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Low Prevalence of Hepatitis B Vaccination Among Patients Receiving Medical Care for HIV Infection in the United States, 2009 to 2012

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Abstract

Background—Persons with HIV infection are at increased risk for hepatitis B virus infection. In 2016, the World Health Organization resolved to eliminate hepatitis B as a public health threat by 2030.

Objective—To estimate the prevalence of hepatitis B vaccination among U.S. patients receiving medical care for HIV infection ("HIV patients").

Design—Nationally representative cross-sectional survey.

Setting—United States.

Participants—18 089 adults receiving HIV medical care who participated in the Medical Monitoring Project during 2009 to 2012.

Measurements—Primary outcomes were prevalence of 1) no documentation of hepatitis B vaccination or laboratory evidence of immunity or infection (candidates to initiate vaccination), and 2) initiation of vaccination among candidates, defined as documentation of at least 1 vaccine dose in a 1-year surveillance period during which patients received ongoing HIV medical care.

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Results—At the beginning of the surveillance period, 44.2% (95% CI, 42.2% to 46.2%) of U.S. HIV patients were candidates to initiate vaccination. By the end of the surveillance period, 9.6% (CI, 8.4% to 10.8%) of candidates were vaccinated, 7.5% (CI, 6.4% to 8.6%) had no documented vaccination but had documented infection or immunity, and 82.9% (CI, 81.1% to 84.7%) remained candidates. Among patients at facilities funded by the Ryan White HIV/AIDS Program (RWHAP), 12.5% (CI, 11.1% to 13.9%) were vaccinated during the surveillance period versus 3.7% (CI, 2.6% to 4.7%) at facilities not funded by RWHAP. At the end of surveillance, 36.7% (CI, 34.4% to 38.9%) of HIV patients were candidates to initiate vaccination.

Limitation—The study was not designed to describe vaccine series completion or actual prevalence of immunity.

Conclusion—More than one third of U.S. HIV patients had missed opportunities to initiate hepatitis B vaccination. Meeting goals for hepatitis B elimination will require increased vaccination of HIV patients in all practice settings, particularly at facilities not funded by RWHAP.

Primary Funding Source—Centers for Disease Control and Prevention.

Persons with HIV infection are at increased risk for hepatitis B virus (HBV) infection due to common modes of acquisition. The incidence of acute HBV infection in U.S. HIV cohort studies is 1.1 to 1.6 cases per 100 person-years (1–3), substantially higher than the incidence in the U.S. population in 2014 (0.9 case per 100 000 persons) (4). The prevalence of chronic hepatitis B was 8% to 9% in HIV cohorts between 1996 and 2007 (2, 3) compared with 0.3% in all U.S. households during this period (5). Infection with HIV negatively affects all phases of the natural history of HBV infection. Compared with HBV monoinfected persons, those co-infected with HIV and HBV are at higher risk for chronic infection, presence of hepatitis B e antigen, higher HBV DNA levels, cirrhosis, primary hepatocellular carcinoma, and liver-related death (5–12).

About 35 years have passed since the introduction of hepatitis B vaccination in the United States (13), and more than 20 years have elapsed since the Advisory Committee on Immunization Practices first recommended hepatitis B vaccination for all persons with HIV (14). After this recommendation, hepatitis B incidence following an HIV diagnosis decreased by 70% between the pre–highly active antiretroviral therapy (HAART) era and the HAART era. However, there was no further decrease in the incidence of hepatitis B in persons with HIV from 2000 to 2008 (1) and no reduction in the prevalence of chronic hepatitis B (3) or the incidence of end-stage liver disease among patients receiving medical care for HIV infection (“HIV patients”) (15). Liver-related deaths among HIV patients, in which hepatitis B plays a central role, account for the largest proportion of deaths not related to AIDS (16, 17).

In 2016, the World Health Organization resolved to eliminate HBV infection as a public health threat by 2030 (18). In 2017, the National Academies of Sciences, Engineering, and Medicine laid out a path to achieving this goal in the United States (19), and the U.S. Department of Health and Human Services National Viral Hepatitis Action Plan outlined strategies for achieving a 60% reduction in new hepatitis B cases by 2020 (20). The plan establishes indicators for measuring progress toward universal vaccination of vulnerable adults, including persons with HIV. However, there are currently no nationally representative

estimates of the percentage of HIV patients who are not vaccinated for hepatitis B against which progress can be measured. To address this knowledge gap and to assess hepatitis B vaccination among HIV patients as a quality-of-care indicator, we examined the prevalence of HIV patients without hepatitis B vaccination, immunity, or infection (candidates to initiate vaccination) and describe factors associated with subsequent vaccination of candidates.

Methods

Sampling and Data Collection

The Medical Monitoring Project (MMP) is a surveillance system designed to produce nationally representative, annual, cross-sectional estimates of behavioral and clinical characteristics of HIV-infected adults in the United States. Methods for MMP have been described in detail (21, 22). During the 2009 to 2012 cycle years, MMP used a 3-stage, probability-proportional-to-size sampling design, in which U.S. states and territories were sampled, followed by facilities providing outpatient HIV clinical care in those jurisdictions, and then HIV-infected adults (aged ≥18 years) receiving care at those facilities. Data were collected from adults with at least 1 HIV clinical care visit to a participating facility between January and April of the cycle year in which they were sampled. Thus, findings describe adults receiving HIV clinical care during these periods. Data were collected retrospectively using face-to-face or telephone interviews and medical record abstractions during 4 annual data collection cycles between June 2009 and May 2013. Data collected during these cycles were combined for this analysis. All sampled states and territories participated in MMP. Facility response rates ranged from 76% to 85%, and patient response rates ranged from 49% to 53%. Data were weighted to account for known probabilities of selection in each state or territory, by facility, and for patients in selected facilities. Predictors of nonresponse were determined from analysis of data from sampled facilities and patients, and data were then weighted to adjust for nonresponse using established methods (23, 24).

