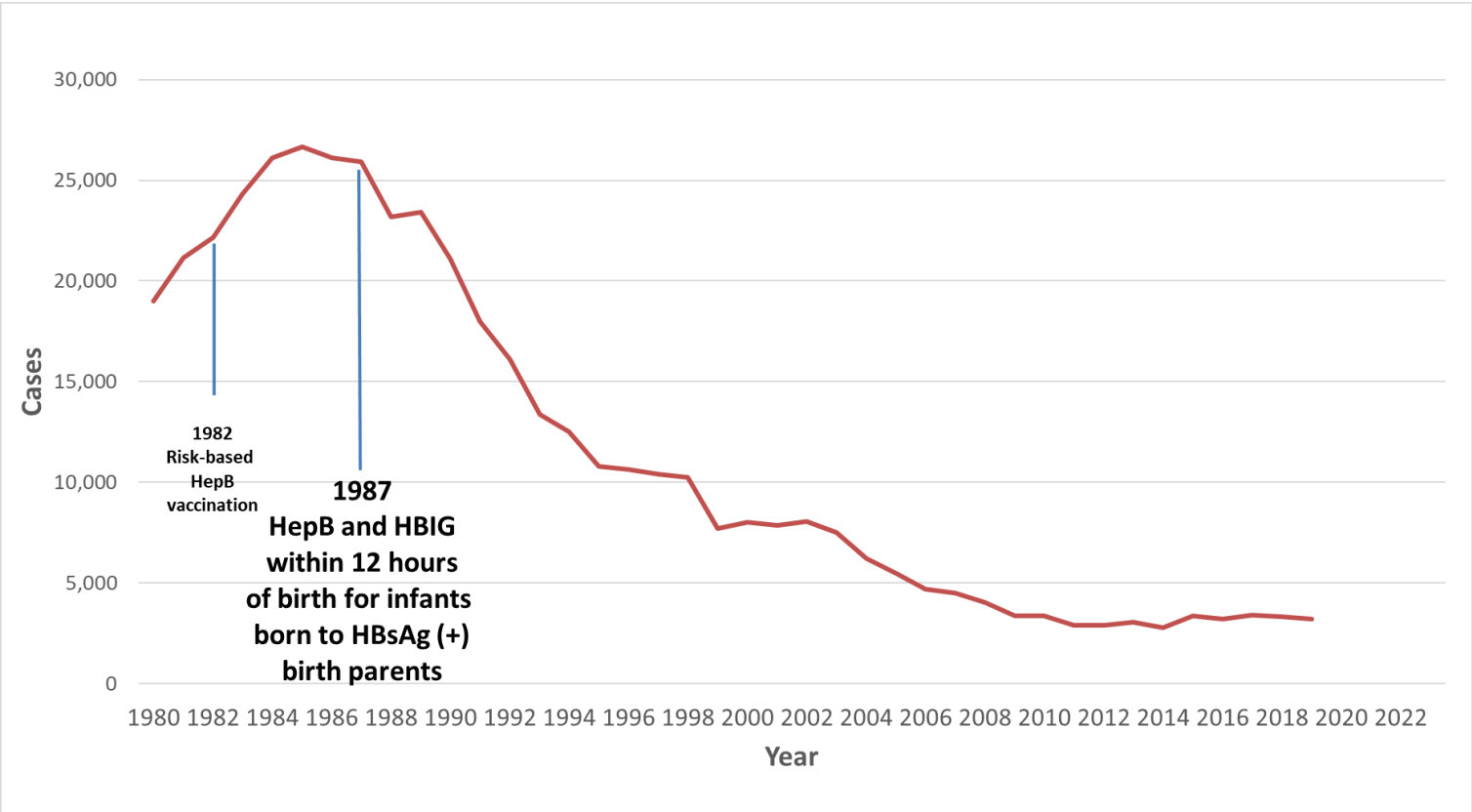
Reported cases of acute hepatitis B and key CDC HepB vaccine recommendations, United States, 1988-2022



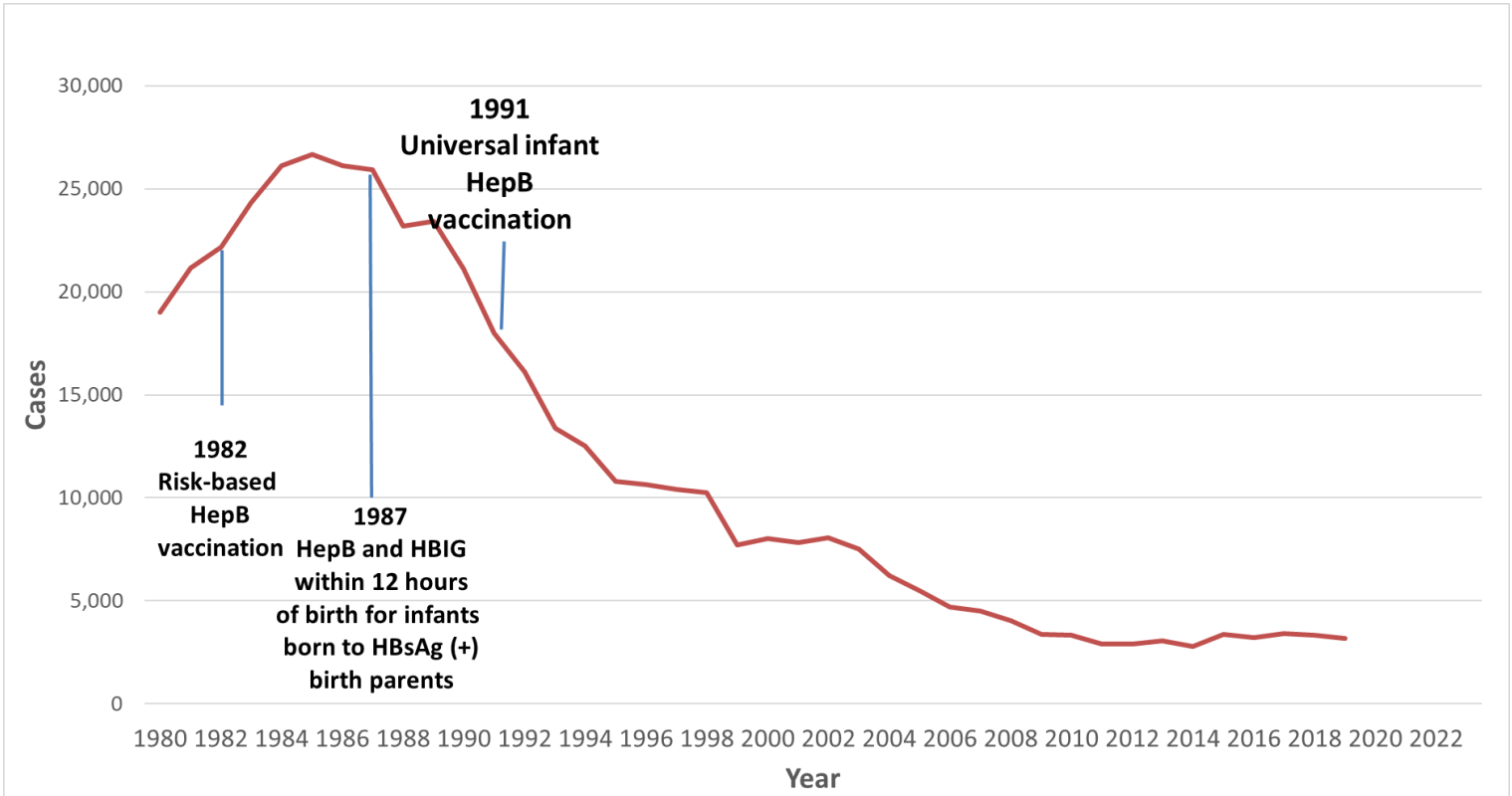
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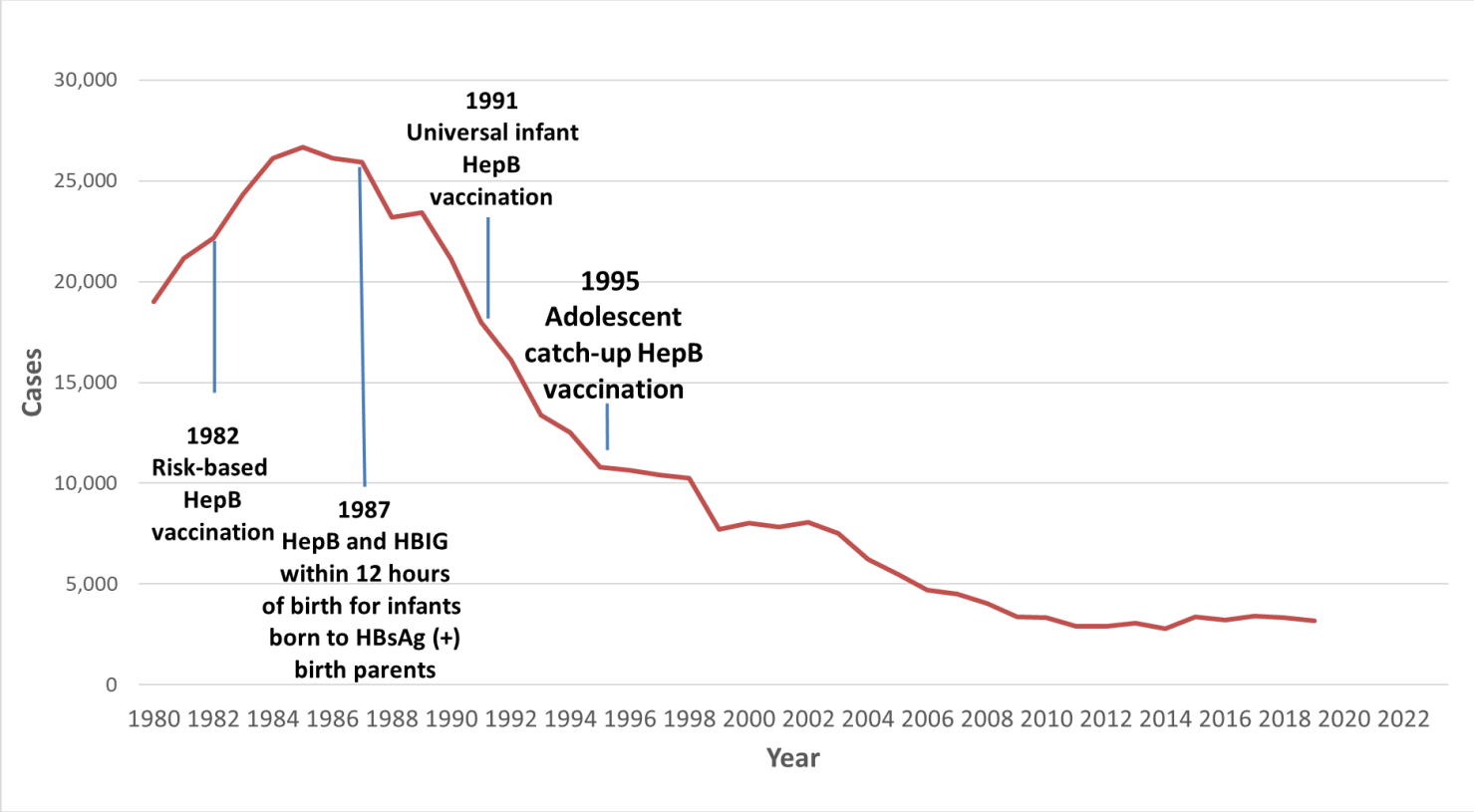
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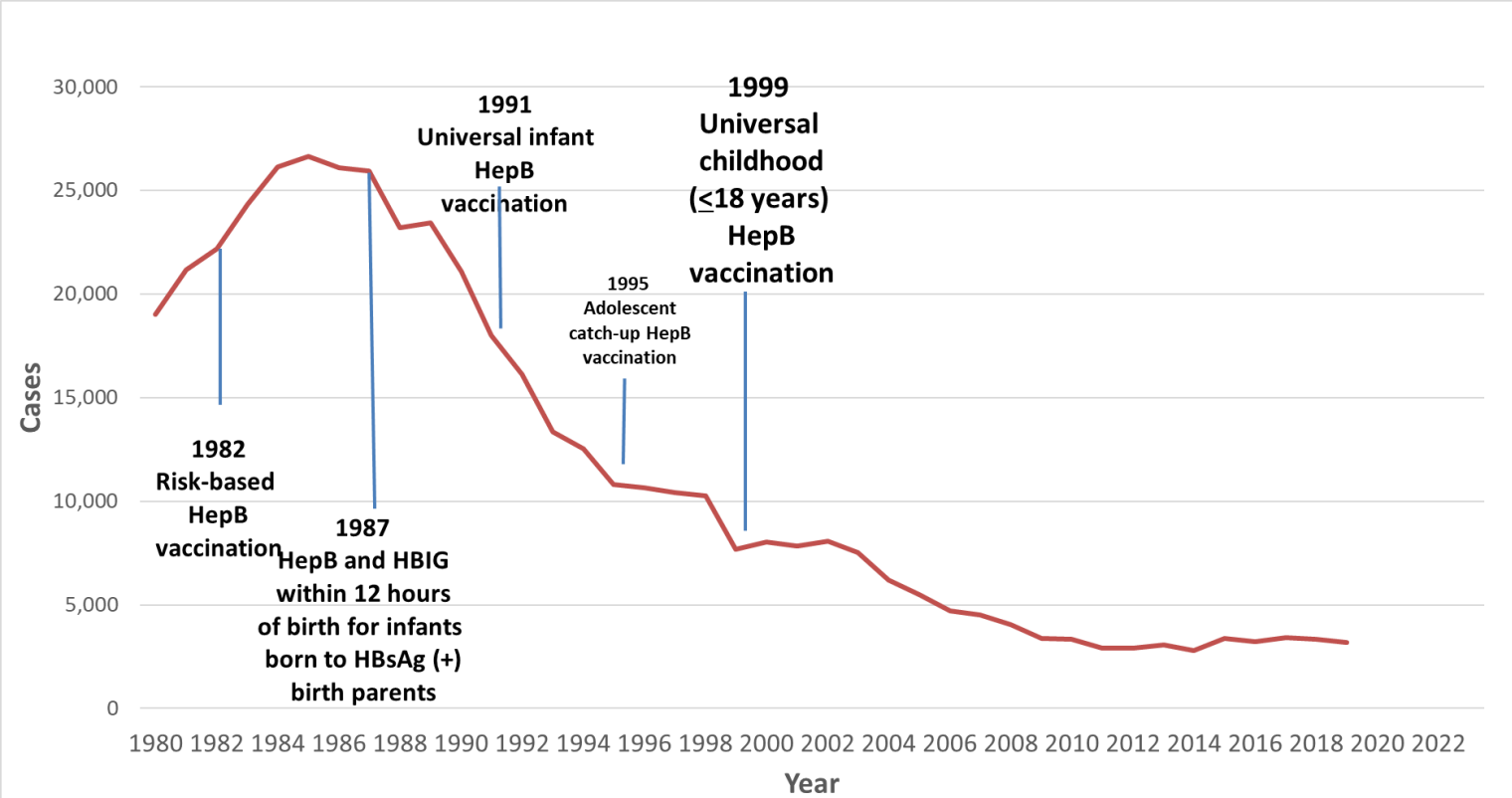
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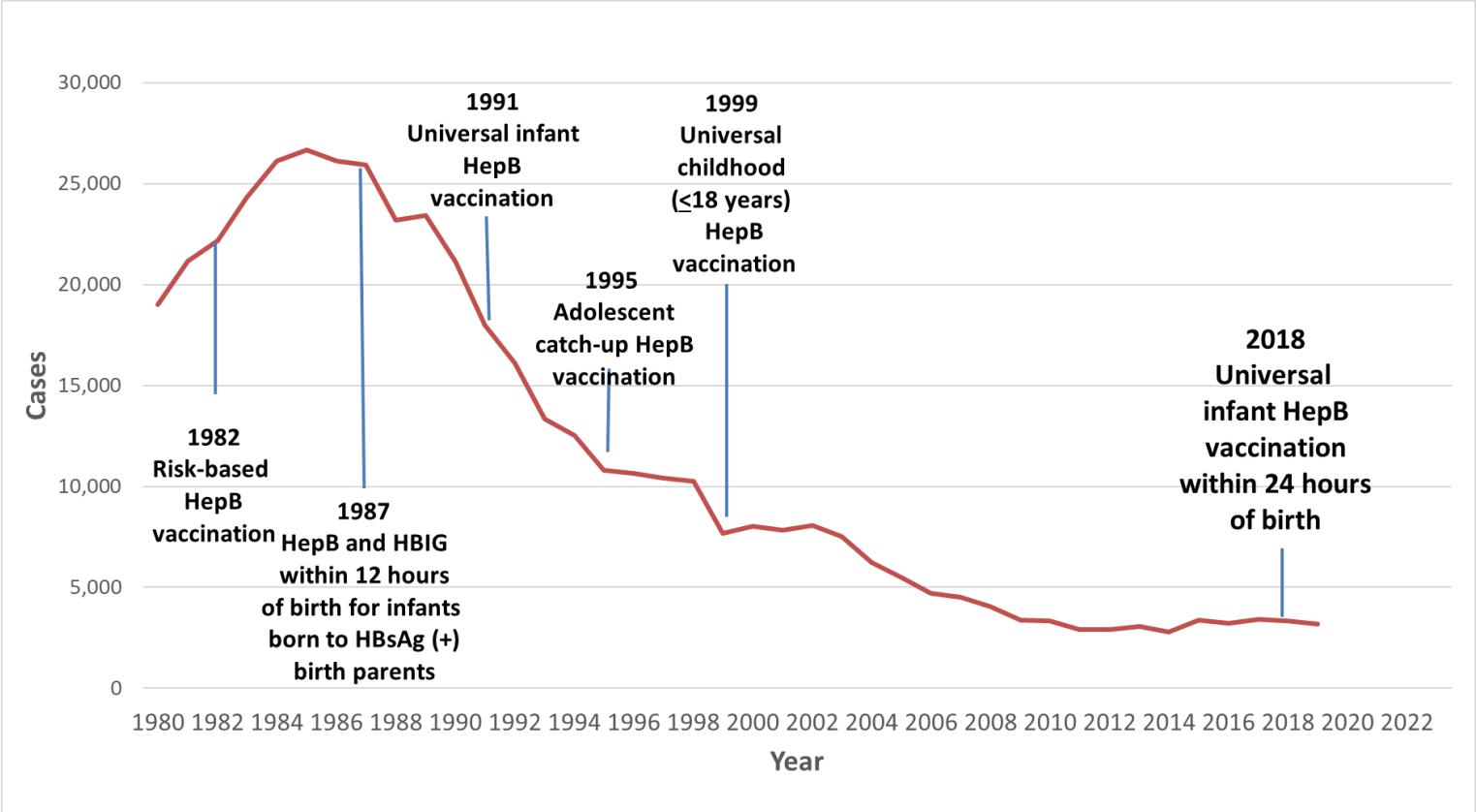
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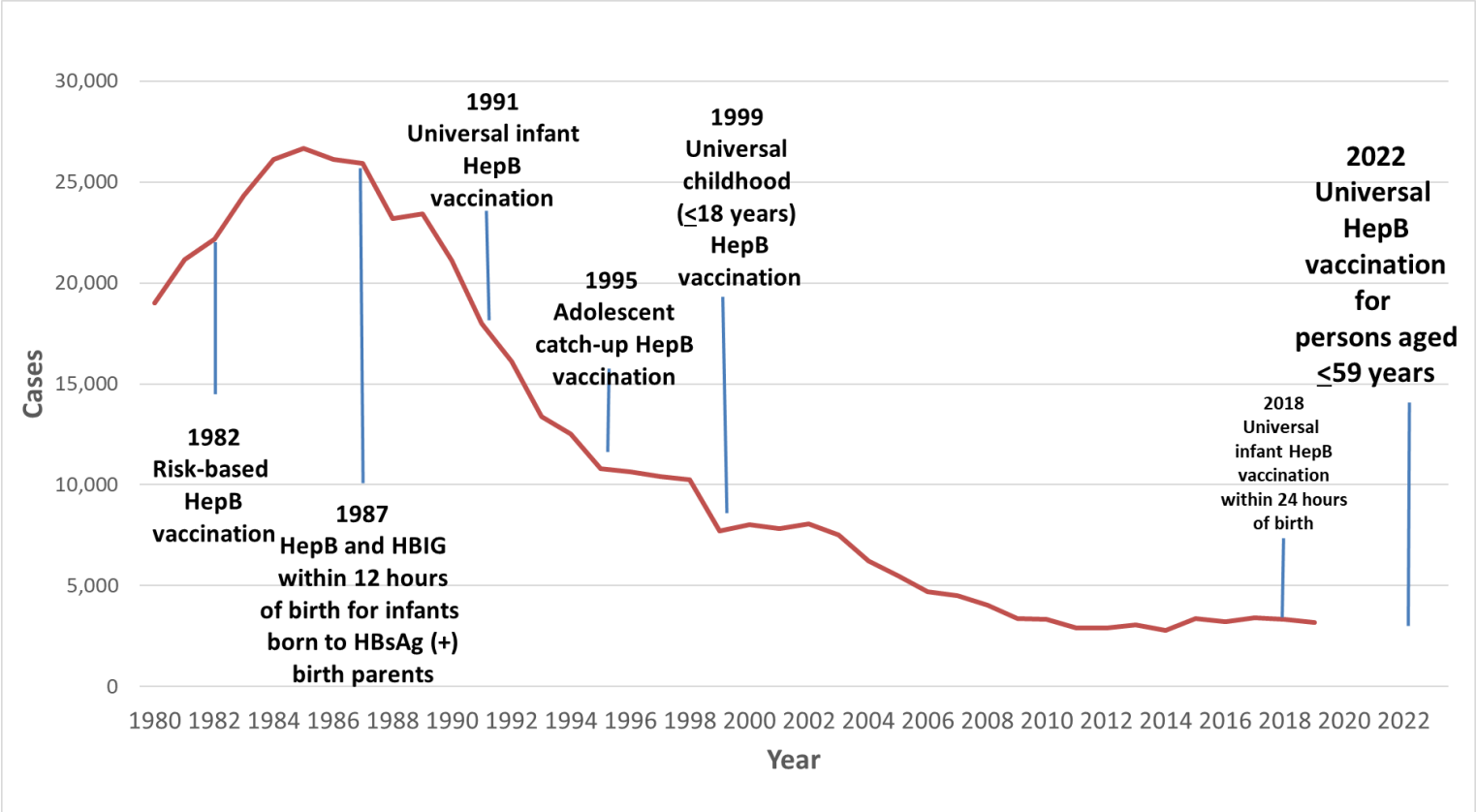
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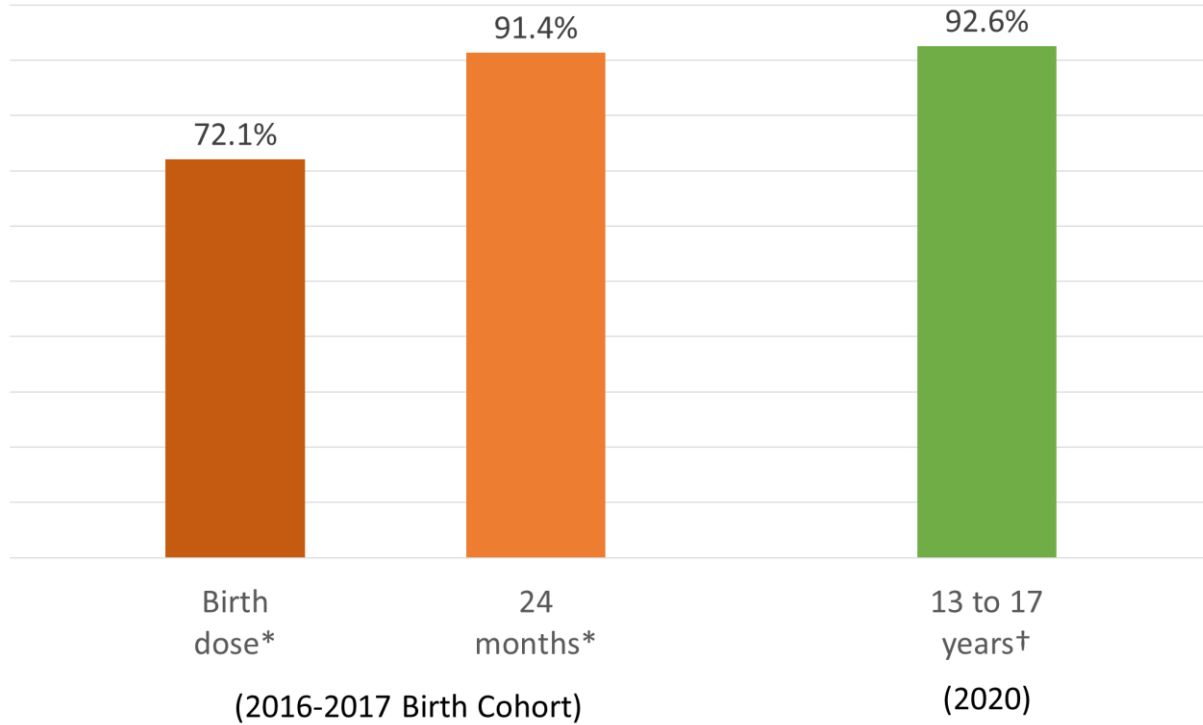
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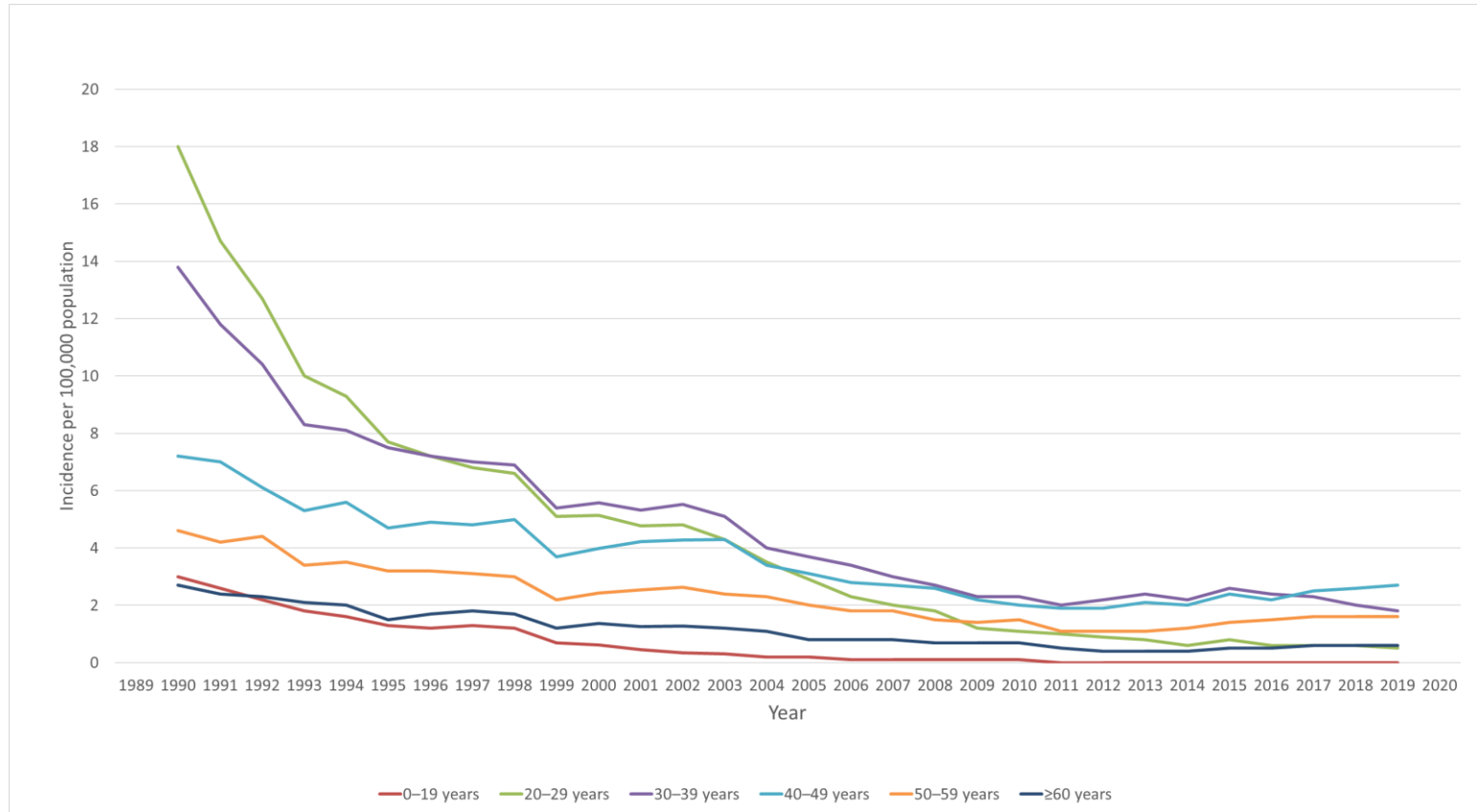
Infant, Childhood and Adolescent Hepatitis B Vaccination Rates



