

Are Future Health Care Workers Protected Against Hepatitis B Virus Infection? Hepatitis B Vaccination Coverage and Seroprotection Among Healthcare Students at an Academic Institution in the United States, 2000 – 2010

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Introduction

- The Centers for Disease Control and Prevention (CDC) and the Advisory Committee for Immunization Practices (ACIP) Hepatitis B vaccination recommendations:
 - 1982: Hepatitis B vaccination recommended for health care workers
 - 1990's: Post-vaccination antibody to hepatitis B surface antigen [anti-HBs] testing recommended for health care workers
 - 1995: Routine vaccination of unvaccinated children aged 11-12 years
 - 1999: Routine vaccination of unvaccinated children aged < 18 years
- Healthy People 2010 goal of achieving 90% hepatitis B vaccination coverage among health care workers set as a benchmark for the elimination of occupationally acquired hepatitis B infection in the United States.
- 8% of needle stick injuries among medical students involve a known hepatitis B carrier.
- Little or no information is available regarding hepatitis B vaccination coverage among health care students in the United States.

Objectives

- Estimate coverage and documentation of Hepatitis B vaccination
- Assess documentation of anti-HBs concentration
- Estimate seroprotection rates (anti-HBs concentration ≥ 10 mIU/mL) and determine factors associated with seroprotection
- Evaluate implementation of the 1995 and 1999 ACIP recommendations in a cohort of medical, nursing, and allied health students (health care students) upon enrollment at an academic institution in the United States.

Methods

- Target Population**
 - Matriculating health care students between January 2000 and January 2010 at a university in the southeastern United States
- Data Source**
 - Hepatitis B immunization electronic records
- Statistical Analysis**
 - Continuous data were reported as median along with the range.
 - Categorical data were reported as percentages.
 - Fisher's exact test was performed to determine factors associated with anti-HBs ≥ 10 mIU/mL.
 - A p-value <0.05 was considered statistically significant.

Results

Figure 1. Completeness of documentation of hepatitis B vaccination and anti-HBs concentration