In accordance with guidelines for defining public health research (25, 26), the Centers for Disease Control and Prevention (CDC) determined that MMP was public health surveillance used for disease control, program, or policy purposes. Local institutional review board approval was obtained in participating states, territories, and facilities when required. Informed consent was obtained from all interviewed participants.

Measures

Primary Outcomes—Primary outcomes were no documentation of hepatitis B vaccination, immunity, or infection in the medical record (candidates to initiate vaccination) and subsequent initiation of hepatitis B vaccination among candidates. For each participant, we collected medical record data that had been recorded during the year before the patient interview (surveillance period) and during the interval between the date of first medical care after HIV diagnosis and the beginning of the surveillance period (medical history period) (Figure 1). Information was collected from the medical record at the sampled facility, including all attached records from other facilities. We recorded results from all hepatitis B surface antigen (HBsAg) tests; hepatitis B surface antibody (HBsAb) total and IgG tests; and

hepatitis B core antibody (HBcAb) total, IgG, and IgM tests during both periods. We also collected qualitative and quantitative HBV DNA test results for the surveillance period. For both periods, we recorded all doses of hepatitis B and hepatitis A/B vaccine. For patients who were not vaccinated, we recorded the reason for deferral (previously vaccinated or previously infected) if it was documented. We categorized patients at the beginning and end of the surveillance period as being candidates versus non-candidates to initiate vaccination. Noncandidates included patients with either 1) documentation of at least 1 dose of hepatitis B vaccine or combination hepatitis A/B vaccine, or documentation that the reason for deferral was previous vaccination, or 2) documentation of immunity (defined as a positive HBsAb test result) or infection (positive HBsAg test result, HBcAb IgM, or detectable HBV DNA). Those with isolated HBcAb (total or IgG and no other markers of hepatitis B) and no documentation of vaccination were classified as candidates to initiate vaccination.

During the surveillance period, candidates were categorized as having received or not received at least 1 vaccine dose. Those who were not vaccinated were further categorized as having new documentation of either immunity or infection. Candidates who were not vaccinated and had no new documentation of infection or immunity were classified as continuing candidates to initiate vaccination. In addition, we determined whether candidates were prescribed antiretroviral agents that were dually active against HBV, including tenofovir disoproxil fumarate (tenofovir) alone, lamivudine or emtricitabine alone, or both tenofovir and either lamivudine or emtricitabine.

Clinical and Sociodemographic Variables—Clinical characteristics included lowest HIV disease stage attained (27) (CDC-defined AIDS, no CDC-defined AIDS and nadir CD4 count of 0.200 to 0.499 × 10^9 cells/L, or no CDC-defined AIDS and nadir CD4 count ≥0.500 × 10^9 cells/L), mean CD4 cell count in the previous 12 months, prescription of antiretroviral therapy (ART) in the previous 12 months, and viral suppression (most recent HIV viral load undetectable or <200 copies/mL). Indications for hepatitis B vaccination, in addition to HIV infection, included past or current hepatitis C virus infection (positive hepatitis C virus antibody test result), homelessness or incarceration in the previous 12 months, injection drug use, being a man who has sex with men (MSM), or having multiple opposite-sex partners.

Sociodemographic variables included race/ethnicity (non-Hispanic black, non-Hispanic white, Hispanic or Latino, or other), age, gender (male, female, or transgender), sexual transmission category (MSM, men who have sex with women only, women who have sex with men, or other), educational attainment (less than high school, high school or equivalent, or above high school), income below the federal poverty level (FPL), and health insurance type (any private, public only, Ryan White HIV/AIDS Program [RWHAP] only, uninsured, or unspecified). We also evaluated met and un-met needs for supportive services and characteristics of the health care facility from which participants were sampled (receives RWHAP funding, community health center, private practice, and HIV caseload [<50, 50 to 400, or >400 patients]).

Statistical Analysis

The analytic data set included records of 18 089 adult MMP participants with paired interviews and medical record abstractions. We computed frequencies and weighted percentages describing characteristics of persons receiving HIV medical care and 95% CIs for these descriptive parameters. Associations between vaccination during the 1-year surveillance period and facility characteristics, met and unmet service needs, and clinical and sociodemographic characteristics were evaluated with Rao–Scott chi-square tests. To assess possible confounding of associations between vaccination and sociodemographic characteristics by facility type, we stratified all associations by the RWHAP funding status of the facilities where patients received HIV care. We performed a sensitivity analysis to assess the effect of excluding patients at facilities with unknown RWHAP funding status on the estimate of vaccination prevalence during the surveillance period. All analyses were performed using procedures for survey data analysis in SAS/STAT, version 9.3 (SAS Institute).

Role of the Funding Source

This study was funded by the CDC, which was responsible for the design, conduct, and analysis of the study.

Results

Among persons receiving medical care for HIV infection from 2009 to 2012, more than two thirds were aged at least 40 years, were male, and had CDC-defined AIDS, and approximately half had a mean CD4 count of at least 0.500×10^9 cells/L in the previous year (Table 1). Overall, 41.3% were black, 34.4% were white, 19.4% were Hispanic or Latino, and 4.9% were of another race/ethnicity. Nearly half were MSM (48.2%), 23.4% were men who had sex with women only, and 25.6% were women who had sex with men.

Among U.S. HIV patients, 44.2% had no documentation of vaccination, immunity, or infection in the medical record at the beginning of the surveillance period and were classified as candidates to initiate vaccination (Table 1 and Figure 2).

Status of Candidates to Initiate Vaccination at the End of the Surveillance Period

Among candidates to initiate vaccination, 9.6% were vaccinated during the surveillance period, 7.5% were not vaccinated but had new documentation of hepatitis B immunity or infection, and 82.9% were not vaccinated and had no new documentation of immunity or infection (continuing candidates to initiate vaccination) (Table 2). Three quarters of candidates were prescribed ART regimens that were dually active against HBV (2.8% were prescribed tenofovir alone, 17.1% were prescribed lamivudine or emtricitabine alone, and 64.8% were prescribed tenofovir and either lamivudine or emtricitabine). At the end of the surveillance period, 36.7% of U.S. HIV patients remained candidates to initiate vaccination (Table 1).