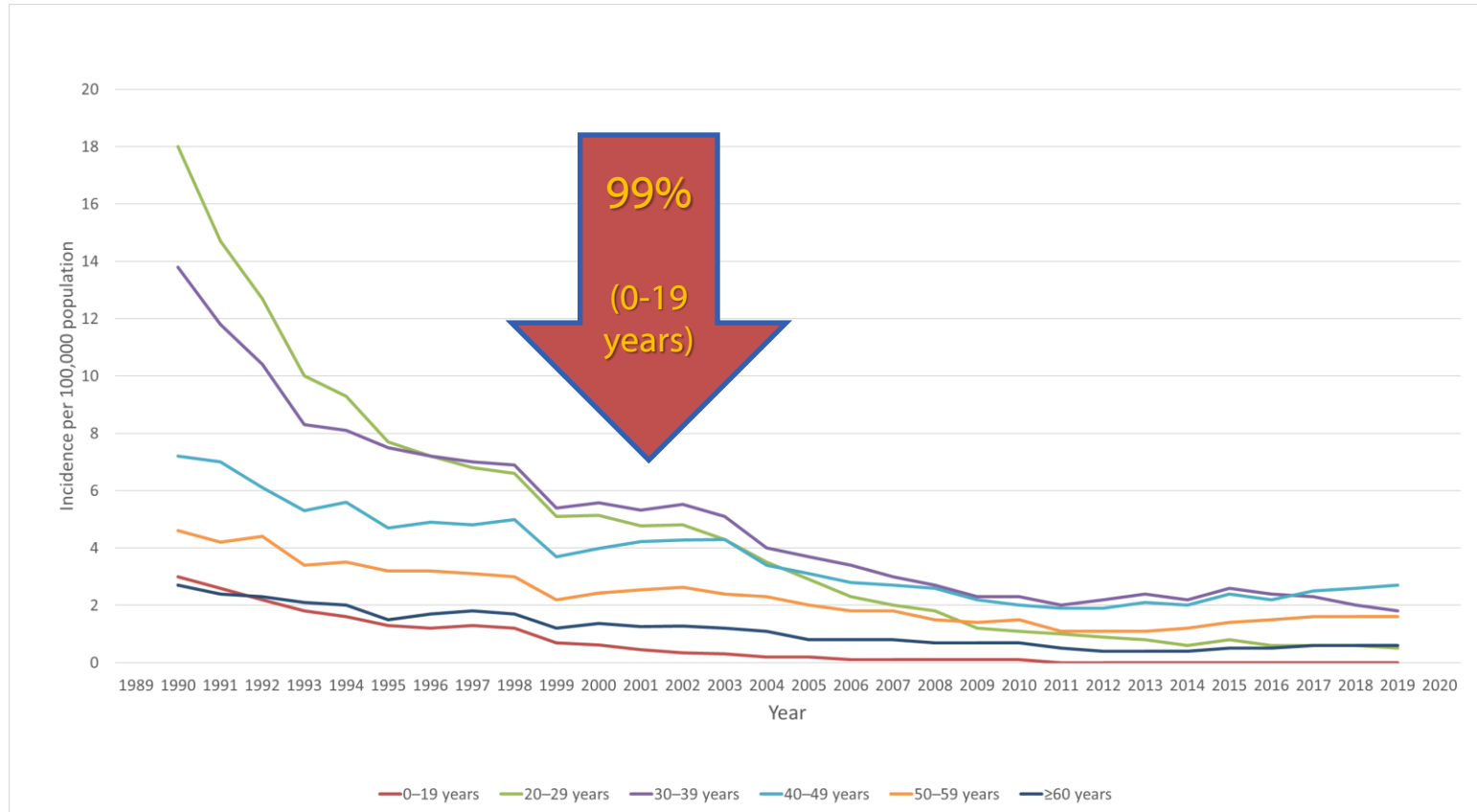
*Hill HA, *MMWR Morb Mortal Wkly Rep.* 2020; 69, no. 42: 1505-11. <https://dx.doi.org/10.15585/mmwr.mm6942a1>.

†Pingali C. *MMWR Morb Mortal Wkly Rep* 2021; 70: 1183-90. <https://dx.doi.org/10.15585/mmwr.mm7035a1>²¹

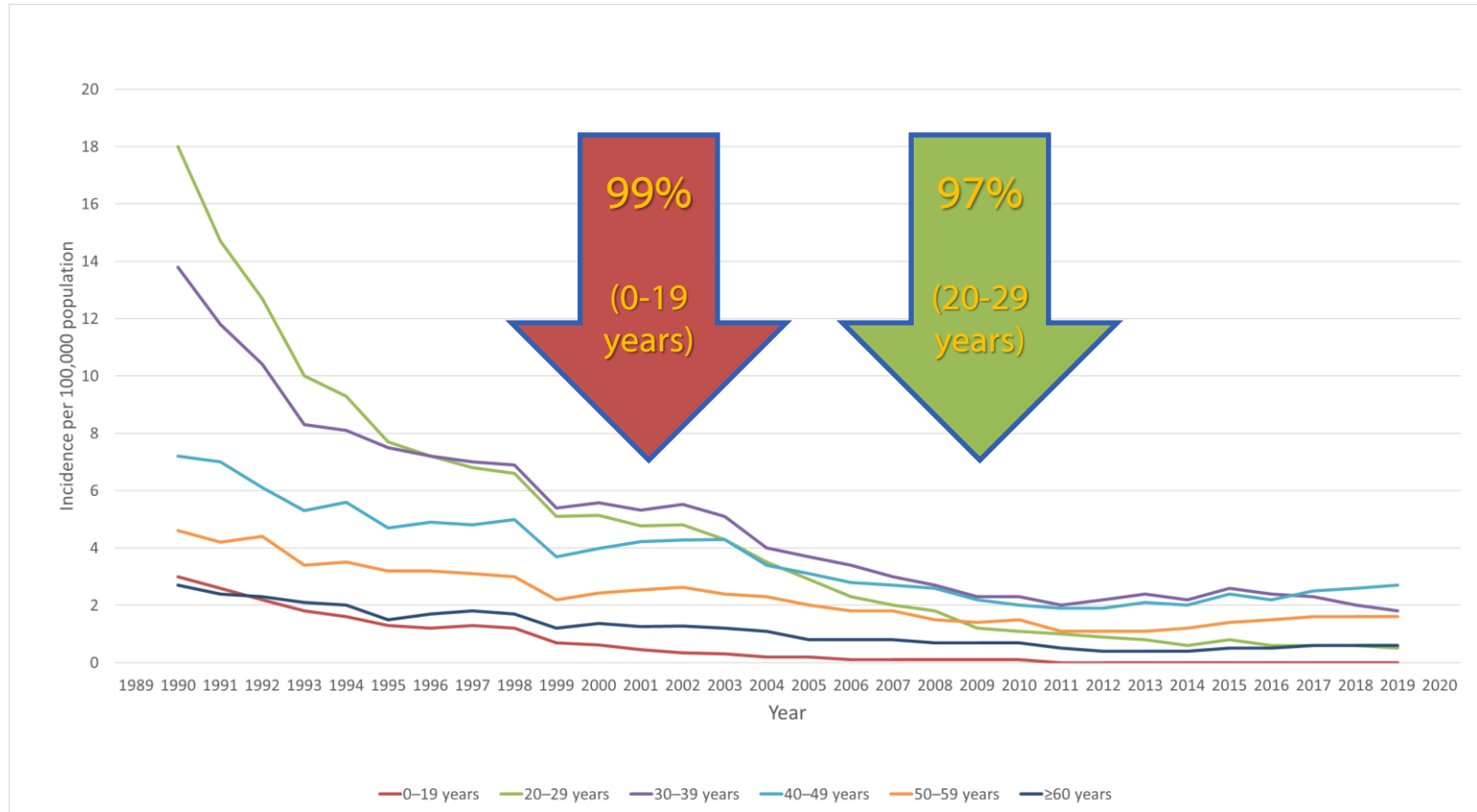
Age-specific incidence of acute hepatitis B, United States, 1990-2019