Association of Vaccination During the Surveillance Period With Patient and Facility Characteristics

Vaccination of candidates during the surveillance period was associated with the type of facility where patients received HIV care. A significantly larger percentage of patients who received care at RWHAP-funded facilities versus non–RWHAP-funded facilities were vaccinated (12.5% vs. 3.7%; $P < 0.001$) (Table 3). Fewer patients who received care at private practices (vs. nonprivate practices) were vaccinated (5.6% vs. 11.8%; $P < 0.001$). Patient characteristics associated with a significantly higher prevalence of vaccination included income below the FPL, lower educational attainment, black race, younger age, recent homelessness, and a mean CD4 count less than 0.500×10^9 cells/L ($P < 0.001$ for each) (Table 4). Vaccination was not associated with having been prescribed ART or attaining viral suppression.

After stratification by facility RWHAP funding status, prevalence of vaccination during the surveillance period was not significantly associated with income below the FPL or educational attainment among patients receiving care at either facility type (Appendix Table, available at Annals.org). Status of RWHAP funding was ascertained for 91% of patients. The estimate of vaccination during the surveillance period was 1% higher when participants at facilities with unknown RWHAP funding status were included.

Discussion

Despite long-standing recommendations to vaccinate all persons with HIV for hepatitis B, more than one third of persons receiving HIV medical care in the United States lacked medical record documentation of vaccination, immunity, or infection. During 1 year of ongoing HIV care, only 1 in 10 candidates was vaccinated. Vaccination prevalence was low among all patients, regardless of their sociodemographic or clinical characteristics or the type of facility where they received care.

Although previous studies have assessed hepatitis B vaccination among HIV patients, this is, to our knowledge, the first to estimate the percentage of U.S. HIV patients who were candidates to initiate hepatitis B vaccination and the characteristics of those who were subsequently vaccinated. Among patients at 8 U.S. HIV clinics during 2004 to 2007, 52% were screened for hepatitis B, of whom 82% were susceptible to infection because they had no evidence of prior HBV exposure or infection. Of these, 25% were subsequently vaccinated (28). At a U.S. urban primary HIV clinic, 70% of unvaccinated patients were vaccinated between 1997 and 2004 (29). Among patients in the U.S. HIV Outpatient Study without a prior positive HBsAb test result, 32% were vaccinated by 2007. In the U.K. Collaborative HIV Cohort, 74% of patients had any hepatitis B serologic testing; of these, 58% had a positive HBsAb result without a positive HBcAb or HBsAg result, suggesting that they were vaccinated (30). In a French hospital-based HIV cohort, among those with sufficient serologic testing, 68% were immunized against hepatitis B after natural infection or vaccination (31). Although our estimates are generally within the range of estimates from these studies, methodological differences prevent direct comparison.

Although vaccination prevalence was low across all facility types, it was substantially higher among patients at RWHAP-funded facilities, which is consistent with other indicators that patients who receive care at such facilities have better clinical outcomes than those at facilities without RWHAP funding (32). Vaccination prevalence was marginally higher among patients with social determinants of poor health, at least partially because vulnerable patients disproportionately receive HIV care at RWHAP-funded facilities (32).

Several factors might contribute to failure of clinicians to vaccinate HIV patients for hepatitis B, including deferral of vaccination because of reports of reduced immunogenicity among such patients (10, 33), inconsistency of recommendations for timing and dosage of vaccination within and across guidelines (34–37), deficiency of robust systems within health care facilities to support vaccination, and lack of access to affordable vaccines for some HIV patients.

Many clinicians are aware of reports of reduced immunogenicity of hepatitis B vaccine among HIV patients (17.5% to 88.6% after 3 doses) compared with the U.S. population (>90%) (10, 37). These studies have reported an association between vaccine effectiveness and higher CD4 cell counts, but each has demonstrated that vaccination can be successful at all CD4 cell counts. Although we did not find substantially lower vaccination prevalence among patients with a CD4 count less than 0.200×10^9 cells/L, a previous study reported such an association (31). Federal guidelines recommend vaccinating all patients with HIV during their first visit, immediately after drawing blood for serologic testing, and not deferring vaccination of patients presenting with a low CD4 cell count (34–37). However, despite the uniformity of these guidelines, some widely used HIV treatment guides state that vaccination can or should be deferred until the CD4 count is greater than 0.200×10^9 cells/L (38–40), which may cause uncertainty among clinicians about the preferred practice. Furthermore, although research supports alternative vaccine doses and schedules for persons with HIV (41–43), the major guidelines offer no firm recommendations for these approaches. A clear statement in all guidelines that hepatitis B vaccination is recommended for all persons with HIV immediately upon initiation of care and consensus of recommendations across guidelines on vaccine dosage and vaccination schedule may enable clinicians to more consistently vaccinate all of their HIV patients.

Several studies have assessed strategies for increasing vaccination in health care facilities. The Advisory Committee on Immunization Practices and the Immunization Action Coalition encourage the use of standing orders for vaccination of adults in outpatient facilities (44, 45). Implementation of a nurse program for vaccination at 1 of the clinics in the Swiss HIV Cohort Study significantly increased the proportion of patients with hepatitis B immunity from 32% to 76% over a 3-year period (46). Use of a hepatitis B vaccination form placed in patients' charts led to an increase in vaccination from 67% to 79% in a British outpatient HIV clinic (47), suggesting that wider use of electronic clinical reminders may also be helpful. In addition, the U.S. Department of Health and Human Services recommends that facilities providing HIV/AIDS counseling, testing, or treatment vaccinate all patients for hepatitis B (35). However, the cost of hepatitis B vaccination may be a barrier to implementing these recommendations. The National Academy of Medicine reports substantial variation in vaccine coverage and payment policies among public and private

insurers. In addition, adults are not included in state systems for universal vaccine purchase and distribution (48). The National Academies of Sciences, Engineering, and Medicine recommend increasing funding for free hepatitis B vaccination for adults in order to achieve coverage goals (19, 48). The RWHAP allows use of funds to purchase and administer vaccines (49). However, the extent to which funds are used for this purpose is not known, and at least one quarter of HIV patients receive care at facilities that are not funded by RWHAP (32). Lack of coverage for vaccination by some RWHAP-funded facilities could help explain why vaccination prevalence is low even at these facilities.