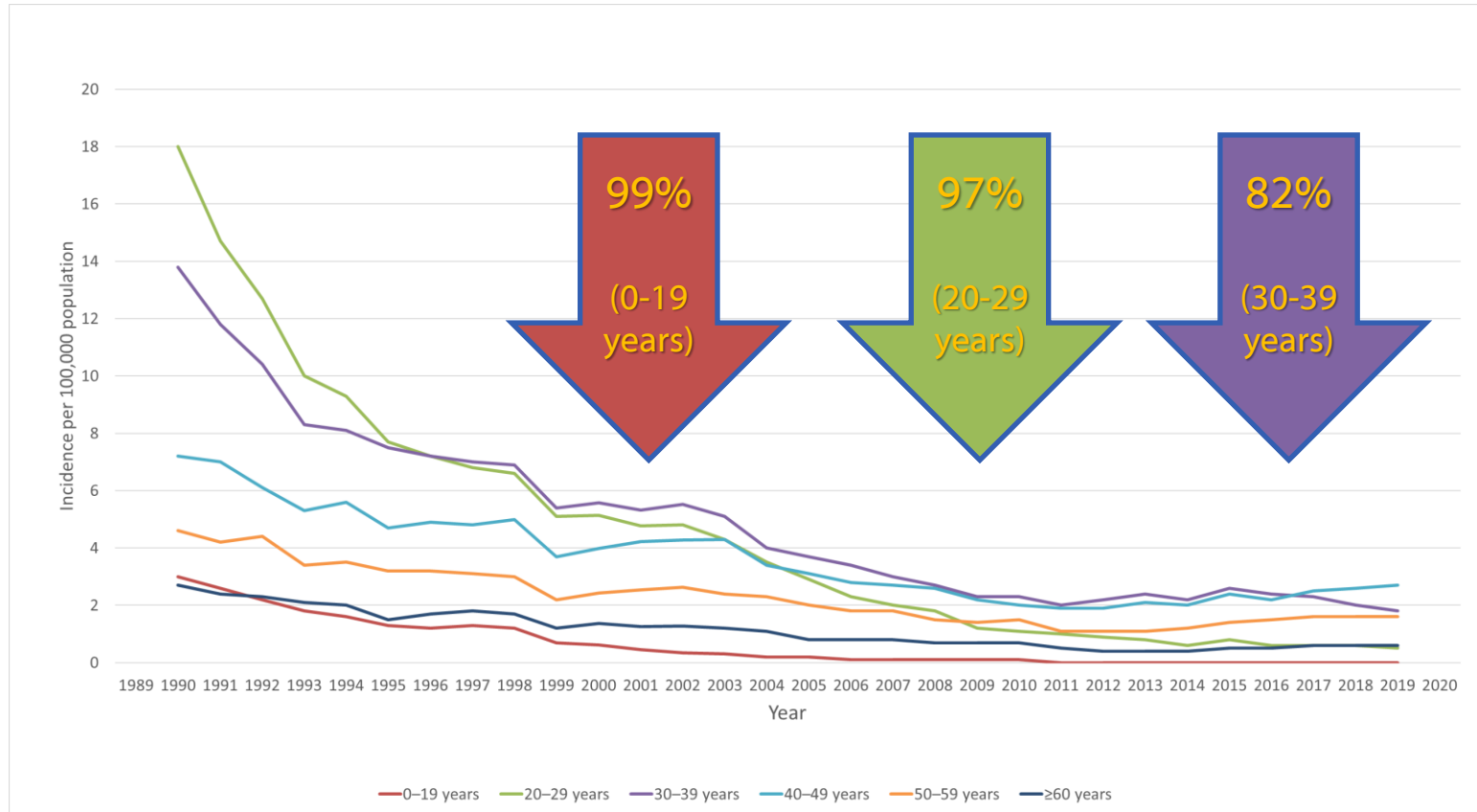
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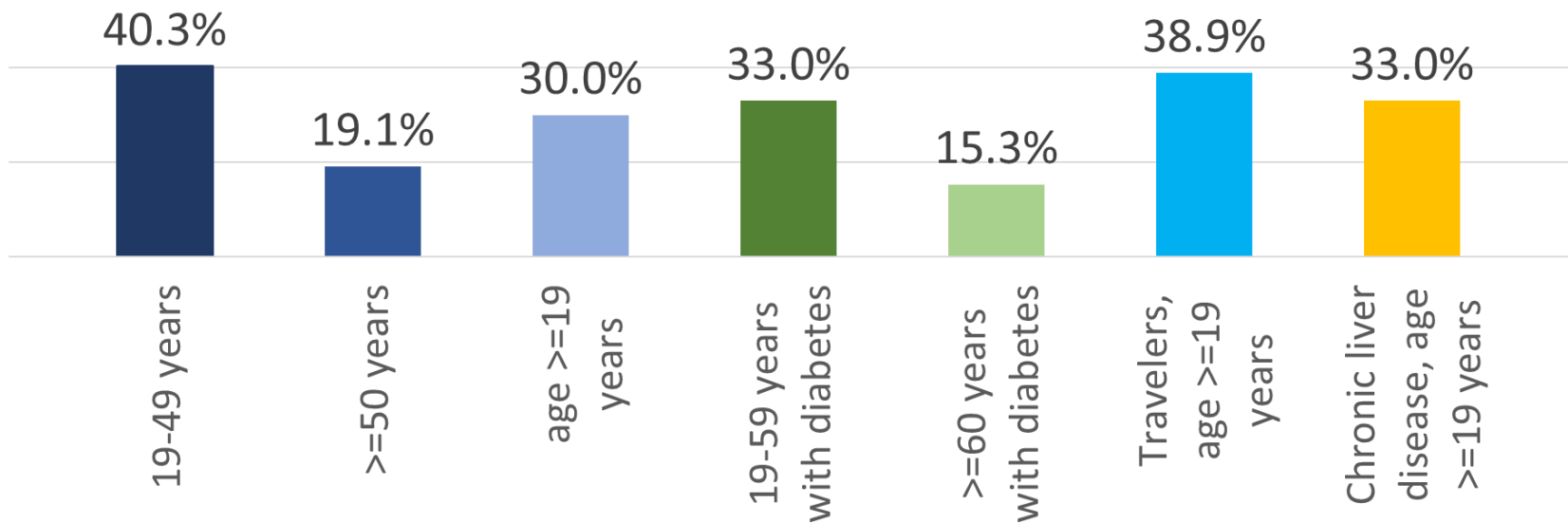
Age-specific incidence of acute hepatitis B, United States, 1990-2019



Age-specific incidence of acute hepatitis B, United States, 1990-2019



Adult Hepatitis B Vaccination Rates, 2018





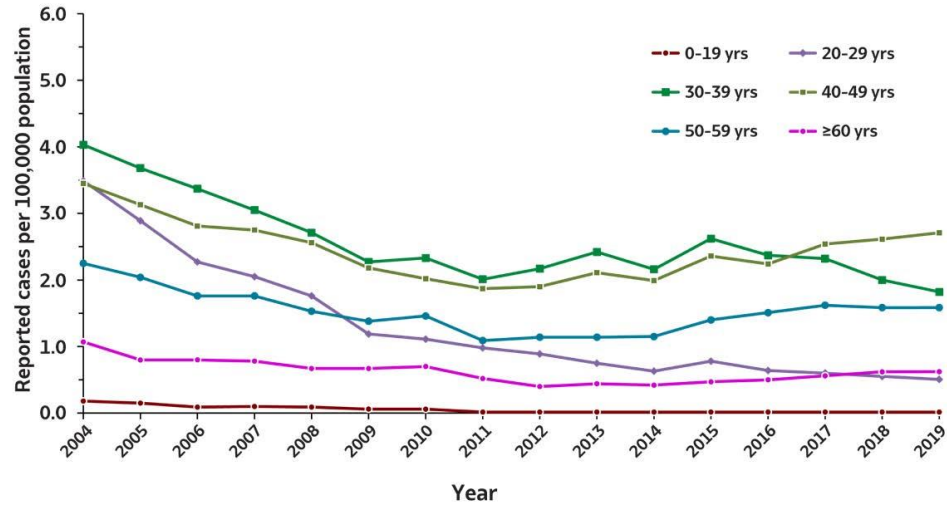
Unfinished Business

Acute hepatitis B

Acute Hepatitis B Surveillance through the Nationally Notifiable Disease Surveillance System (NNDSS)

- Standard case definition for acute hepatitis B
- Counts and incidence per 100,000 population
- Limitations:
 - Undercounts cases by a factor of 6.5
 - Missing data, especially for risk behaviors

Figure 2.4. Rates of reported acute hepatitis B virus infection, by age group — United States, 2004–2019



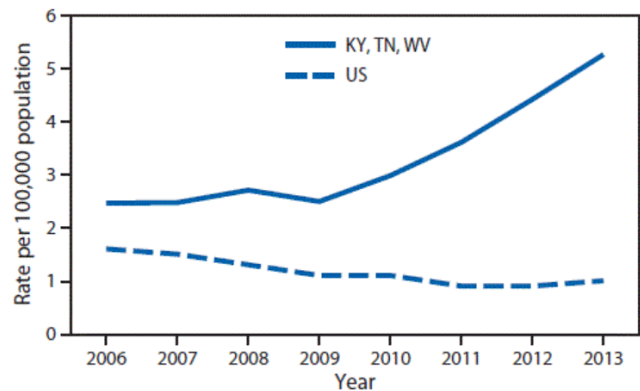
Age (years)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
0–19	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0	0
20–29	3.5	2.9	2.3	2.0	1.8	1.2	1.1	1.0	0.9	0.8	0.6	0.8	0.6	0.6	0.6	0.5
30–39	4.0	3.7	3.4	3.0	2.7	2.3	2.3	2.0	2.2	2.4	2.2	2.6	2.4	2.3	2.0	1.8
40–49	3.4	3.1	2.8	2.7	2.6	2.2	2.0	1.9	1.9	2.1	2.0	2.4	2.2	2.5	2.6	2.7
50–59	2.3	2.0	1.8	1.8	1.5	1.4	1.5	1.1	1.1	1.1	1.2	1.4	1.5	1.6	1.6	1.6
≥60	1.1	0.8	0.8	0.8	0.7	0.7	0.7	0.5	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6

Source: CDC, National Notifiable Diseases Surveillance System.

Increases in Acute Hepatitis B Virus Infections — Kentucky, Tennessee, and West Virginia, 2006–2013

Weekly / January 29, 2016 / 65(3);47–50

Aaron M. Harris, MD¹; Kashif Iqbal, MPH¹; Sarah Schillie, MD¹; James Britton²; Marion A. Kainer, MBBS³; Stacy Tressler, MPH⁴; Claudia Vellozzi, MD¹ (View author affiliations)



Abbreviations: KY = Kentucky; TN = Tennessee; US = United States; WV = West Virginia;

Acute Hepatitis B Virus Incidence Rates, West Virginia, 2016–2020

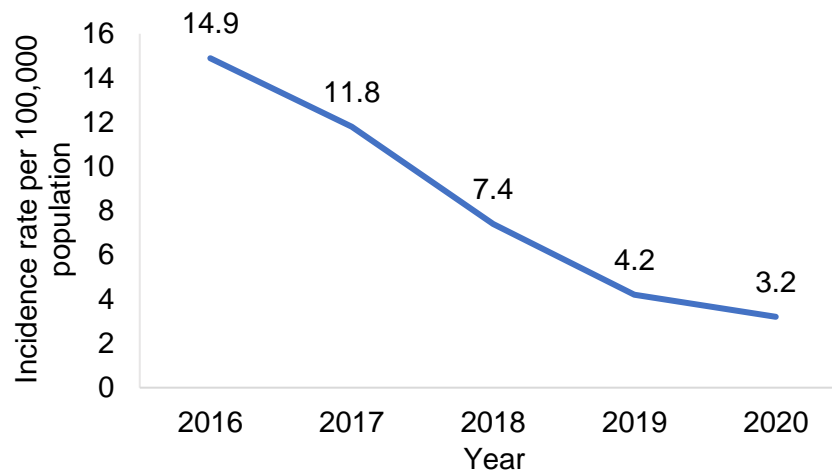




Table 2.3. Reported risk behaviors or exposures*† among reported cases of acute hepatitis B virus infection — United States, 2019

Risk behaviors/exposures	Risk identified*	No risk identified	Risk data missing
Injection drug use	631	1,149	1,412
Multiple sexual partners	241	801	2,150
Surgery	120	1,139	1,933
Sexual contact §	92	807	2,293
Needlestick	73	1,121	1,998
Men who have sex with men ¶	79	374	1,568
Household contact (non-sexual) §	17	882	2,293
Dialysis patient	34	1,258	1,900
Occupational	2	1,536	1,654
Transfusion	4	1,269	1,919

Source: CDC, Nationally Notifiable Diseases Surveillance System.

* Casereports with at least one of the following risk behaviors/exposures reported 6 weeks to 6 months prior to symptom onset or documented seroconversion if asymptomatic: 1) injection drug use; 2) multiple sexual partners; 3) underwent surgery; 4) men who have sex with men; 5) sexual contact with suspected/confirmed hepatitis B case; 6) sustained a percutaneous injury; 7) household contact with suspected/confirmed hepatitis B case; 8) occupational exposure to blood; 9) dialysis; and 10) transfusion. Reported cases may include more than one risk behavior/exposure.

† Risk behaviors/exposures data from one state was classified as 'missing' because of errors in reporting.

§ Cases with more than one type of contact reported were categorized according to a hierarchy: (1) sexual contact; (2) household contact (nonsexual).

¶ A total of 2,471 acute hepatitis C cases were reported among males in 2019.

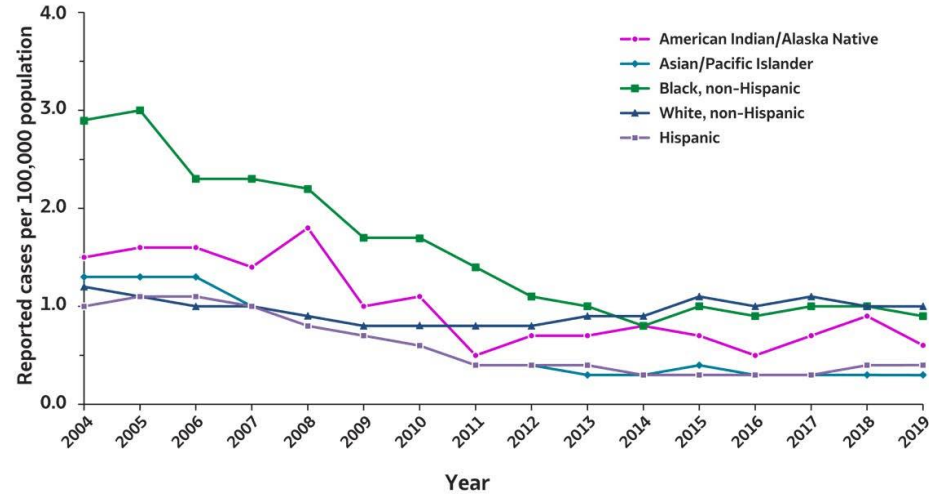
Reported Risk Behaviors or Exposures* among Acute Hepatitis B Cases, West Virginia, 2020

Risk Factor	Yes	No	Unknown
Injection Drug Use	48%	32%	20%
Non-Injection Drug Use	55%	34%	11%
Tattoos	23%	43%	34%
Past STI Treatment**	13%	43%	45%

*Cases may report more than one risk behavior/exposure

**STI=sexually transmitted infection

Figure 2.6. Rates of reported acute hepatitis B virus infections, by race/ethnicity — United States, 2004–2019



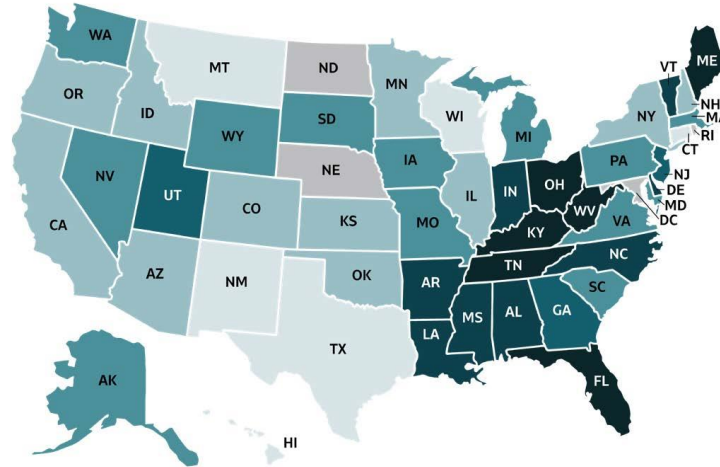
Race/Ethnicity	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
American Indian/ Alaska Native	1.5	1.6	1.5	1.4	1.8	1.0	1.1	0.5	0.7	0.7	0.8	0.7	0.5	0.7	0.9	0.6
Asian/Pacific Islander	1.3	1.3	1.2	0.9	0.8	0.7	0.6	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.3
Black, non-Hispanic	2.9	3.0	2.3	2.3	2.2	1.7	1.7	1.4	1.1	0.9	0.8	1.0	0.9	1.0	1.0	0.9
White, non-Hispanic	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.9	0.9	1.1	1.0	1.1	1.0	1.0
Hispanic	1.0	1.1	1.1	1.0	0.8	0.7	0.6	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.4

Source: CDC, National Notifiable Diseases Surveillance System.

Acute Hepatitis B by Race and Ethnicity, West Virginia, 2020

Race	Count	Percent*
White	49	88%
Black	1	2%
Other	1	2%
Unknown	5	9%
Ethnicity	Count	Percent
Not Hispanic or Latino	47	84%
Hispanic or Latino	0	0%
Unknown	9	16%
Total	56	100%

Figure 2.3. Rates of reported acute hepatitis B virus infection, by state or jurisdiction — United States, 2019



Color Key	Cases/10 0,000 Population	State or Jurisdiction
(Lightest blue)	0.0-0.2	CT, HI, MT, NM, TX, WI
(Light blue)	0.3-0.4	AZ, CA, CO, ID, IL, KS, MN, NH, NY, OK, OR
(Medium-light blue)	0.5-0.8	AK, IA, MA, MD, MI, MO, NV, PA, SC, SD, VA, WA, WY
(Medium blue)	0.9-1.1	GA, NJ, UT
(Dark blue)	1.2-2.5	AL, AR, DE, IN, LA, MS, NC, VT
(Darkest blue/black)	National Health and Medical Research Council	FL, KY, ME, OH, TN, WV
(Grey)	Data not available	DC, ND, NE, RI



Unfinished Business

Chronic hepatitis B



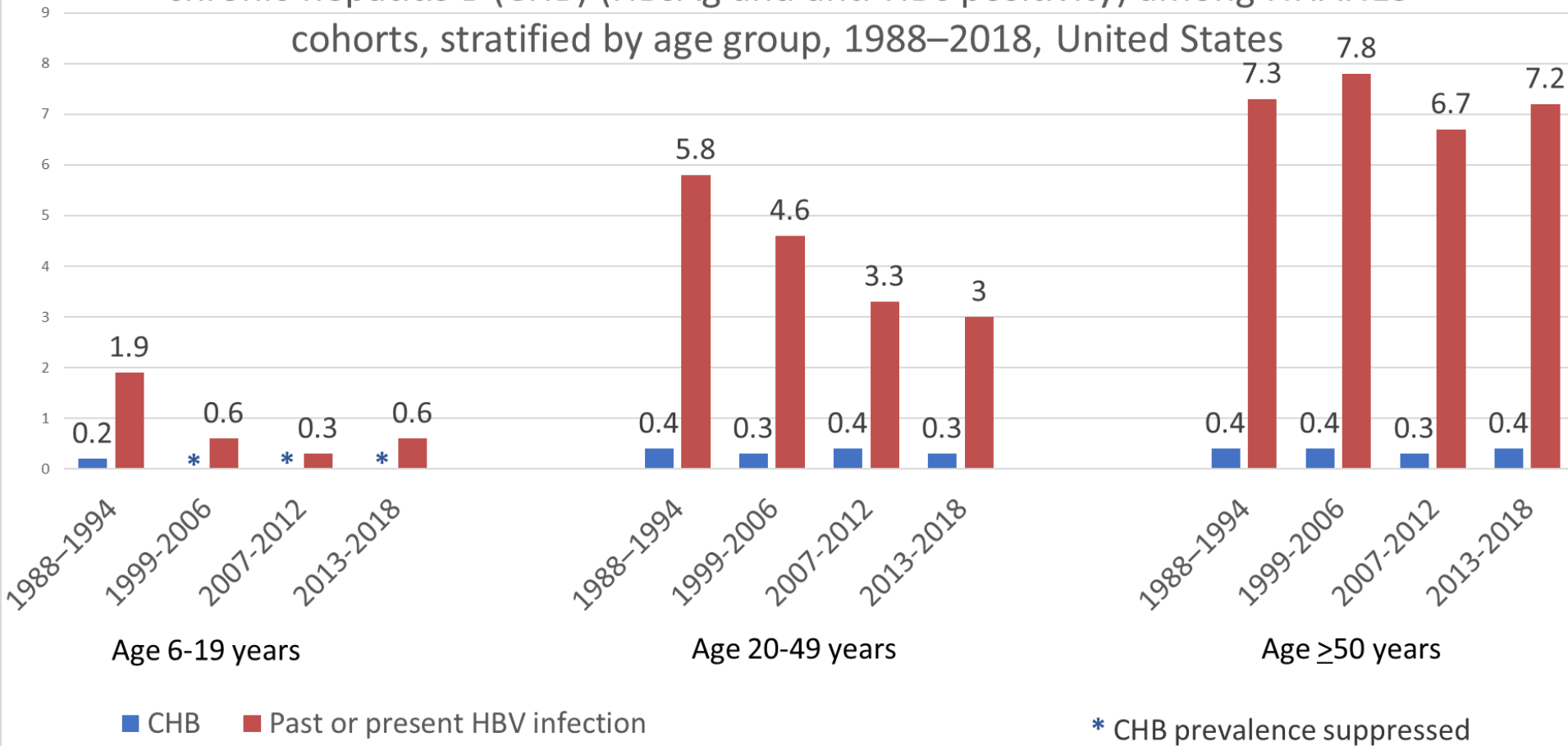
Sources of data for chronic hepatitis B (CHB)

- CHB - National Health and Nutrition Examination Survey (NHANES)
 - Probability sample of the US population + testing for HBV
- Mortality - Multiple Cause of Death (MCOB) files
 - Death certificates + diagnosis of hepatitis B
- HCC - Surveillance Epidemiology and End Results-Medicare (SEER-Medicare)
 - Cancer registries linked to Medicare data with diagnosis code for hepatitis B
- Liver transplantation - United Network for Organ Sharing/ Organ Procurement and Transplantation Network (UNOS)
 - Liver recipient with a diagnosis of hepatitis B

Sources of data for chronic hepatitis B (CHB)

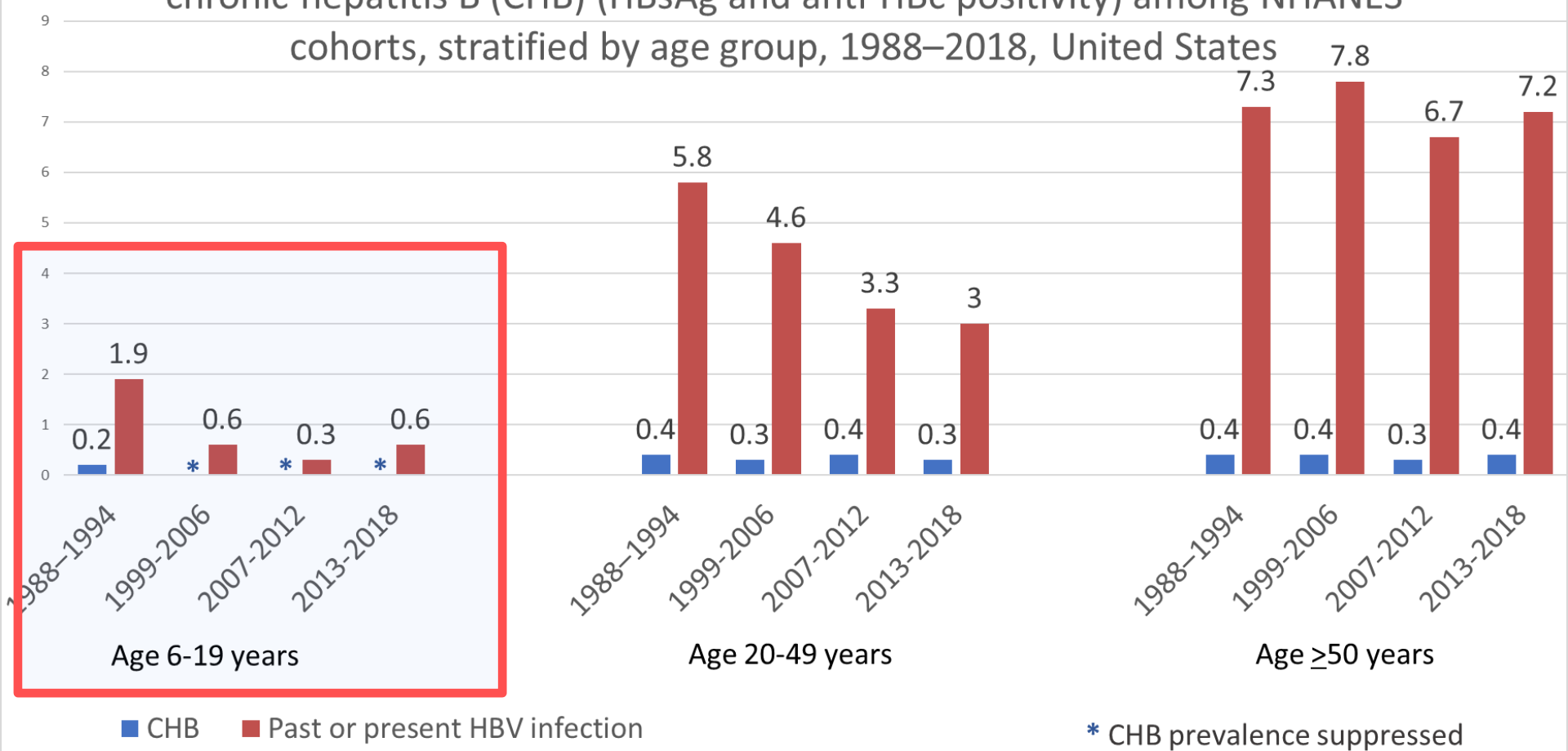
- CHB - National Health and Nutrition Examination Survey (NHANES)
 - Probability sample of the US population + testing for HBV
 - Measures prevalence of:
 - Anti-HBc (total) – past or present hepatitis B
 - HBsAg – chronic hepatitis B (CHB)

Prevalence (%) of past or present (anti-HBc positivity) HBV infection and chronic hepatitis B (CHB) (HBsAg and anti-HBc positivity) among NHANES cohorts, stratified by age group, 1988–2018, United States



* CHB prevalence suppressed

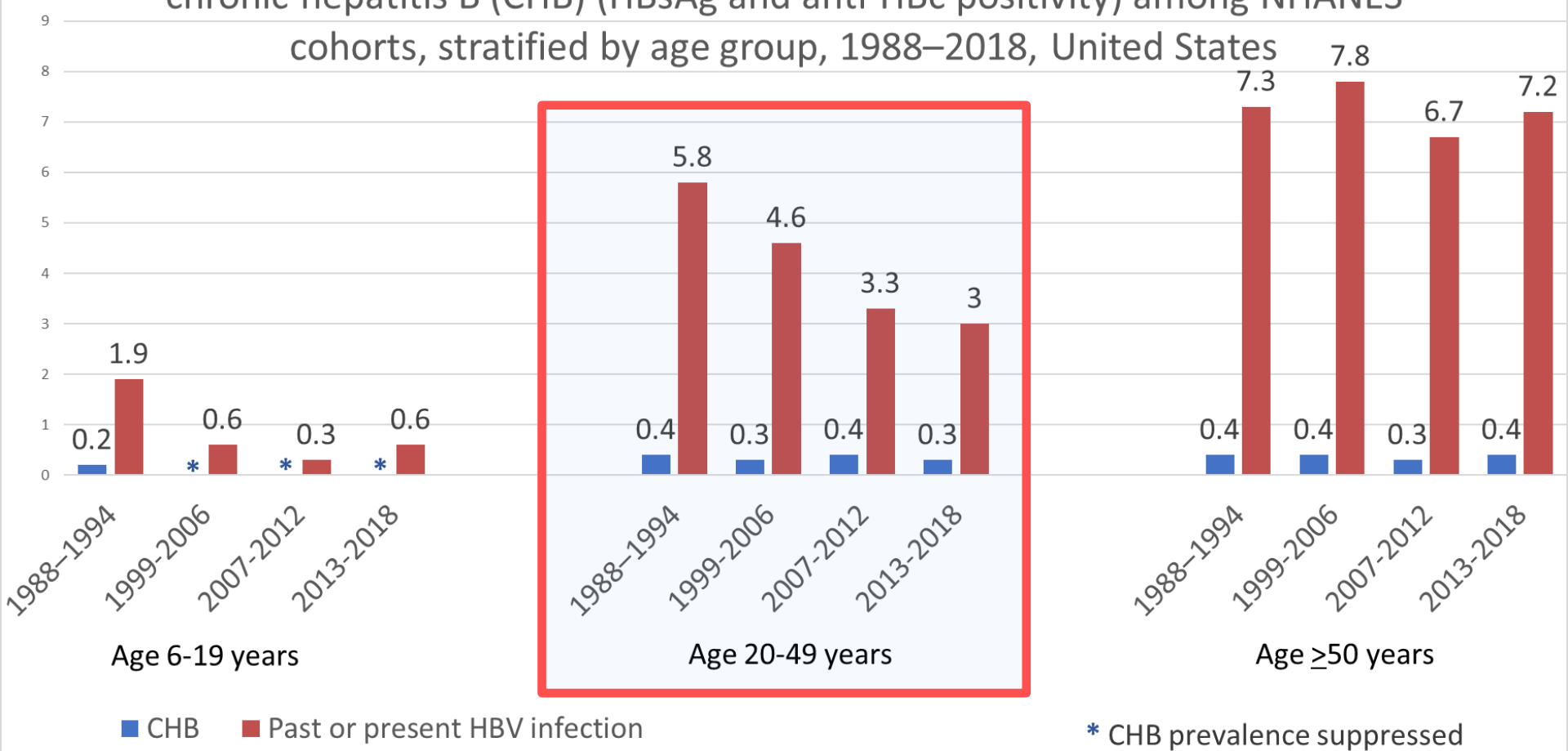
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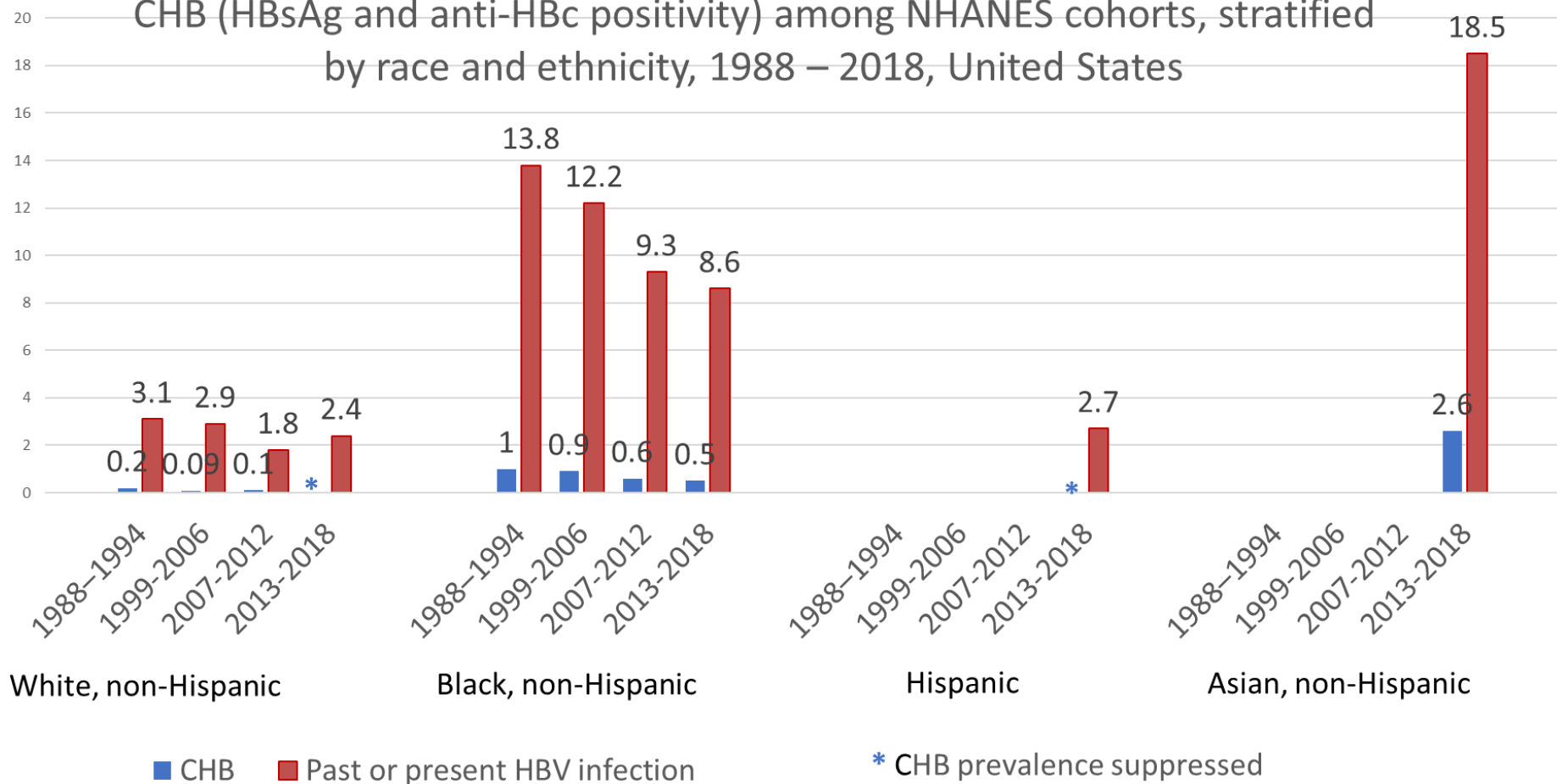
■ CHB ■ Past or present HBV infection

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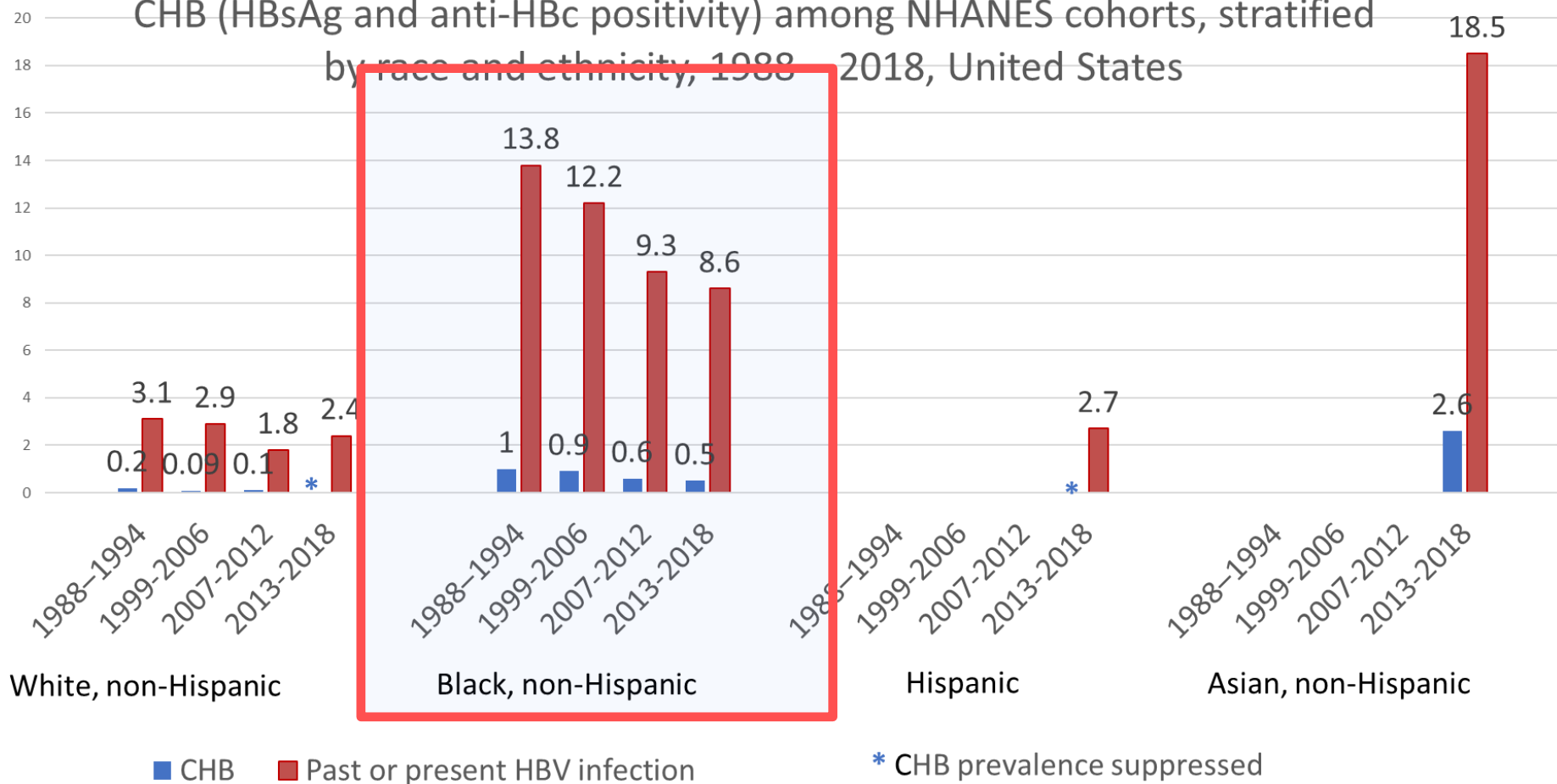
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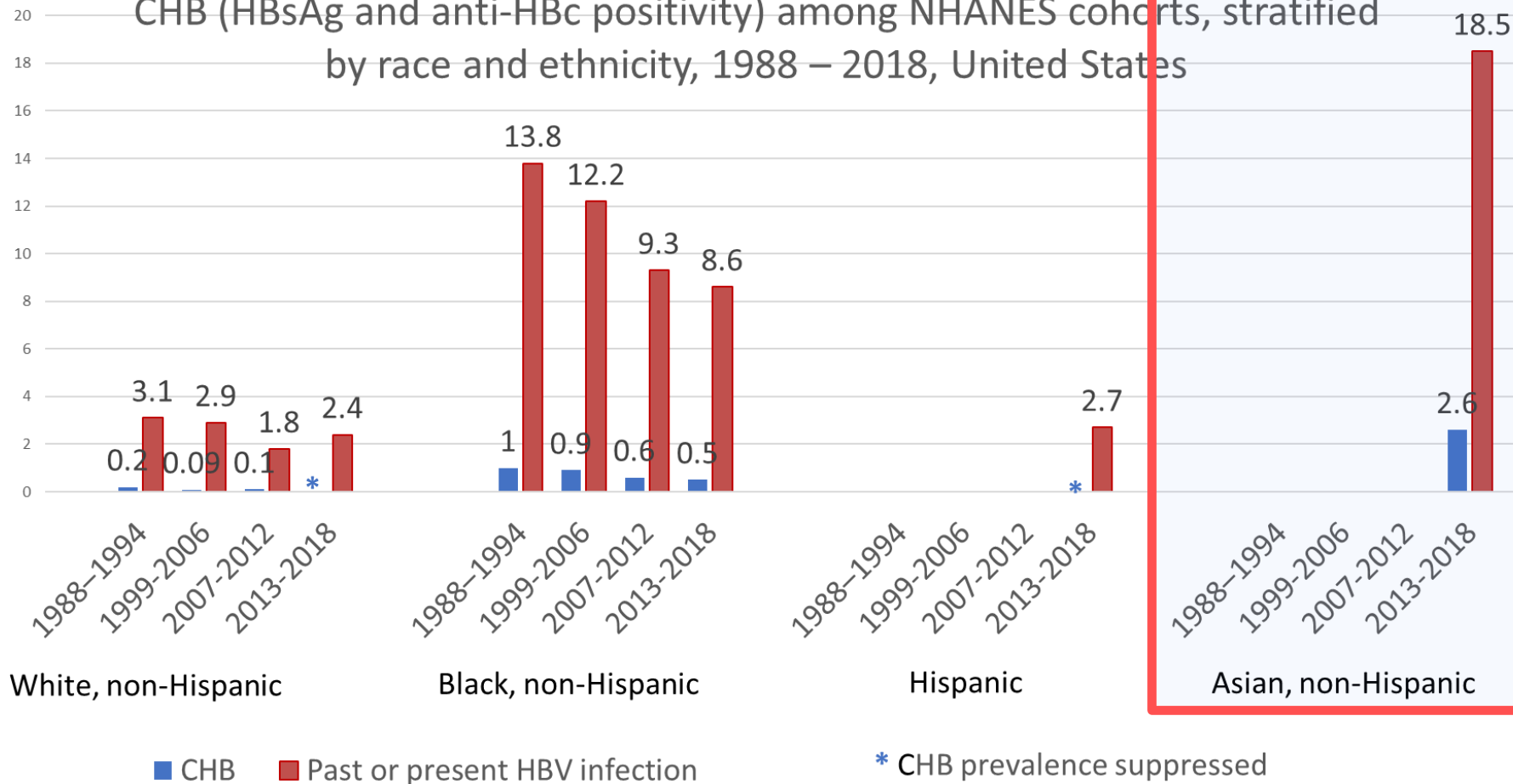
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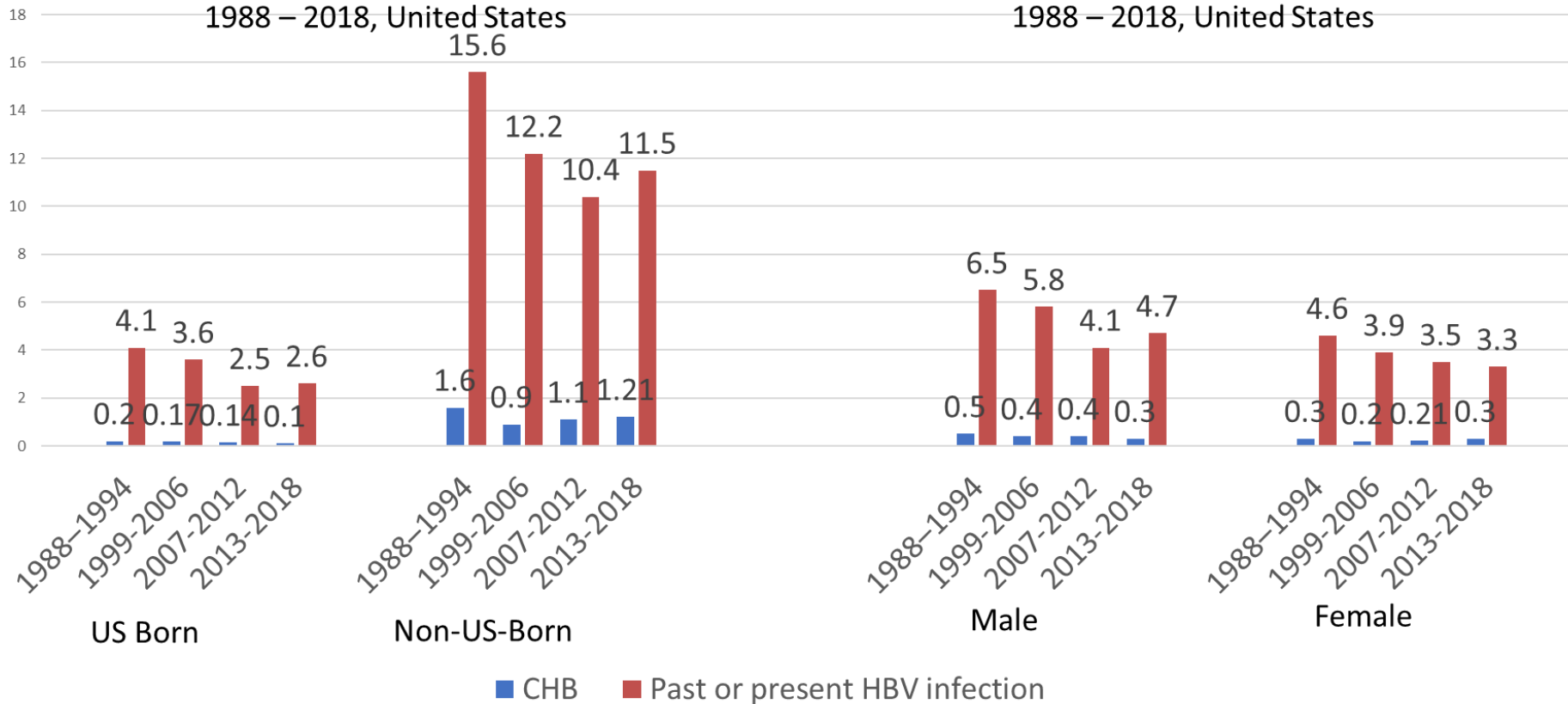