Although many HIV patients are susceptible to HBV infection, approximately 5 out of 6 vaccine candidates had been prescribed at least 1 antiretroviral agent that is dually active against HBV, and two thirds were prescribed 2 dually active drugs. An analysis of the Swiss HIV Cohort suggests that these medications likely confer protection against HBV acquisition (50). Investigators reported an overall 70% reduction in the hazard of HBV infection among patients prescribed tenofovir alone, emtricitabine or lamivudine alone, or a combination of tenofovir and either emtricitabine or lamivudine compared with no reduction among patients prescribed other ART regimens. Patients in the Swiss HIV Cohort who were prescribed 2 dually active drugs had a 90% reduction in the hazard of incident HBV infection. However, although dually active ART may be effective for preventing HBV acquisition while it is being used, it should not be considered an alternative to vaccination, which may confer long-term immunity.

Our study had limitations. First, given the moderate response rate of our survey, nonresponse bias is possible. However, we used standard methods to mitigate this possibility. We collected information on all sampled patients and facilities and compared characteristics of respondents and nonrespondents; on the basis of the results of these nonresponse analyses, the data were weighted to minimize nonresponse bias. In addition, our probabilistic sampling frame was rigorously constructed and geographically diverse and included urban and rural clinics, public and private facilities, providers who saw many and few patients with HIV, and jurisdictions with varying prevalence of HIV infection. Empirical research suggests that low response rates do not necessarily indicate nonresponse bias, particularly when probabilistic samples are drawn from rigorously constructed frames (51). Second, the inclusion criterion requiring patients to have had a care visit during a 4-month window could have resulted in selection bias, with underrepresentation of persons receiving less frequent care. However, a sensitivity analysis using HIV Outpatient Study cohort data revealed no differences in clinical outcomes between patients with visits during January to April versus January to December (52). Third, incomplete availability of medical records from outside facilities could have resulted in measurement error, with misclassification of participants as candidates to initiate vaccination. Although all vaccination and laboratory data documented in outside medical records attached to the record at the sampled facility were recorded, if outside records had been universally available, our estimates of documented vaccination, immunity, and infection would likely have been at least marginally higher (53). Also, because medical record data were collected starting at the date of HIV diagnosis, patients with documentation of immunity, infection, or vaccination only before the date of diagnosis could have been misclassified as vaccination candidates. Fourth, the study was not designed to assess completion of the vaccine series or the actual prevalence of immunity among

persons with HIV. A single vaccine dose typically is not immunogenic. However, the absence of at least 1 dose is a clear indicator of a missed opportunity to initiate vaccination. Finally, testing and subsequent vaccination for hepatitis B may have increased recently in connection with 2012 recommendations for routine hepatitis C screening of all persons born between 1945 and 1965 (54).

In conclusion, more than one third of U.S. HIV patients have not been vaccinated for hepatitis B. Only 1 in 10 of these vaccination candidates was vaccinated in the course of 1 year of ongoing HIV care. Meeting goals for hepatitis B elimination will require a multifaceted approach to increasing vaccination of HIV patients. Particular attention should be focused on increasing vaccination of patients who receive care in private practices or at facilities that are not funded by RWHAP.

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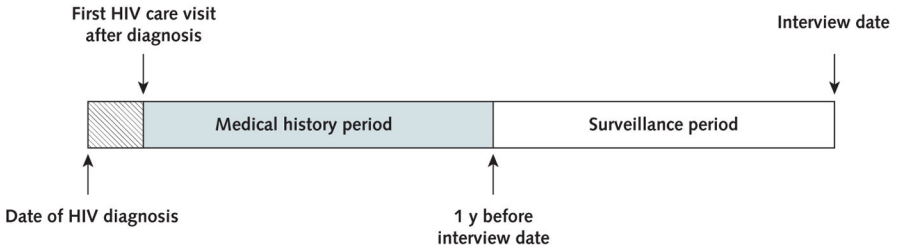

Figure 1.
Medical Monitoring Project data collection periods.

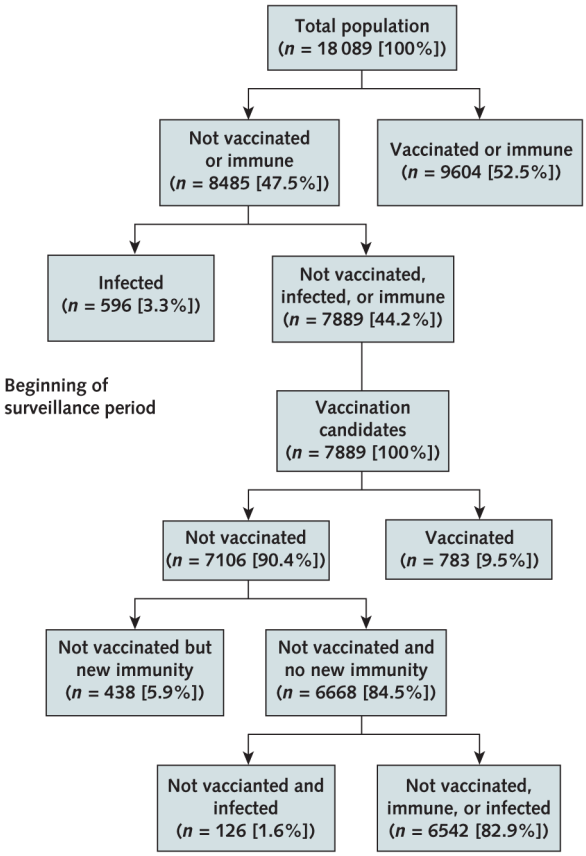

Figure 2.

Sample and population distribution.

Percentages are weighted percentages.

Table 1

Characteristics of Patients Receiving Care for HIV Infection in the United States, 2009–2012 (n = 18 089)

Characteristic	Participants Receiving Care for HIV Infection, *n*	Weighted Percentage (95% CI)
Race/ethnicity		
Non-Hispanic white	5893	34.4 (29.2–39.6)
Non-Hispanic black	7473	41.3 (34.7–47.9)
Hispanic/Latino*	3888	19.4 (15.2–23.5)
Other	835	4.9 (4.1–5.6)
Age		
18–29 y	1341	7.6 (6.8–8.4)
30–39 y	2841	16.0 (15.3–16.7)
40–49 y	6395	35.1 (34.2–35.9)
≥50 y	7512	41.3 (40.4–42.2)
Gender		
Male	13 060	72.4 (70.0–74.8)
Female	4780	26.2 (23.9–28.6)
Transgender	249	1.4 (1.2–1.6)
Sexual transmission risk category		
Men who have sex with men	8514	48.2 (44.2–52.1)
Men who have sex with women only	4419	23.4 (21.6–25.3)
Women who have sex with men	4651	25.6 (23.3–27.9)
Other	505	2.8 (2.5–3.1)
Injection drug use in previous 12 mo	444	2.2 (1.6–2.9)
Lowest HIV disease stage		
CDC-defined AIDS or nadir CD4 count of 0–0.199 × 10^9 cells/L	12 488	68.6 (67.6–69.6)
No CDC-defined AIDS and nadir CD4 count of 0.200–0.499 × 10^9 cells/L	4325	24.4 (23.5–25.3)
No CDC-defined AIDS and nadir CD4 count ≥0.500 × 10^9 cells/L	1208	7.0 (6.5–7.5)
Mean CD4 count in previous 12 mo		
0–0.199 × 10^9 cells/L	2112	11.9 (11.2–12.7)
0.200–0.499 × 10^9 cells/L	6831	39.6 (38.6–40.6)

Characteristic	Participants Receiving Care for HIV Infection, *n*	Weighted Percentage (95% CI)
≥0.500 × 10^9 cells/L	8322	48.5 (47.3–49.6)
Prescribed antiretroviral therapy in previous 12 mo	16 523	91.1 (90.5–91.6)
Most recent HIV viral load undetectable or <200 copies/mL	13 559	74.8 (73.5–76.0)
Site where care received[†]		
RWHAP-funded (vs. nonfunded) facility	12 289	72.9 (67.4–78.4)
Community health center (vs. non–community health center)	4877	37.9 (31.0–44.8)
Private (vs. nonprivate) practice	4818	43.9 (35.8–51.9)
Facility HIV caseload		
<50 patients	1279	7.7 (6.3–9.2)
50–400 patients	6777	40.8 (36.8–44.9)
>400 patients	10 033	51.4 (48.3–54.6)
Candidate to initiate hepatitis B vaccination[‡]		
At beginning of surveillance period	7889	44.2 (42.2–46.2)
At end of surveillance period	6542	36.7 (34.4–38.9)

CDC = Centers for Disease Control and Prevention; RWHAP = Ryan White HIV/AIDS Program.

[*] Regardless of race.

[†] Percentages sum to >100 because facility characteristics are independent variables (e.g., an RWHAP-funded facility could also be a community health center).

[‡] Patients who had no medical record documentation of vaccination (defined as having received ≥1 dose of hepatitis B vaccine or combination hepatitis A/B vaccine or documentation that the reason for vaccination deferral was previous vaccination), immunity (defined as a positive result on hepatitis B surface antibody testing in the medical record), or infection (defined as any positive result on hepatitis B surface antigen or hepatitis B core antibody IgM testing or having detectable hepatitis B virus DNA). The surveillance period was defined as the 1-y interval ending on the date of the patient interview.

Table 2

Status of Candidates to Initiate Hepatitis B Vaccination at the End of 1 Year of Ongoing HIV Care in the United States, 2009–2012 (n = 7889)

Vaccination and Laboratory Status	Participants Who Were Candidates, *n*	Weighted Percentage (95% CI)
Vaccinated *	783	9.6 (8.4–10.8)
Not vaccinated but new medical record documentation of infection or immunity †	564	7.5 (6.4–8.6)
Continuing candidates to initiate vaccination	6542	82.9 (81.1–84.7)
Prescription of ART regimen dually active against HBV		
Tenofovir only	214	2.8 (2.3–3.2)
Lamivudine or emtricitabine only	1371	17.1 (15.9–18.3)
Tenofovir and either lamivudine or emtricitabine	5114	64.8 (63.2–66.4)

ART = antiretroviral therapy; HBV = hepatitis B virus; tenofovir = tenofovir disoproxil fumarate.

* Defined as documentation of ≥1 dose of hepatitis B vaccine or combination hepatitis A/B vaccine.

† Infection was defined as a positive result on hepatitis B surface antigen or hepatitis B core antibody IgM testing or detectable HBV DNA. Immunity was defined as a positive result on hepatitis B surface antibody testing.