Prevalence (%) of past or present (anti-HBc positivity) HBV infection and CHB (HBsAg and anti-HBc positivity) among NHANES cohorts, stratified by race and ethnicity, 1988 – 2018, United States

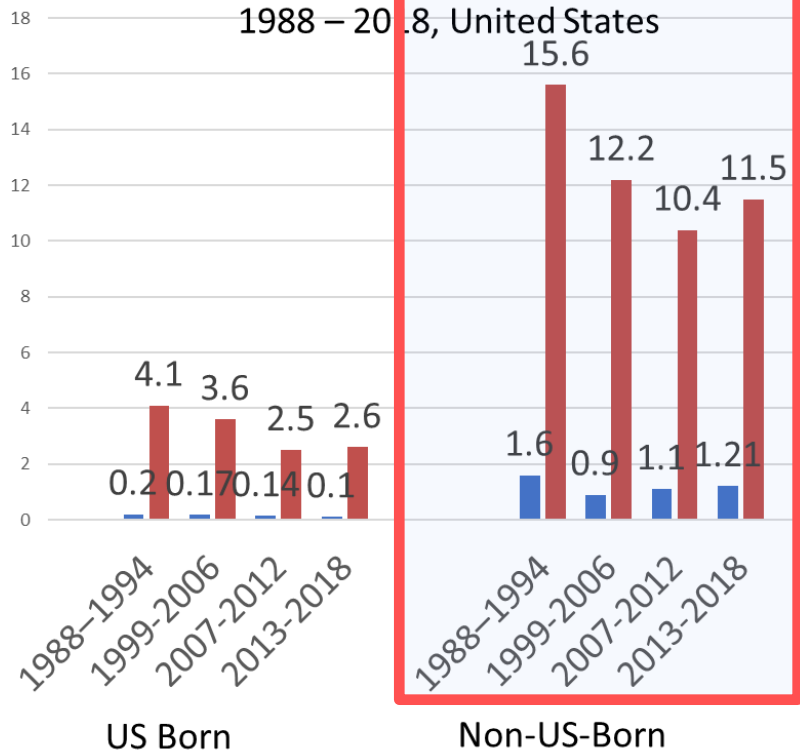


Prevalence (%) of past or present (anti-HBc positivity) HBV infection and CHB (HBsAg positivity) among NHANES cohorts, stratified by place of birth, 1988 – 2018, United States

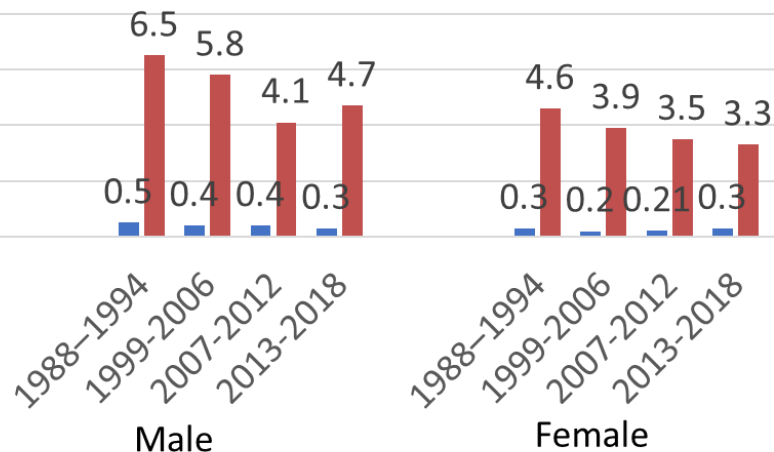
Prevalence (%) of past or present (anti-HBc positivity) HBV infection and CHB (HBsAg positivity) among NHANES cohorts, stratified by sex, 1988 – 2018, United States



Prevalence (%) of past or present (anti-HBc positivity) HBV infection and CHB (HBsAg positivity) among NHANES cohorts, stratified by place of birth, 1988 – 2018, United States

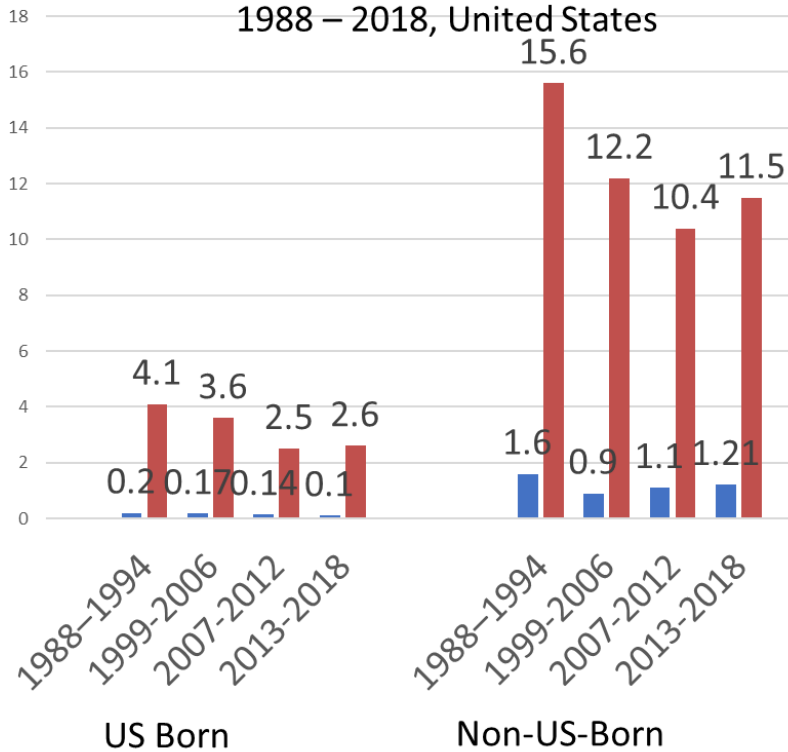


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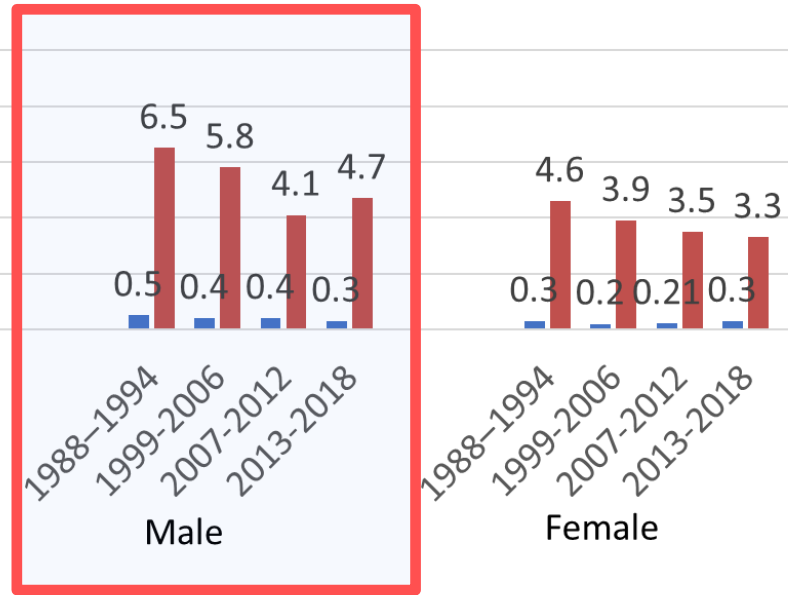


■ CHB ■ Past or present HBV infection

Prevalence (%) of past or present (anti-HBc positivity) HBV infection and CHB (HBsAg positivity) among NHANES cohorts, stratified by place of birth, 1988 – 2018, United States



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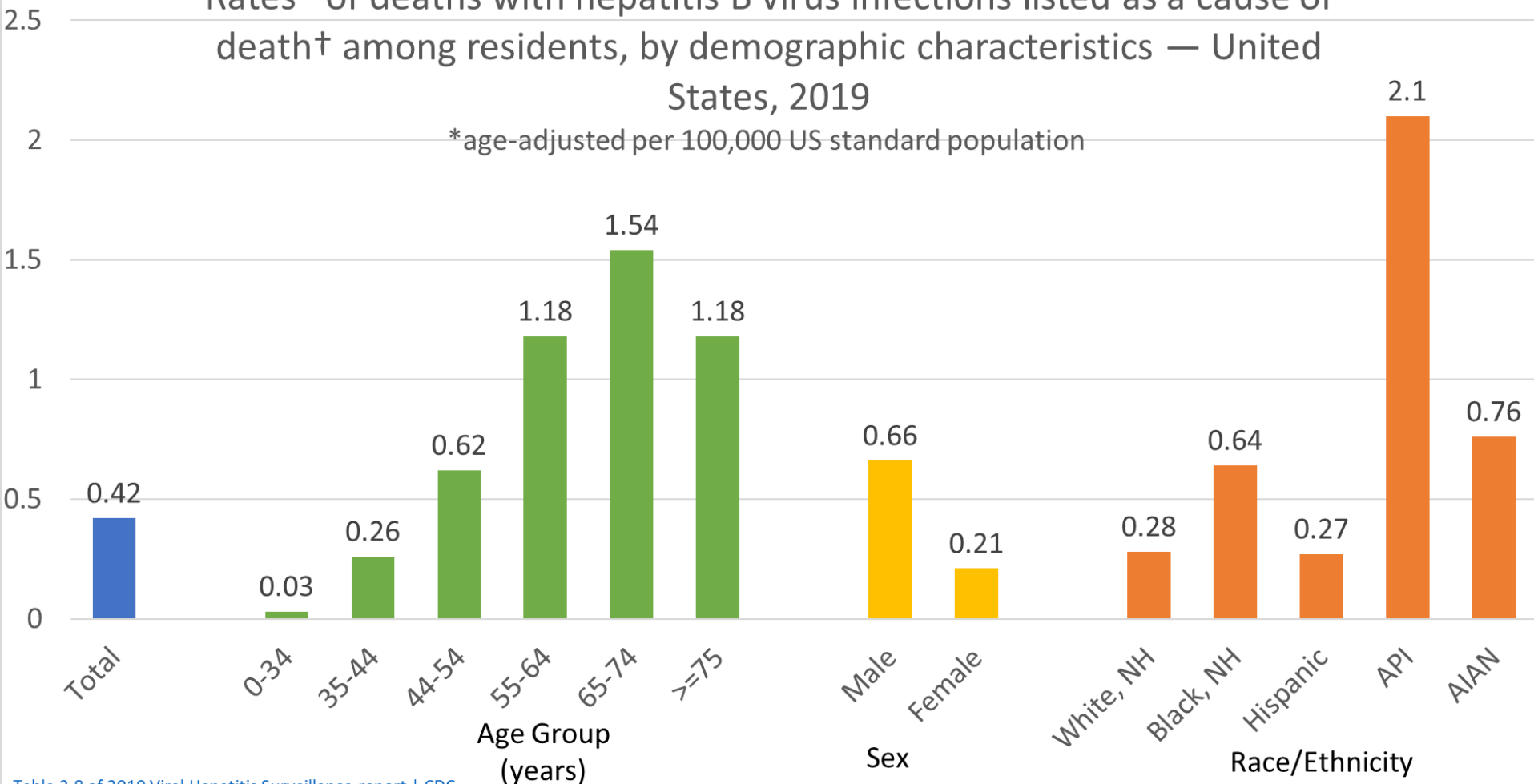
■ CHB ■ Past or present HBV infection

Sources of data for chronic hepatitis B (CHB)

- Mortality - Multiple Cause of Death (MCOD) files
 - Death certificates + diagnosis of hepatitis B
 - Cases included if:
 - Hepatitis B listed among multiple causes of death
 - Decedent resided in 50 states or DC
 - (no data on country of birth)

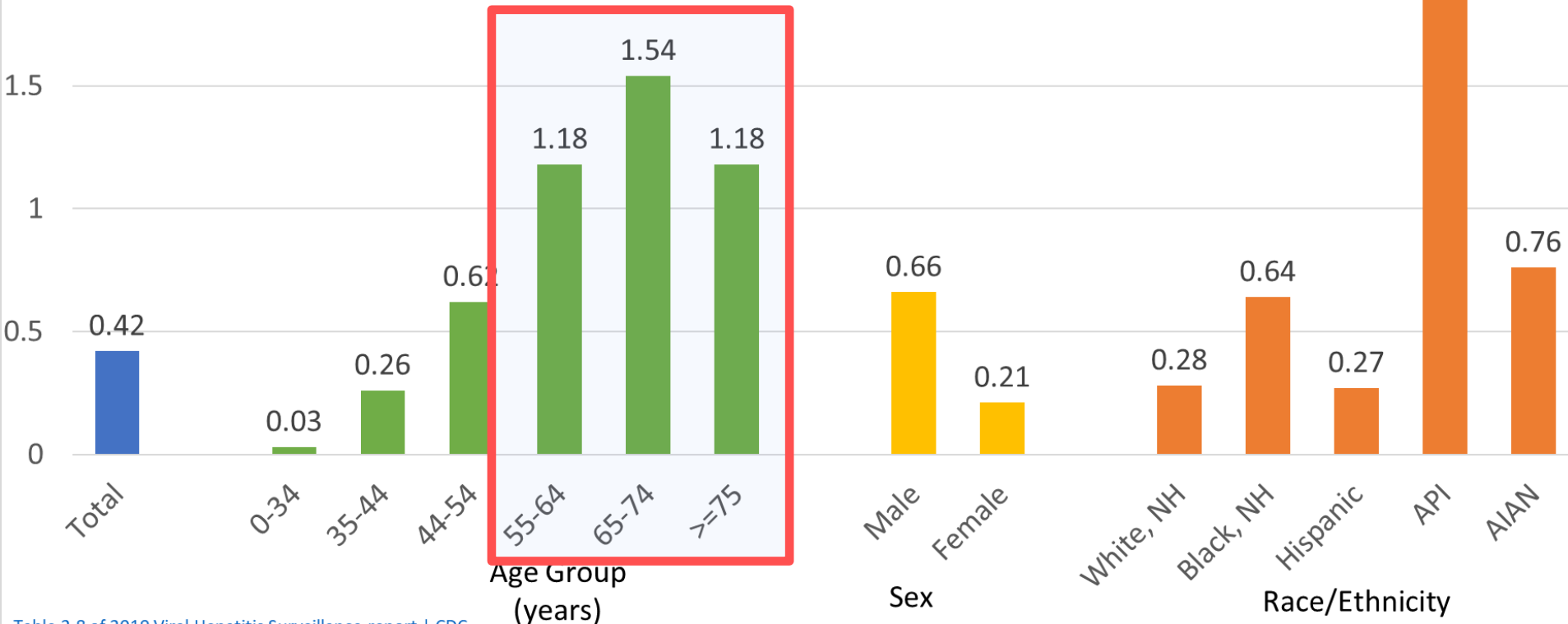
Rates* of deaths with hepatitis B virus infections listed as a cause of death† among residents, by demographic characteristics — United States, 2019