Table 3

Percentages of Candidates to Initiate Hepatitis B Vaccination Who Were Vaccinated During 1 Year of Ongoing HIV Care in the United States, 2009–2012 (n = 7257): Stratified by Facility Characteristics and Service Needs*

Variable	Candidates Who Were Vaccinated, *n*	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value
Site where care received			
RWHAP-funded facility			
Yes	629	12.5 (11.1–13.9)	<0.001
No	83	3.7 (2.6–4.7)	
Community health center			
Yes	237	12.4 (10.5–14.2)	<0.001
No	475	8.5 (7.3–9.7)	
Private practice			
Yes	124	5.6 (4.2–6.9)	<0.001
No	588	11.8 (10.3–13.3)	
Facility HIV caseload			
<50 patients	56	9.7 (6.2–13.2)	0.76
50–400 patients	254	9.0 (6.9–11.2)	
>400 patients	402	9.9 (8.6–11.2)	
Unmet need			
Transportation			
Yes	72	10.7 (7.0–14.4)	0.41
No	639	9.4 (8.3–10.6)	
Meals/food services			
Yes	68	12.4 (8.9–16.0)	0.027
No	643	9.3 (8.1–10.5)	
Housing or shelter			
Yes	69	11.7 (8.5–14.9)	0.098
No	642	9.3 (8.1–10.6)	

RWHAP = Ryan White HIV/AIDS Program.

* Candidates were patients with HIV without evidence of vaccination, infection, or immunity during the surveillance period who received care at facilities with known RWHAP funding status. Percentages do not sum to 100 because they are the percentage of patients within each level of several variables who were vaccinated. For example, 12.5% of patients who received care at an RWHAP-funded facility were vaccinated.

Table 4

Percentages of Candidates to Initiate Hepatitis B Vaccination Who Were Vaccinated During 1 Year of Ongoing HIV Care in the United States, 2009–2012 (n = 7257): Stratified by Clinical and Sociodemographic Characteristics*

Variable	Candidates Who Were Vaccinated, *n*	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value
Disease stage			
CDC-defined AIDS or nadir CD4 count of 0–0.199 × 10^9 cells/L	449	8.5 (7.3–9.7)	<0.001
No CDC-defined AIDS and nadir CD4 count of 0.200–0.499 × 10^9 cells/L	214	13.1 (11.0–15.3)	
No CDC-defined AIDS and nadir CD4 count ≥0.500 × 10^9 cells/L	47	8.9 (6.2–11.7)	
Mean CD4 count in previous 12 mo			
0–0.199 × 10^9 cells/L	116	11.3 (9.1–13.6)	<0.001
0.200–0.499 × 10^9 cells/L	337	12.0 (10.3–13.8)	
≥0.500 × 10^9 cells/L	247	7.7 (6.4–9.1)	
Antiretroviral therapy prescription			
Yes	627	9.3 (8.0–10.5)	0.071
No	85	11.7 (8.6–14.8)	
Most recent HIV viral load undetectable or <200 copies/mL			
Yes	494	9.3 (8.0–10.6)	0.29
No	218	10.1 (8.4–11.9)	
HCV infection†			
Yes	113	7.8 (5.8–9.7)	0.061
No	599	9.9 (8.5–11.3)	
Men who have sex with men			
Yes	276	7.8 (6.6–9.1)	<0.001
No	436	11.1 (9.5–12.7)	
Multiple opposite-sex partners in previous 12 mo‡			
Yes	46	11.1 (7.3–14.8)	0.32
No	666	9.4 (8.2–10.7)	
Injection drug use in previous 12 mo			
Yes	16	6.9 (3.1–10.7)	0.23

Variable	Candidates Who Were Vaccinated, *n*	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value
No	694	9.6 (8.3–10.9)	
Homeless in previous 12 mo			
Yes	97	14.0 (10.5–17.5)	<0.001
No	615	9.1 (7.9–10.3)	
Income at or below the federal poverty level in previous 12 mo			
Yes	381	11.5 (9.7–13.3)	<0.001
No	301	7.9 (6.7–9.2)	
Incarcerated in previous 12 mo			
Yes	54	12.0 (8.4–15.6)	0.081
No	658	9.4 (8.1–10.6)	
Race/ethnicity			
Non-Hispanic white	157	6.3 (4.9–7.6)	<0.001
Non-Hispanic black	365	12.1 (10.4–13.9)	
Hispanic/Latino	156	9.7 (7.7–11.6)	
Other	34	9.9 (6.2–13.6)	
Age			
18–29 y	101	18.2 (14.6–21.8)	<0.001
30–39 y	170	15.0 (12.6–17.3)	
40–49 y	241	9.4 (7.5–11.2)	
≥50 y	200	6.1 (4.9–7.2)	
Gender			
Male	494	9.1 (7.8–10.4)	0.011
Female	203	10.2 (8.3–12.1)	
Transgender	15	21.0[§] (8.2–33.8)	
Education			
Less than high school	185	11.6 (9.5–13.7)	<0.001
High school or equivalent	225	10.5 (8.7–12.3)	
Above high school	302	8.2 (6.9–9.5)	
Income below federal poverty level			
Yes	381	11.5 (9.7–13.3)	<0.001

Variable	Candidates Who Were Vaccinated, *n*	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value
No	301	7.9 (6.7–9.2)	
Health insurance			
Any private insurance	168	7.6 (6.2–9.0)	<0.001
Public only	337	8.7 (7.4–10.0)	
RWHAP only	139	14.2 (11.1–17.4)	
Uninsured	41	18.9 (12.6–25.3)	
Unspecified	22	13.3 (8.1–18.6)	

CDC = Centers for Disease Control and Prevention; HCV = hepatitis C virus; RWHAP = Ryan White HIV/AIDS Program.

[*] Candidates were patients with HIV without evidence of vaccination, infection, or immunity during the surveillance period who received care at facilities with known RWHAP funding status. Percentages do not sum to 100 because they are the percentage of patients within each level of several variables who were vaccinated. For example, 11.3% of patients with a mean CD4 count of 0 to 0.199×10^9 cells/L in the previous 12 mo were vaccinated.

[†] Any positive results on HCV antibody testing.

[‡] The CDC recommends defining this as >1 partner in the previous 6 mo.

[§] The coefficient of variation is >0.3; thus, this estimate is unstable.

Ann Intern Med. Author manuscript; available in PMC 2018 August 20.

Appendix Table

Percentages of Candidates to Initiate Hepatitis B Vaccination in the United States Who Were Vaccinated During 1 Year of Ongoing HIV Care, Overall and at RWHAP-Funded and Nonfunded Facilities, Stratified by Facility Characteristics and Service Needs, 2009–2012 *

Variable	All Patients (*n* = 712)			Patients at Facilities With RWHAP Funding (*n* = 629)			Patients at Facilities Without RWHAP Funding (*n* = 83)		
	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value
Total vaccinated	712	9.5 (8.3–10.8)		629	87.1 (82.9–91.3)		83	12.9 (8.7–17.1)	
Characteristic									
Lowest disease stage									
CDC-defined AIDS or nadir CD4 count of 0–0.199 × 10^9 cells/L	449	8.5 (7.3–9.7)	<0.0001	402	11.2 (9.9–12.4)	<0.0001	47	3.1 (2–4.2)	0.03
No CDC-defined AIDS and nadir CD4 count of 0.200–0.499 × 10^9 cells/L	214	13.1 (11–15.3)		184	16.9 (14.2–19.6)		30	5.8 (3.4–8.3)	
No CDC-defined AIDS and nadir CD4 count =0.500 × 10^9 cells/L	47	8.9 (6.2–11.7)		41	13 (9.4–16.6)		6	2.7 (0.4–5.1)	
CD4 count									
0–0.199 × 10^9 cells/L	116	11.3 (9.1–13.6)	<0.0001	103	13.8 (11.4–16.2)	<0.0001	13	5 (2.2–7.7)	0.05
0.200–0.499 × 10^9 cells/L	337	12 (10.3–13.8)		303	15.3 (13.3–17.2)		34	4.8 (2.7–7)	
≥0.500 × 10^9 cells/L	247	7.7 (6.4–9.1)		215	10.8 (8.9–12.6)		32	2.6 (1.6–3.6)	
ART prescription									
Yes	627	9.3 (8–10.5)	0.07	552	12.2 (10.7–13.7)	0.10	75	3.6 (2.5–4.7)	0.71
No	85	11.7 (8.6–14.8)		77	15.5 (11.4–19.6)		8	4.1 (1.3–7)	
Most recent HIV viral load undetectable or <200 copies/mL									
Yes	494	9.3 (8–10.6)	0.29	432	12.5 (10.8–14.1)	0.90	62	3.6 (2.4–4.8)	0.77
No	218	10.1 (8.4–11.9)		197	12.6 (10.7–14.5)		21	3.9 (2.3–5.4)	

Variable	All Patients (n = 712)			Patients at Facilities With RWHAP Funding (n = 629)			Patients at Facilities Without RWHAP Funding (n = 83)		
	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test P Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test P Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test P Value
HCV infection†									
Yes	113	7.8 (5.8–9.7)	0.06	102	9.1 (6.6–11.5)	0.002	11	3.5 (1.5–5.4)	0.87
No	599	9.9 (8.5–11.3)		527	13.3 (11.9–14.7)		72	3.7 (2.5–4.8)	
Men who have sex with men									
Yes	276	7.8 (6.6–9.1)	<0.0001	228	11.2 (9.3–13)	0.04	48	3.4 (2.2–4.6)	0.42
No	436	11.1 (9.5–12.7)		401	13.5 (11.7–15.2)		35	4 (2.7–5.4)	
Others with multiple sex partners‡									
Yes	46	11.1 (7.3–14.8)	0.32	44	12.9 (8.9–17)	0.82	2	2 (0–4.9)	0.42
No	666	9.4 (8.2–10.7)		585	12.5 (11.1–13.9)		81	3.7 (2.6–4.8)	
Injection drug use in previous 12 mo									
Yes	16	6.9 (3.1–10.7)	0.23	15	9 (3.5–14.6)	0.26	1	2.5 (0–7)	0.65
No	694	9.6 (8.3–10.9)		612	12.6 (11.2–14.1)		82	3.7 (2.7–4.7)	
Homeless in previous 12 mo									
Yes	97	14 (10.5–17.5)	0.0004	89	15.5 (11.8–19.2)	0.05	8	7.7 (3.1–12.4)	0.01
No	615	9.1 (7.9–10.3)		540	12.2 (10.7–13.6)		75	3.4 (2.4–4.5)	
Income in previous 12 mo									
<100% of FPL	381	11.5 (9.7–13.3)	<0.0001	355	13.2 (11.4–15.1)	0.35	26	4.5 (2.5–6.5)	0.53
100%–138% of FPL	104	8.1 (6.3–9.9)		98	10.6 (8.3–12.9)		6	2.3 (0.5–4.2)	
139%–399% of FPL	145	8.9 (7.1–10.7)		123	12.8 (9.9–15.8)		22	3.5 (1.5–5.4)	
≥400% of FPL	52	5.8 (4.1–7.5)		27	11.6 (7.8–15.3)		25	3.5 (2.1–5)	

Ann Intern Med. Author manuscript; available in PMC 2018 August 20.