*age-adjusted per 100,000 US standard population



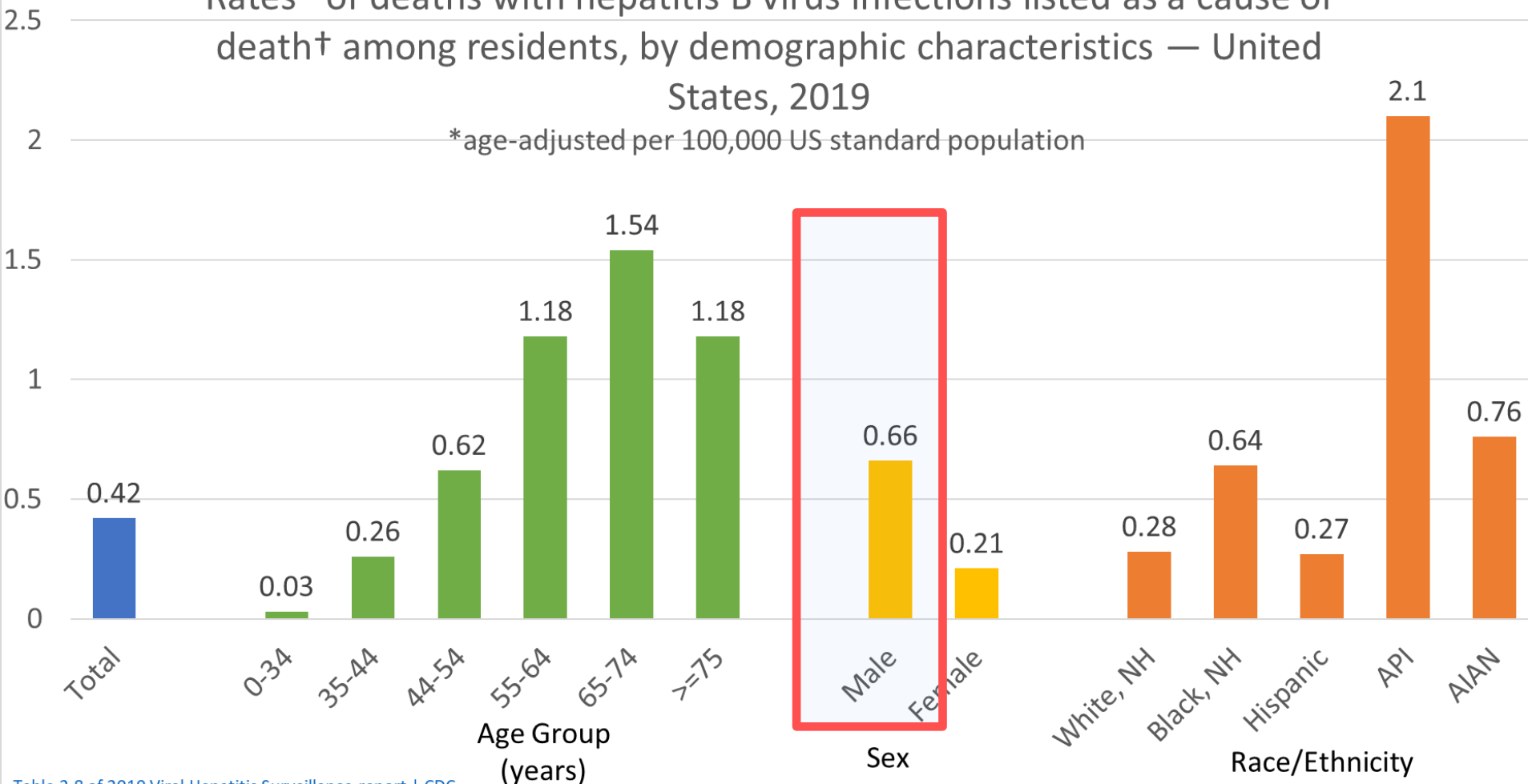
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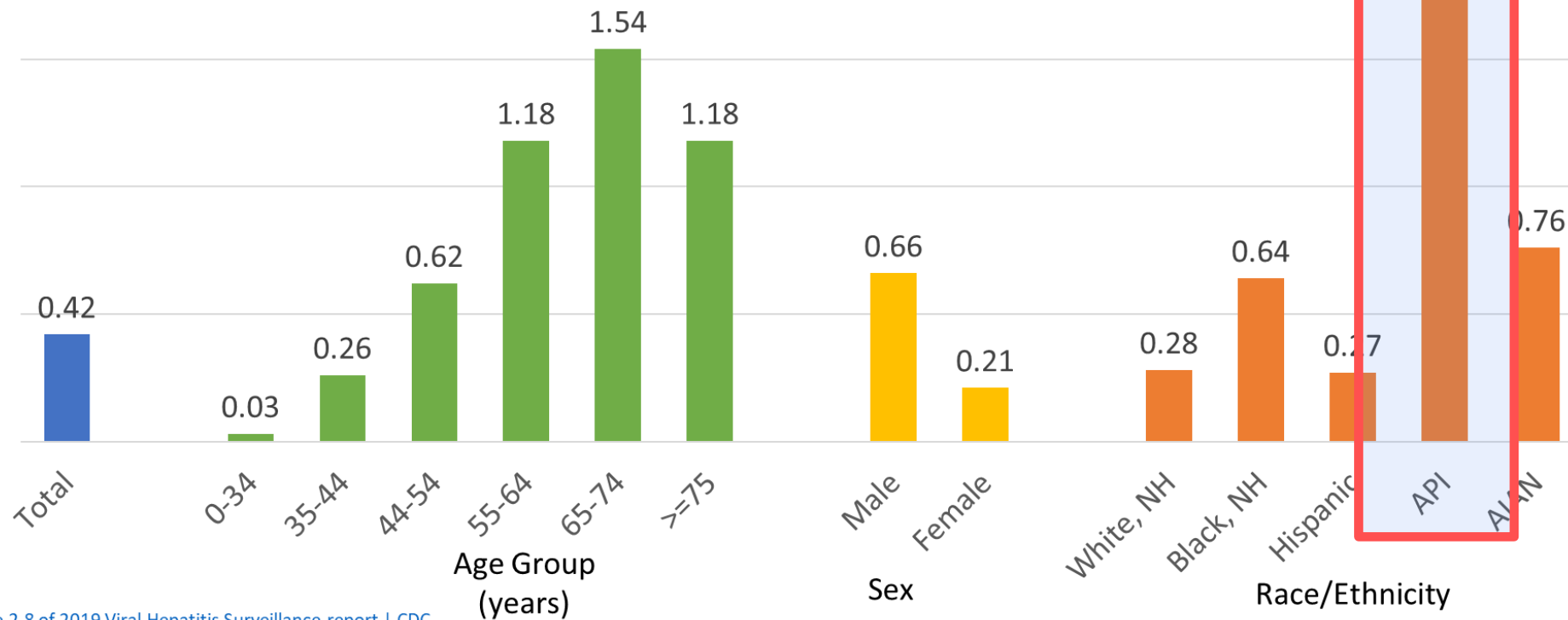
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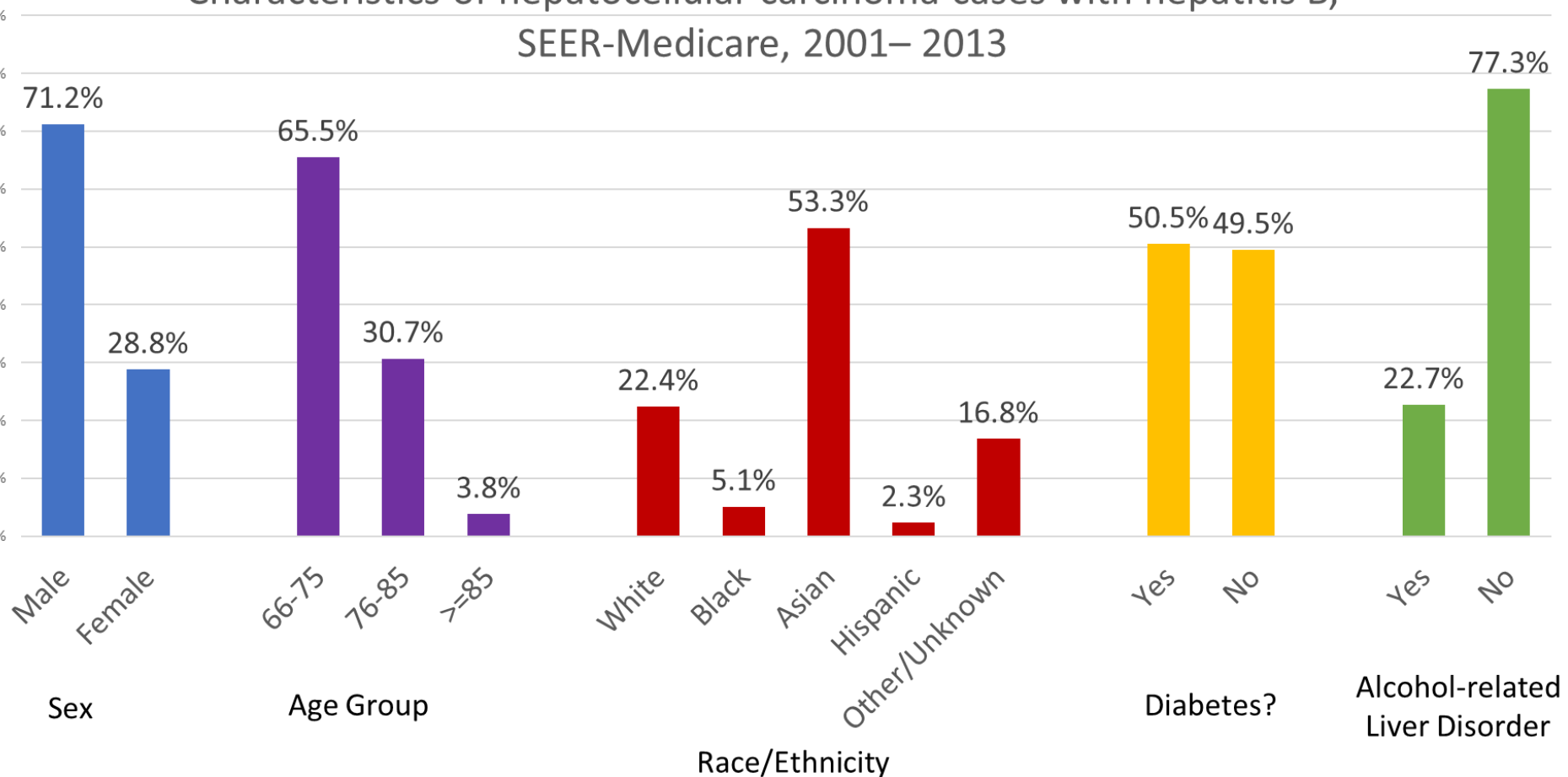
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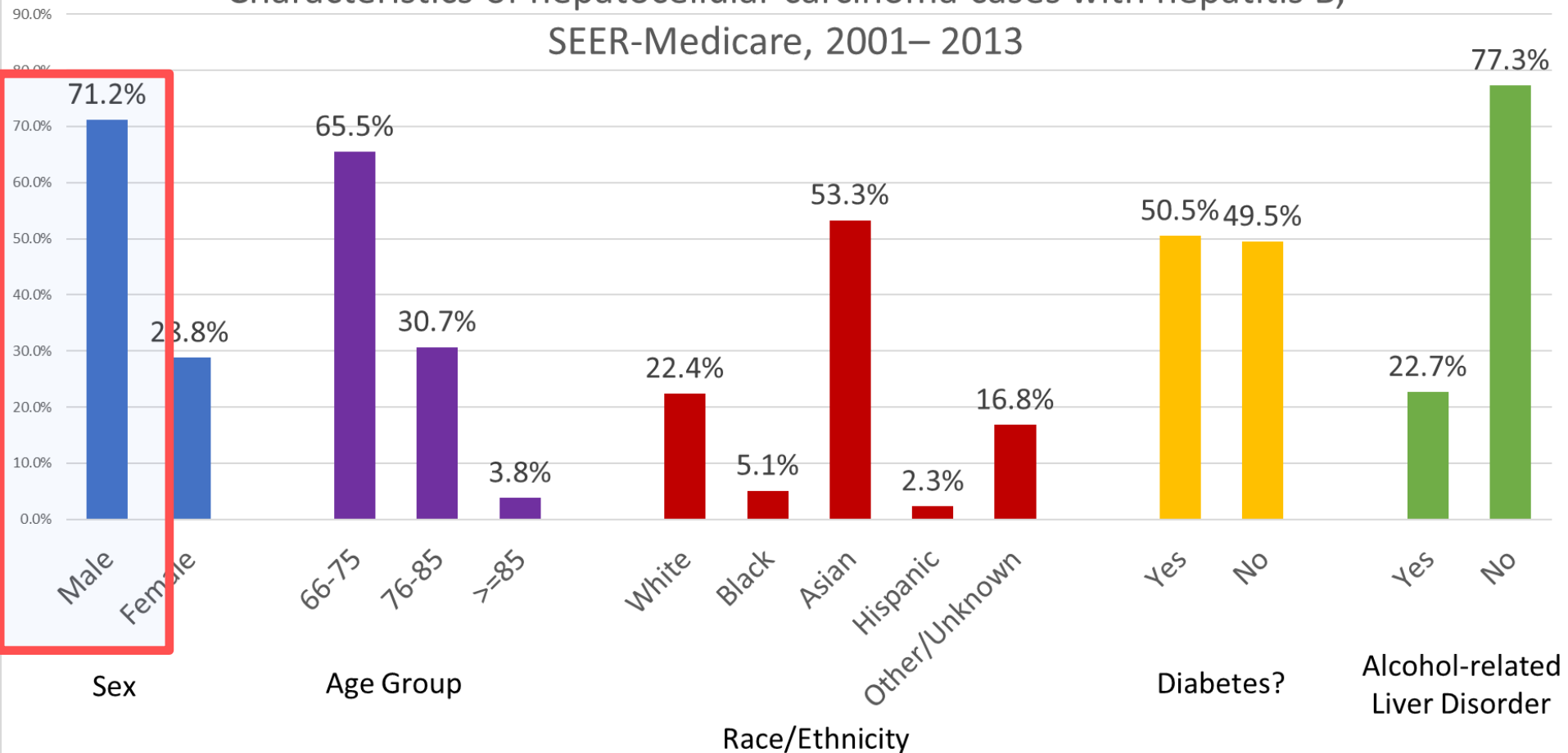
Sources of data for chronic hepatitis B (CHB)

- HCC - Surveillance Epidemiology and End Results-Medicare (SEER-Medicare)
 - Cancer registries linked to Medicare data
 - Included:
 - Diagnosis of HCC in cancer registry
 - Diagnosis code for hepatitis B in Medicare data
 - (no data on country of birth)

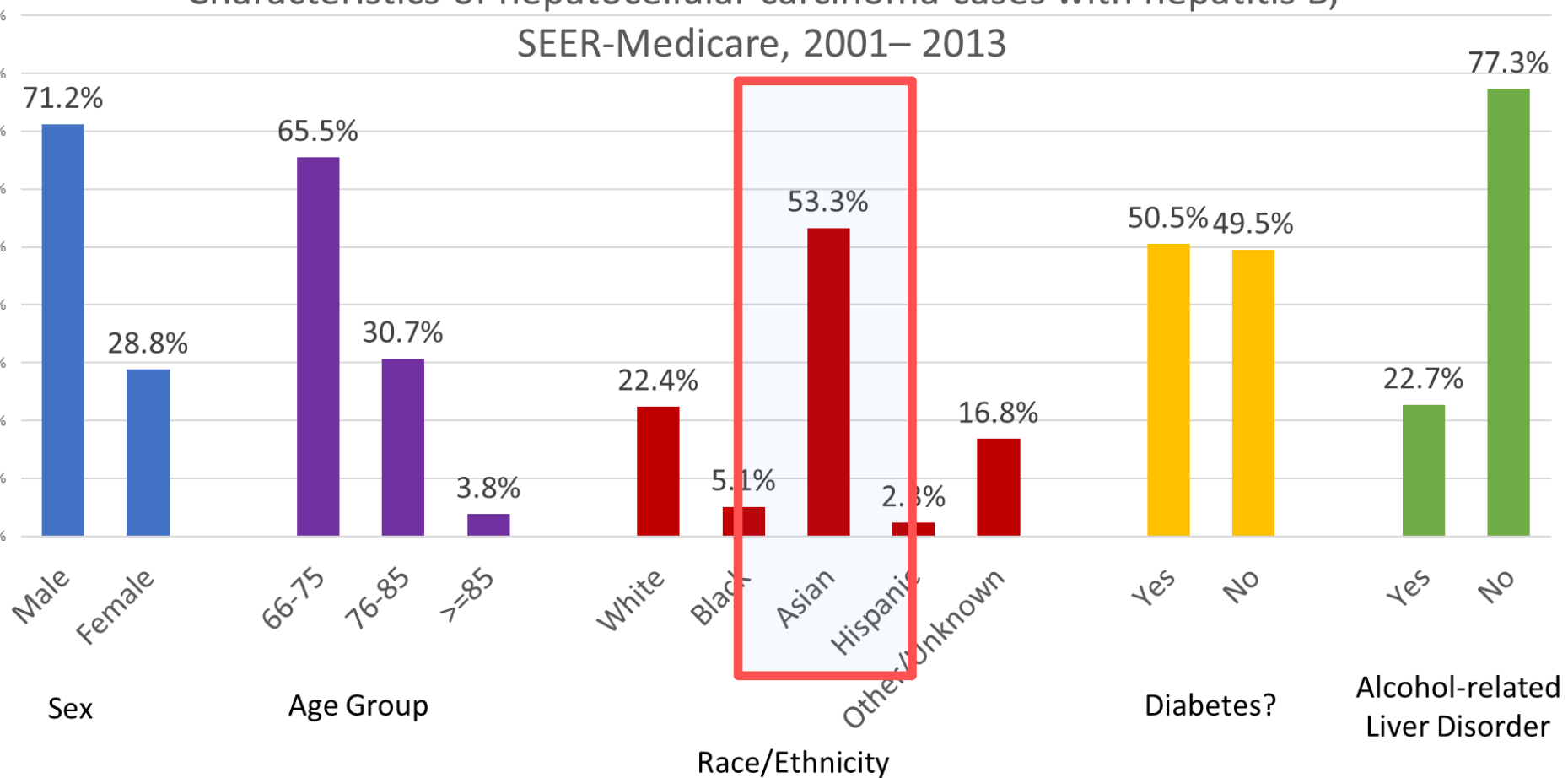
Characteristics of hepatocellular carcinoma cases with hepatitis B, SEER-Medicare, 2001– 2013