Variable	All Patients (n = 712)			Patients at Facilities With RWHAP Funding (n = 629)			Patients at Facilities Without RWHAP Funding (n = 83)		
	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test P Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test P Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test P Value
Incarcerated in previous 12 mo									
Yes	54	12 (8.4–15.6)	0.08	52	14.2 (10.4–18)	0.35	2	2.4 (0–6.5)	0.61
No	658	9.4 (8.1–10.6)		577	12.4 (10.9–13.9)		81	3.7 (2.7–4.7)	
Race/ethnicity									
Non-Hispanic white	157	6.3 (4.9–7.6)	<0.0001	119	10 (7.9–12.1)	0.02	38	2.9 (1.8–3.9)	0.18
Non-Hispanic black	365	12.1 (10.4–13.9)		334	14.3 (12.4–16.2)		31	5.1 (3–7.3)	
Hispanic/Latino	156	9.7 (7.7–11.6)		145	11.4 (8.6–14.1)		11	3.8 (1.3–6.2)	
Other	34	9.9 (6.2–13.6)		31	13 (8.3–17.8)		3	3.4 (0–7.6)	
Age									
18–29 y	101	18.2 (14.6–21.8)	<0.0001	92	20.6 (16.3–24.8)	<0.0001	9	9.8 (4.1–15.4)	0.002
30–39 y	170	15 (12.6–17.3)		152	18.7 (15.8–21.5)		18	5.8 (2.5–9.2)	
40–49 y	241	9.4 (7.5–11.2)		214	12.7 (10.6–14.8)		27	3.2 (1.5–4.9)	
≥50 y	200	6.1 (4.9–7.2)		171	8 (6.4–9.7)		29	2.7 (1.7–3.7)	
Gender									
Male	494	9.1 (7.8–10.4)	0.01	432	12.3 (10.7–13.9)	0.13	62	3.4 (2.3–4.6)	0.16
Female	203	10.2 (8.3–12.1)		184	12.4 (10.1–14.8)		19	4.1 (2.3–5.9)	
Transgender	15	21[§] (8.2–33.8)		13	23.4[§] (8–38.7)		2	12.6[§] (0–31.9)	
Education									
Less than high school	185	11.6 (9.5–13.7)	0.0002	176	13.4 (11.1–15.7)	0.16	9	4 (1.2–6.8)	0.82
High school or equivalent	225	10.5 (8.7–12.3)		207	13.3 (11.2–15.4)		18	3.2 (1.4–4.9)	

Variable	All Patients (*n* = 712)			Patients at Facilities With RWHAP Funding (*n* = 629)			Patients at Facilities Without RWHAP Funding (*n* = 83)		
	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value
Above high school	302	8.2 (6.9–9.5)		246	11.5 (9.9–13.2)		56	3.8 (2.6–5)	
Income below FPL									
Yes	381	11.5 (9.7–13.3)	<0.0001	355	13.2 (11.4–15.1)	0.24	26	4.5 (2.5–6.5)	0.29
No	301	7.9 (6.7–9.2)		248	11.8 (10–13.7)		53	3.3 (2.1–4.5)	
Health insurance									
Any private insurance	168	7.6 (6.2–9)	<0.0001	125	13.2 (10.7–15.6)	0.003	43	3.4 (2–4.8)	<0.0001
Public only	337	8.7 (7.4–10)		312	10.9 (9.4–12.4)		25	2.7 (1.7–3.7)	
RWHAP only	139	14.2 (11.1–17.4)		127	14 (10.9–17.1)		12	16.7 (5.1–28.4)	
Uninsured	41	18.9 (12.6–25.3)		39	20.3 (13.4–27.2)		2	6.6 (0–15.8)	
Unspecified	22	13.3 (8.1–18.6)		21	15.6 (9.5–21.7)		1	1.7 (0–5.3)	
Unmet need									
Transportation									
Yes	72	10.7 (7–14.4)	0.41	69	13.8 (9.5–18.1)	0.48	3	1.5 (0–3.3)	0.10
No	639	9.4 (8.3–10.6)		559	12.4 (11–13.8)		80	3.8 (2.7–4.9)	
Meals/food services									
Yes	68	12.4 (8.9–16)	0.03	67	16 (12–19.9)	0.04	1	0.8 (0–2.3)	0.07
No	643	9.3 (8.1–10.5)		561	12.2 (10.8–13.7)		82	3.8 (2.7–4.9)	
Housing									
Yes	69	11.7 (8.5–14.9)	0.10	66	14.4 (10.8–18.1)	0.26	3	2.1 (0–4.5)	0.28
No	642	9.3 (8.1–10.6)		562	12.3 (10.8–13.8)		80	3.7 (2.7–4.8)	
Site where care received									
RWHAP-funded									

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Variable	All Patients (*n* = 712)			Patients at Facilities With RWHAP Funding (*n* = 629)			Patients at Facilities Without RWHAP Funding (*n* = 83)		
	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value	Number	Weighted Percentage (95% CI)	Rao–Scott Chi-Square Test *P* Value
Yes	629	12.5 (11.1–13.9)	<0.0001						
No	83	3.7 (2.6–4.7)							
Community health center									
Yes	237	12.4 (10.5–14.2)	<0.0001	234	12.8 (10.9–14.7)	0.72	3	3.6 (0.6–6.6)	0.98
No	475	8.5 (7.3–9.7)		395	12.3 (10.5–14.2)		80	3.7 (2.6–4.7)	
Private practice									
Yes	124	5.6 (4.2–6.9)	<0.0001	67	12 (8.9–15.1)	0.74	57	3.3 (2.2–4.3)	0.03
No	588	11.8 (10.3–13.3)		562	12.6 (11–14.2)		26	5.2 (3.1–7.3)	
Facility HIV caseload									
<50 patients	56	9.7 (6.2–13.2)	0.77	43	18.5 (12.8–24.2)	0.007	13	4.1 (1.5–6.7)	0.91
50–400 patients	254	9 (6.9–11.2)		208	13.9 (11.4–16.4)		46	3.5 (2.2–4.9)	
400 patients	402	9.9 (8.6–11.2)		378	11.3 (9.7–12.8)		24	3.6 (2.1–5.2)	

ART = antiretroviral therapy; CDC = Centers for Disease Control and Prevention; FPL = federal poverty level; HCV = hepatitis C virus; RWHAP = Ryan White HIV/AIDS Program.

*7257 participants who were candidates initiated vaccination. These candidates had no evidence of infection or immunity during the surveillance period and received care at facilities with known RWHAP funding status. Percentages do not sum to 100 because they are the percentage of patients within each level of several variables who were vaccinated. For example, 11.3% of patients with a mean CD4 count of 0 to 0.199 × 10^9 cells/L in the previous 12 mo were vaccinated.

†Any positive result on testing for HCV infection (HCV antibodies, HCV RNA, and HCV genotype).

‡The CDC recommends defining this as >1 partner in the previous 6 mo, but this measure is for >1 partner in the previous 12 mo.

§The coefficient of variation is >0.3; thus, this estimate is unstable.