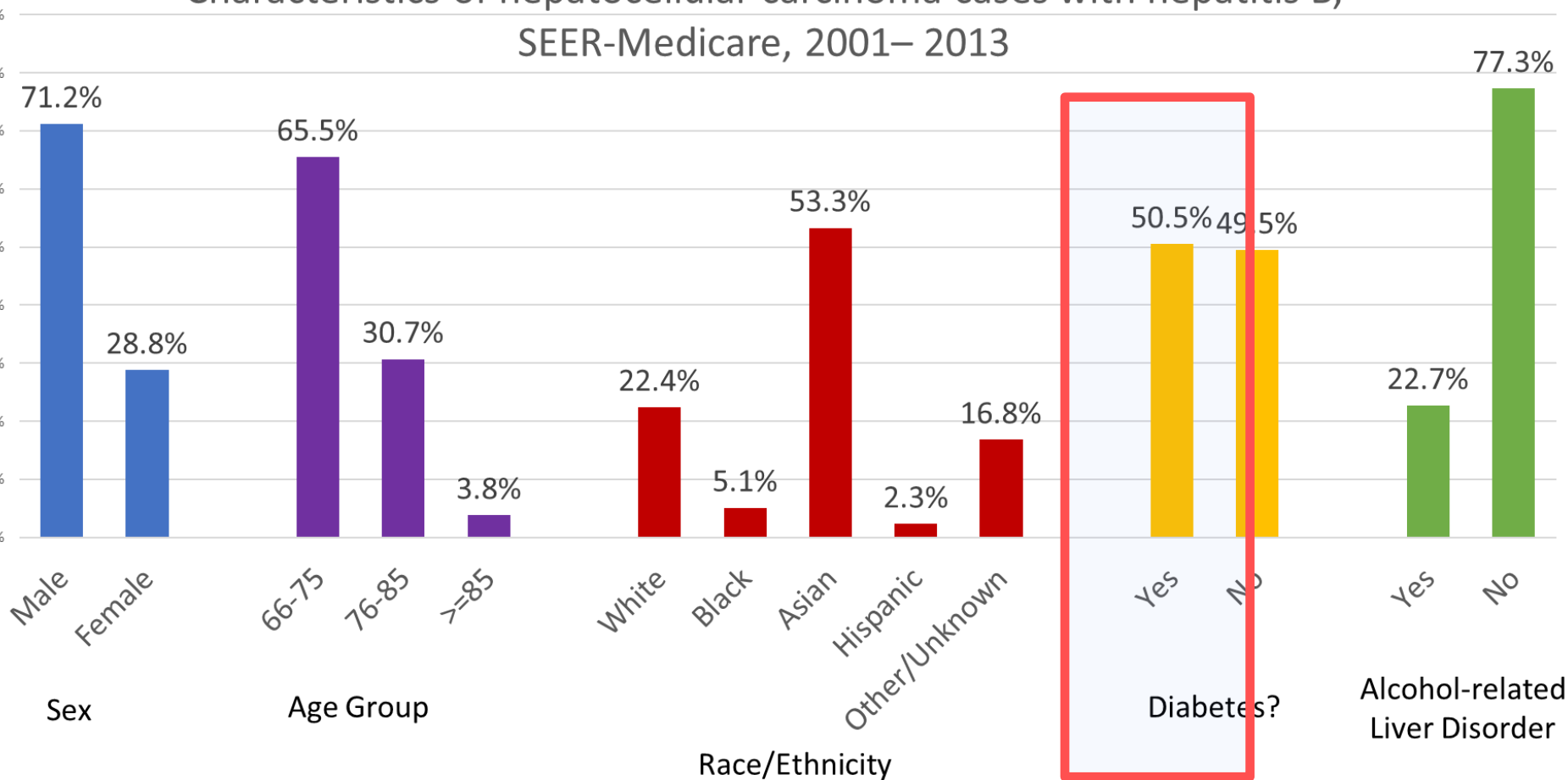
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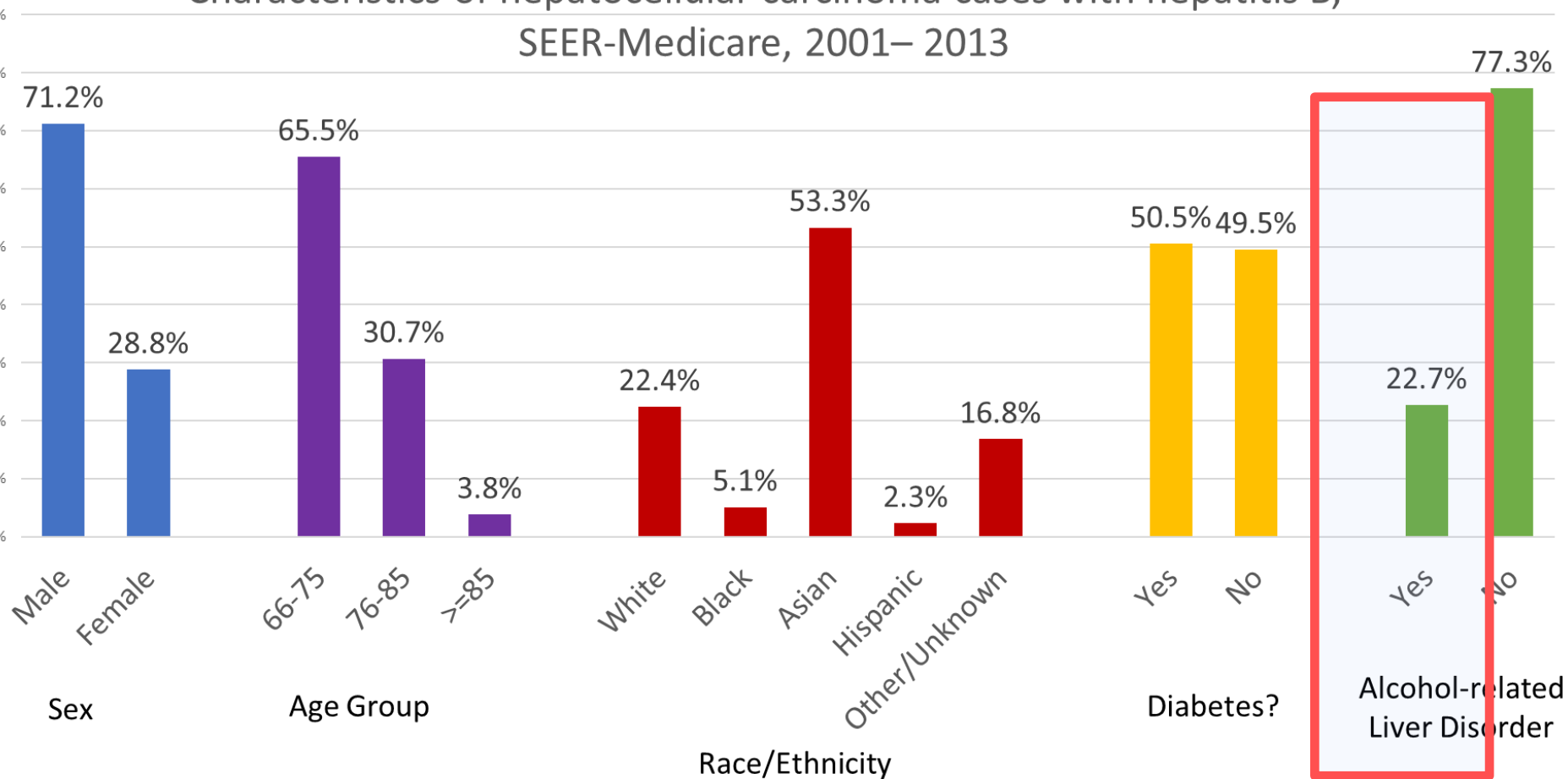
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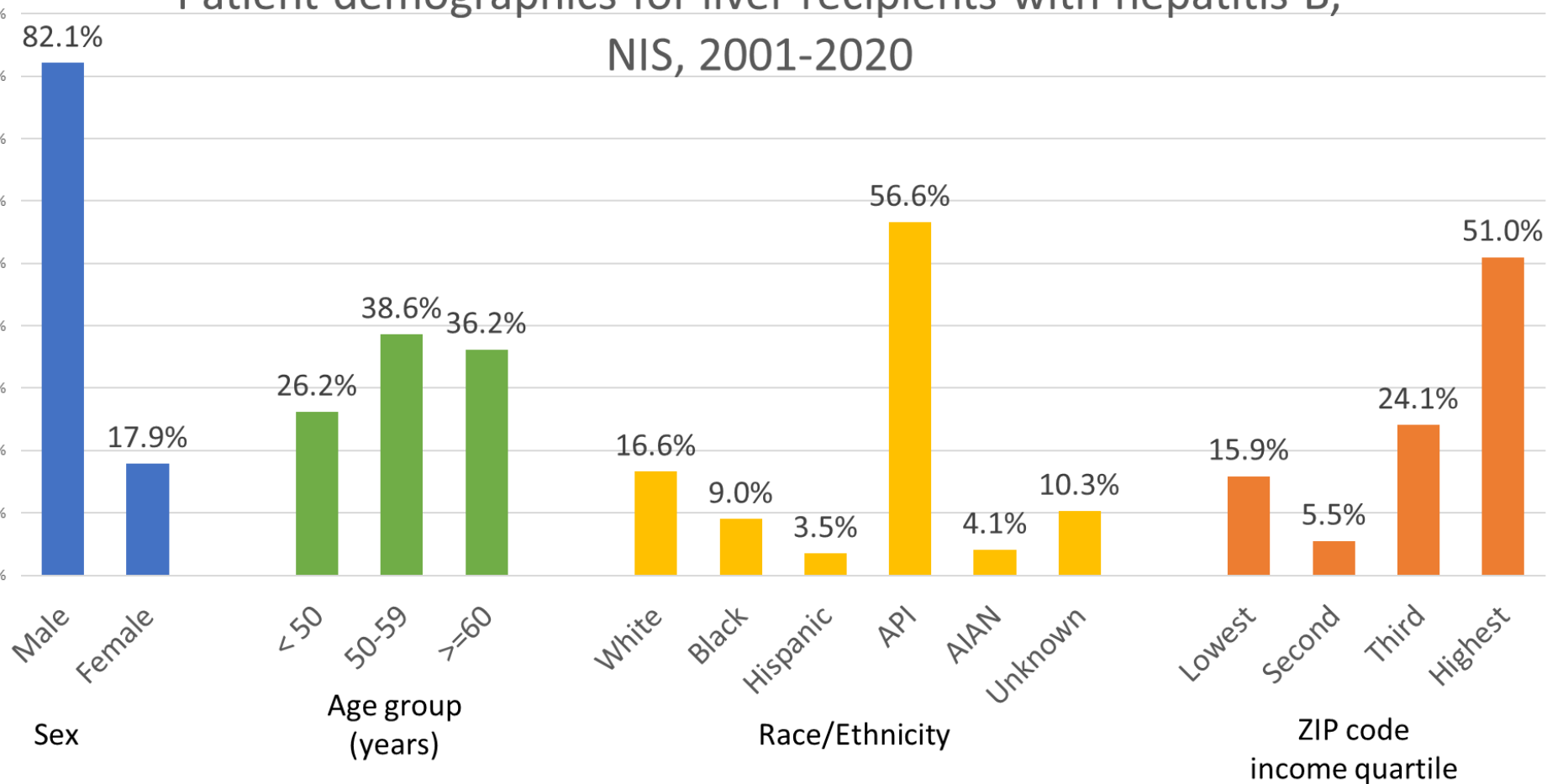
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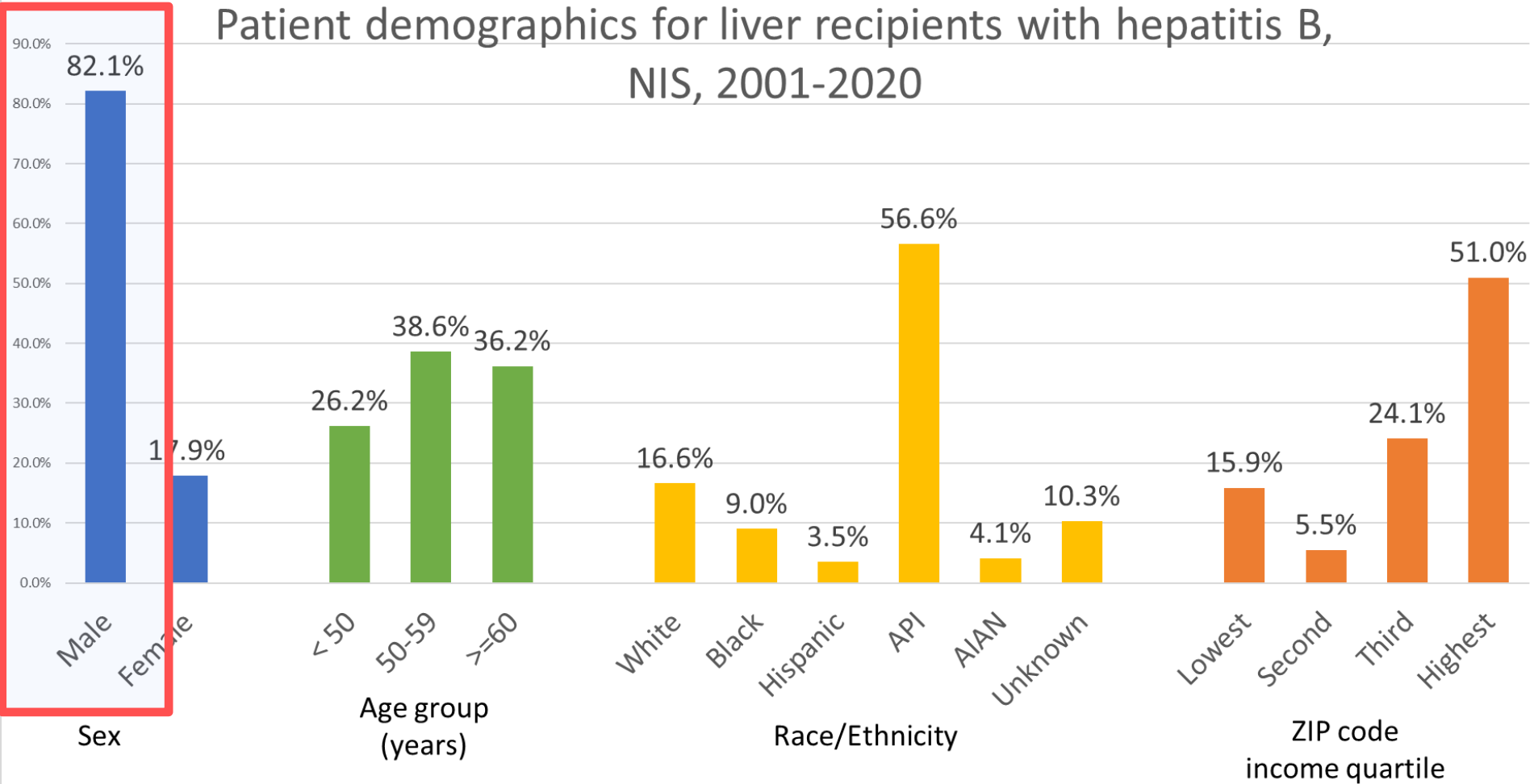
Sources of data for chronic hepatitis B (CHB)

- Liver transplantation - United Network for Organ Sharing/ Organ Procurement and Transplantation Network (UNOS)
 - Inclusion
 - Liver recipient
 - Physician diagnosis of hepatitis B
 - (no data on country of birth)

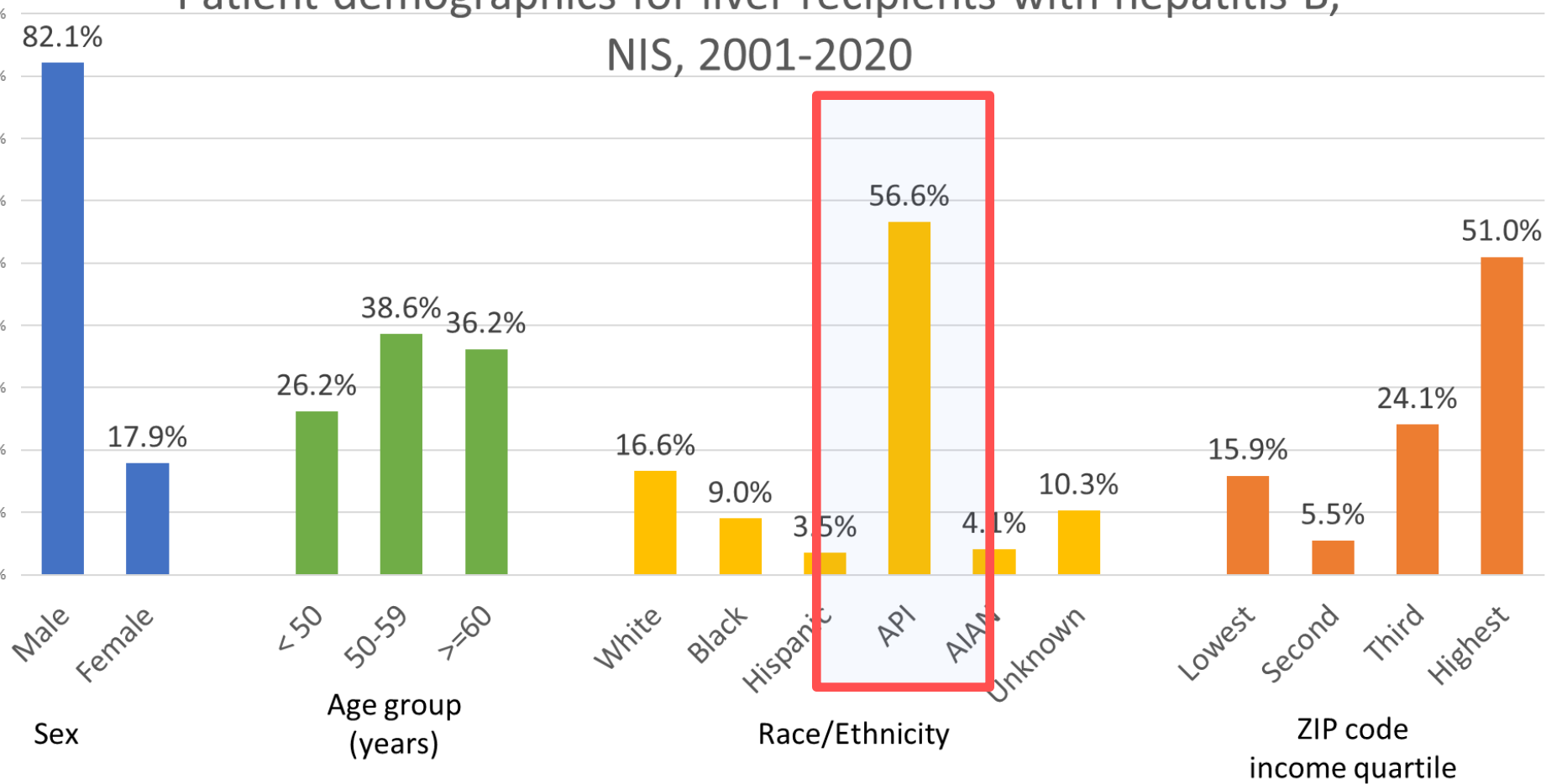
Patient demographics for liver recipients with hepatitis B, NIS, 2001-2020



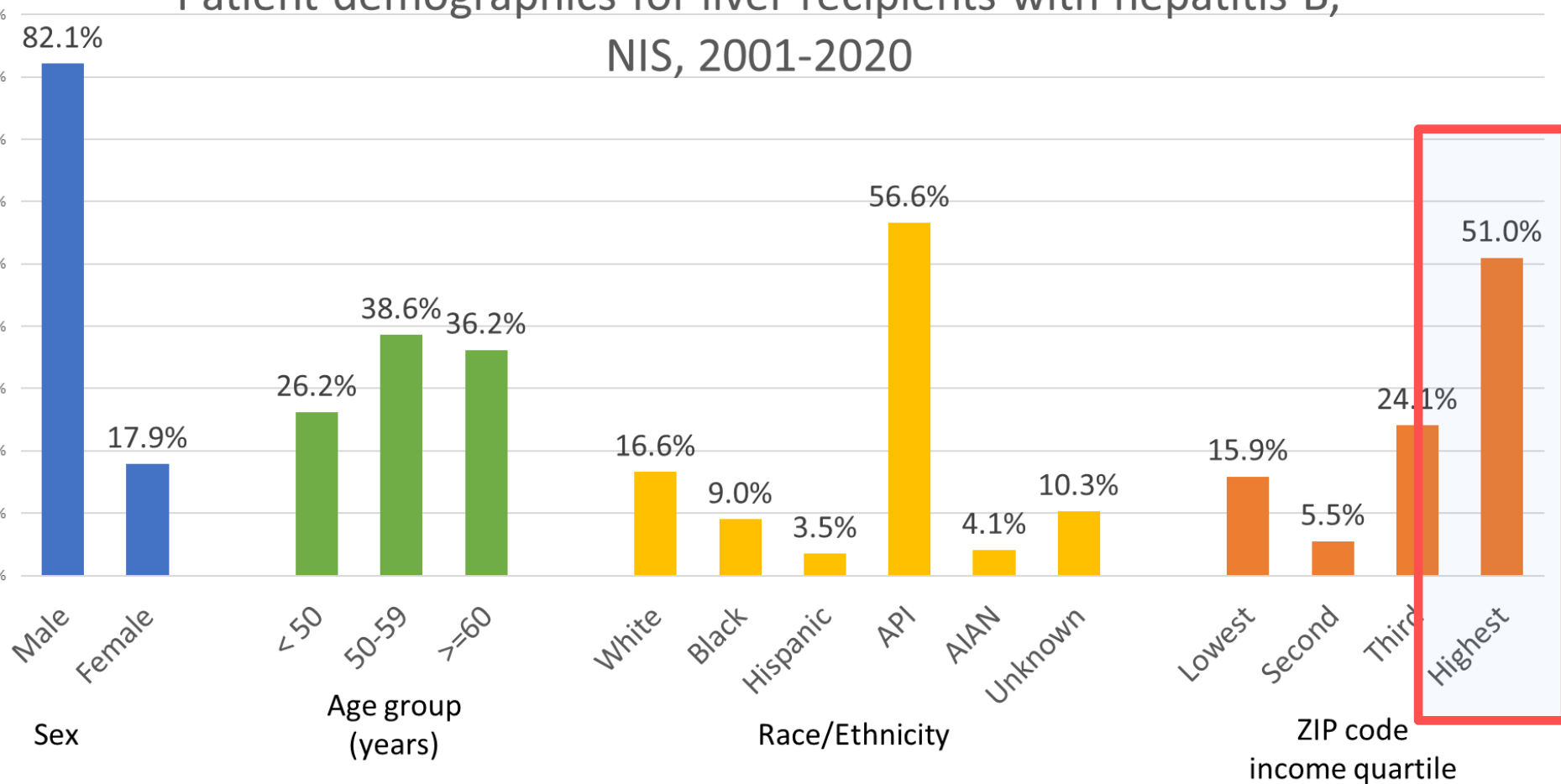
Patient demographics for liver recipients with hepatitis B, NIS, 2001-2020



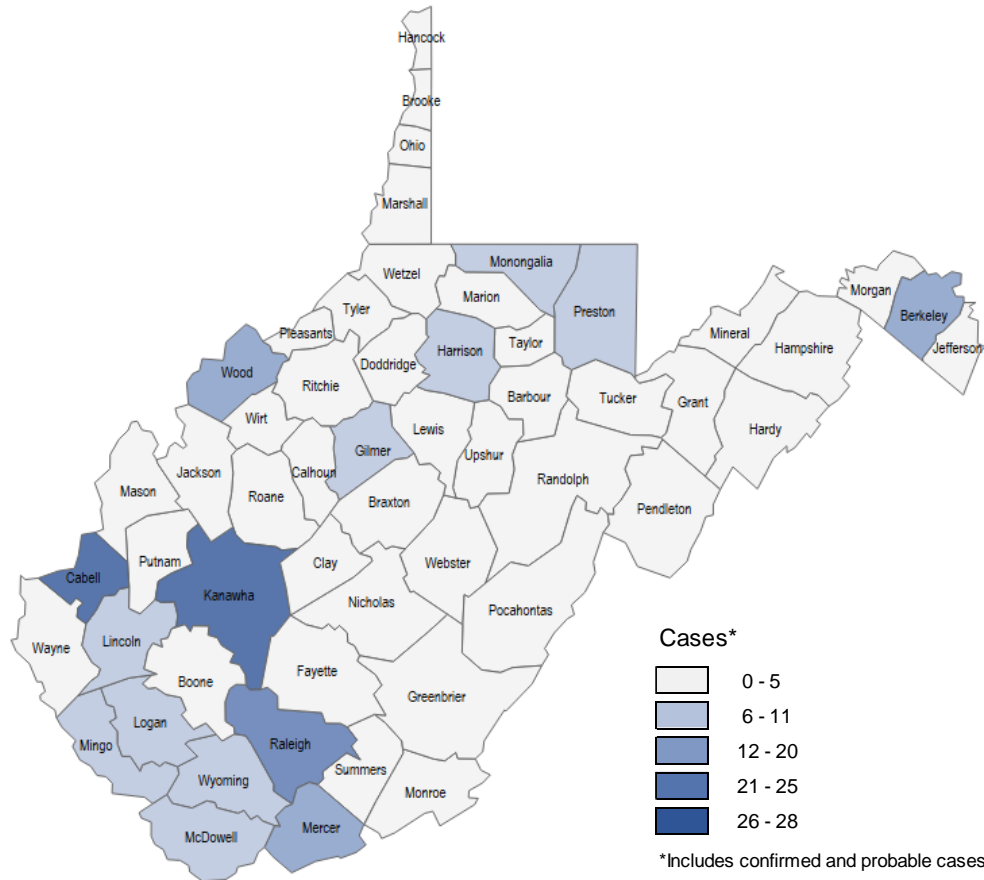
Patient demographics for liver recipients with hepatitis B, NIS, 2001-2020



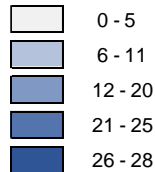
Patient demographics for liver recipients with hepatitis B, NIS, 2001-2020



Chronic Hepatitis B Cases by County West Virginia 2020



Cases*



*Includes confirmed and probable cases



National Initiatives



National Initiatives

- Universal adult vaccination for hepatitis B
 - Acute hepatitis B
- Universal adult testing for hepatitis B
 - Chronic hepatitis B
- Nationwide surveillance and prevention funding for health jurisdictions
- Viral Hepatitis National Strategic Plan

Universal Hepatitis B Vaccination in Adults Aged 19–59 Years: Updated Recommendations of the Advisory Committee on Immunization Practices — United States, 2022

Weekly / April 1, 2022 / 71(13);477–483

- **Between 2011 and 2019, rates among persons age 40-59 years increased by > 40%**
- **Hepatitis B vaccine rates in adults are suboptimal**
- **Risk factor data are missing for 37% of acute cases**



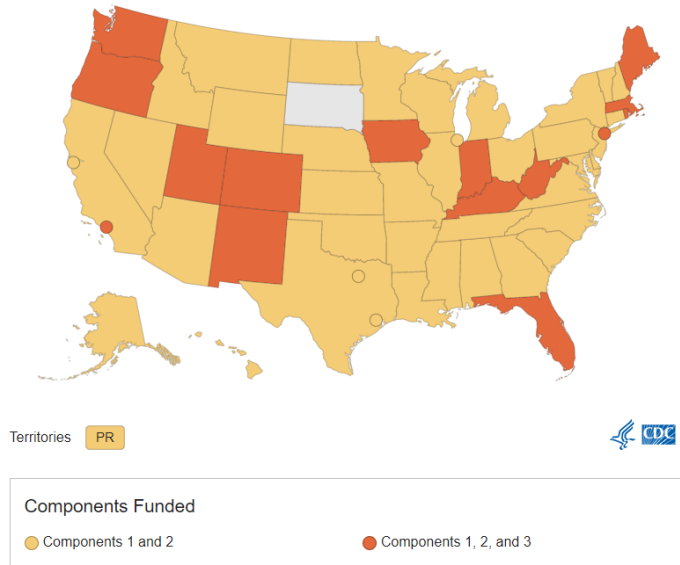
CDC Recommendations for Hepatitis B Screening and Testing-United States, 2022; Request for Comment

■ Universal adult screening for hepatitis B

- Estimated 880,000 persons living with CHB
 - 2/3 are unaware of their CHB
- During 2011-2019, acute hepatitis B increased among persons aged 40-59 years
- Rates of newly reported CHB are highest among API and NH Black persons

Viral hepatitis surveillance and prevention in the United States, 2021

To meet these goals, CDC is funding surveillance and prevention activities in 59 jurisdictions and is funding special projects related to the infectious disease consequences of drug use in 17 jurisdictions.



49 states and 9 cities funded for

▪ Viral hepatitis surveillance:

- Hepatitis A
- Acute and chronic hepatitis B, including:
 - (-) HBV DNA reporting
- Acute and chronic hepatitis C, including:
 - (-) HCV RNA reporting
 - Burden of disease and outcomes

▪ Viral hepatitis prevention including development of a hepatitis B and C elimination plan

<https://www.cdc.gov/hepatitis/policy/FO-CDC-RFA-PS21-2103.htm>

Viral Hepatitis National Strategic Plan: 2021–2025

- **Goal 1: Prevent New Viral Hepatitis Infections**
- **Goal 2: Improve Viral Hepatitis–Related Health Outcomes of People with Viral Hepatitis**
- **Goal 3: Reduce Viral Hepatitis–Related Disparities and Health Inequities**
- **Goal 4: Improve Viral Hepatitis Surveillance and Data Usage**
- **Goal 5: Achieve Integrated, Coordinated Efforts That Address the Viral Hepatitis Epidemics among All Partners and Stakeholders**

Viral Hepatitis National Strategic Plan: 2021–2025

- **Goal 1: Prevent New Viral Hepatitis Infections**
 - Universal infant, childhood and adult vaccination

Viral Hepatitis National Strategic Plan: 2021–2025

- **Goal 2: Improve Viral Hepatitis–Related Health Outcomes of People with Viral Hepatitis**
- **Goal 3: Reduce Viral Hepatitis–Related Disparities and Health Inequities**
 - Testing of adults
 - Linkage to care for ALL HBsAg (+) persons

Viral Hepatitis National Strategic Plan: 2021–2025

- **Goal 4: Improve Viral Hepatitis Surveillance and Data Usage**
 - Data completeness
 - Contact tracing
 - Sharing data with stakeholders

Viral Hepatitis National Strategic Plan: 2021–2025

- **Goal 5: Achieve Integrated, Coordinated Efforts That Address the Viral Hepatitis Epidemics among All Partners and Stakeholders**

Viral Hepatitis National Strategic Plan: 2021–2025

- **Goal 1: Prevent New Viral Hepatitis Infections**
- **Goal 2: Improve Viral Hepatitis–Related Health Outcomes of People with Viral Hepatitis**
- **Goal 3: Reduce Viral Hepatitis–Related Disparities and Health Inequities**
- **Goal 4: Improve Viral Hepatitis Surveillance and Data Usage**
- **Goal 5: Achieve Integrated, Coordinated Efforts That Address the Viral Hepatitis Epidemics among All Partners and Stakeholders**

Resources

- HepB vaccine: [Hepatitis B Vaccination | CDC](#)
- Hepatitis B testing: [Testing and Public Health Management of Persons with Chronic HBV | CDC](#)
- HBV treatment guidelines: <https://www.aasld.org/publications/hepatitis-b-chronic>
- Training
<https://www.cdc.gov/hepatitis/resources/professionals/trainingresources.htm>
- HBV serology: <https://www.cdc.gov/hepatitis/hbv/pdfs/SerologicChartv8.pdf>

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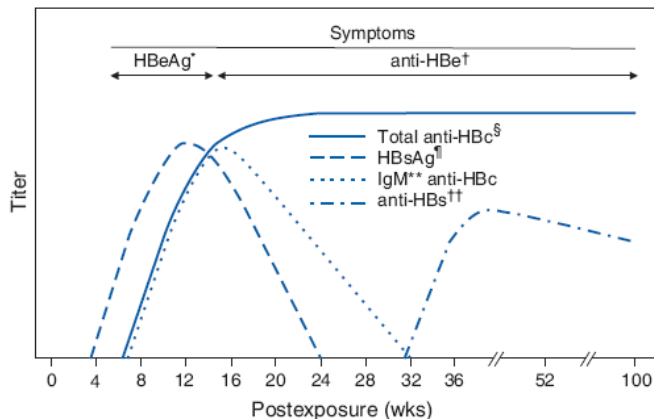
Laura Casto

Division of Epidemiologic Evaluation

Rosemary Levenson, BSN, RN

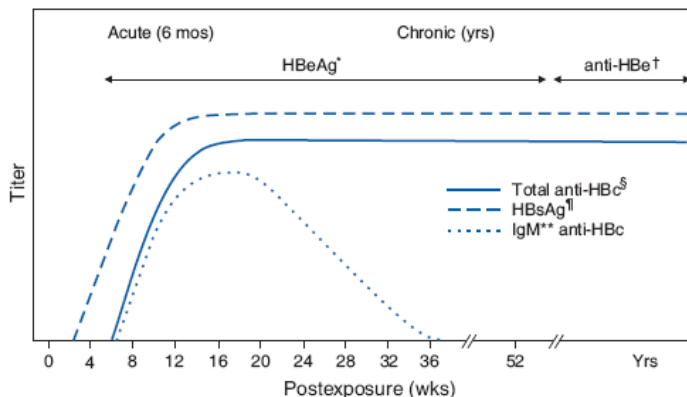
Serologic course of acute HBV

FIGURE 1. Typical serologic course of acute hepatitis B virus infection with recovery



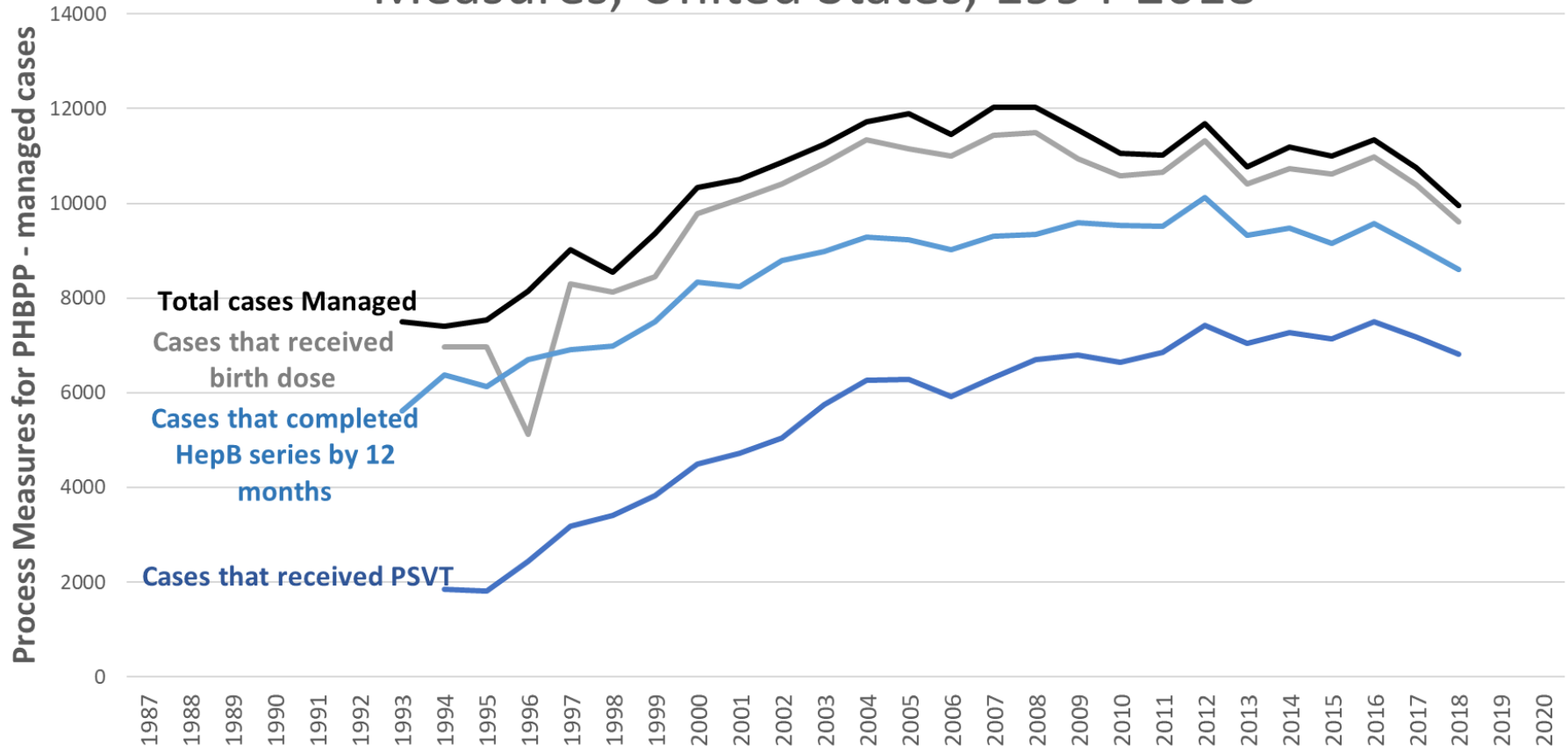
- * Hepatitis B e antigen.
- † Antibody to HBeAg.
- § Antibody to hepatitis B core antigen.
- ¶ Hepatitis B surface antigen.
- ** Immunoglobulin M.
- †† Antibody to HBsAg.

FIGURE 2. Typical serologic course of acute hepatitis B virus (HBV) infection with progression to chronic HBV infection



- * Hepatitis B e antigen.
- † Antibody to HBeAg.
- § Antibody to hepatitis B core antigen.
- ¶ Hepatitis B surface antigen.
- ** Immunoglobulin M.

Perinatal Hepatitis B Prevention Program Process Measures, United States, 1994-2018



Goal 4: Improve Viral Hepatitis Surveillance and Data Usage

- **4.1 Improve public health surveillance through data collection, case reporting, and investigation at the national, state, tribal, local, and territorial health department levels**
- **4.2 Improve reporting, sharing, and use of clinical viral hepatitis data**
- **4.3 Conduct routine analysis of viral hepatitis data and disseminate findings to inform public health action and the public**