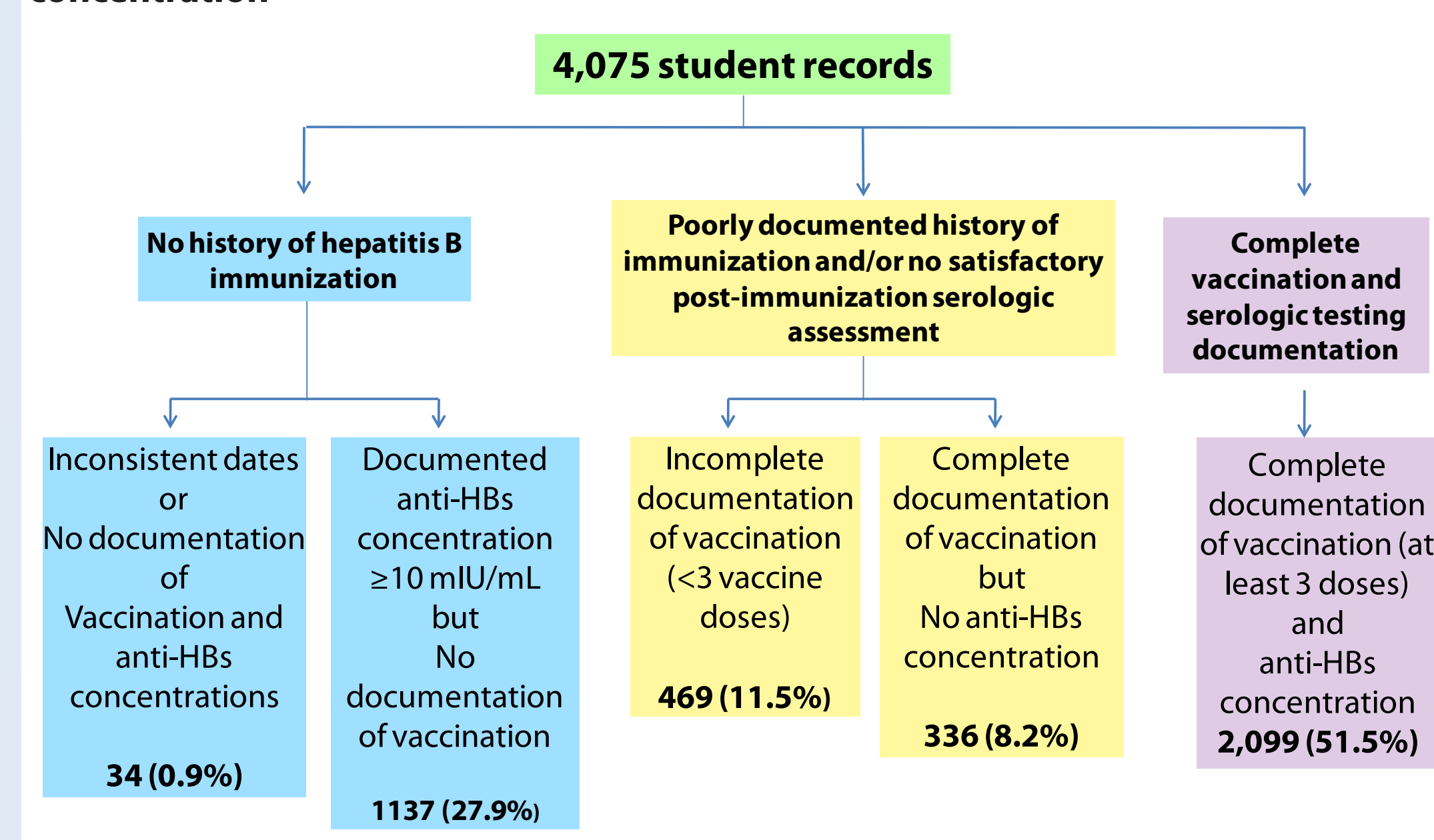


Table 1. Age at vaccination and seroprotection characteristics of health care students, by number of recorded lifetime doses of hepatitis B vaccine received

	Total number of documented vaccine doses in the student database		
	< 3 doses N= 1634	3 doses N= 2168	>3 doses N=267
Age at primary hepatitis B vaccination series, years			
Dose 1, median age (range)	23.5 ^a (3.4 – 56.6)	22.0 (0 – 59.6)	19.4 (0 – 56.4)
Dose 2, median age (range)	24.1 ^b (7.1 – 47.9)	22.2 (0.08 – 59.7)	20.3 (0.5 – 56.5)
Dose 3, median age (range)	-	22.9 (0.5 – 60.1)	21.5 (2.0 – 56.9)
Students with available anti-HBs concentration post primary series vaccination, n (%)	1489/1634 (91.1%)	1918/2168 (88.5%)	181/267 (67.8%)
Age at post-vaccine anti-HBs concentration, years median (range)	24.0 (8.8 – 62.9)	24.0 (14.1 – 60.2)	23.9 (18.7 – 60.3)
Interval between primary series and first anti-HBs concentration, months median (range)	8.4 (0.5 – 172.8)	7.6 (0.06 – 256.8)	42.0 (1.2 – 172.8)
Post-primary series anti-HBs concentration ≥ 10 mIU/mL, n (%)^c	1382/1489 (92.8%)	1898/1918 (98.9%)	20/181 (11.0%)

^a n=469 students; ^b n= 186 students; ^c Among students with available anti-HBs concentration before administration of booster dose(s).

Table 2. Immune status of students after the primary vaccination series by duration between vaccination and anti-HBs concentration and age at vaccination

	Anti HBs concentration after primary vaccine series				P-value ^a
	<10 mIU/mL		≥ 10 mIU/mL		
	n	%	n	%	
Total	181	8.6	1918	91.4	
Interval between primary series and anti-HBs					<0.001
< 5 years	117	7.2	1499	92.8	
5 to < 10 years	51	12.8	346	87.2	
10 to < 15 years	13	16.5	66	83.5	
≥ 15 years	0	0.0	7	100.0	
Age at primary vaccine series					0.2
<1 years	0	0.0	6	100.0	
1 to <5 years	0	0.0	1	100.0	
5 to <11 years	5	26.3	14	73.7	
11 to <20 years	73	12.9	494	87.1	
20 to < 30 years	75	6.0	1178	94.0	
30 to < 40 years	23	11.7	173	88.3	
≥ 40 years	5	8.8	52	91.2	

^a Fisher's exact test

Figure 2. Distribution of years of birth and year of completion of primary vaccination series among matriculating healthcare students, 2000-2009

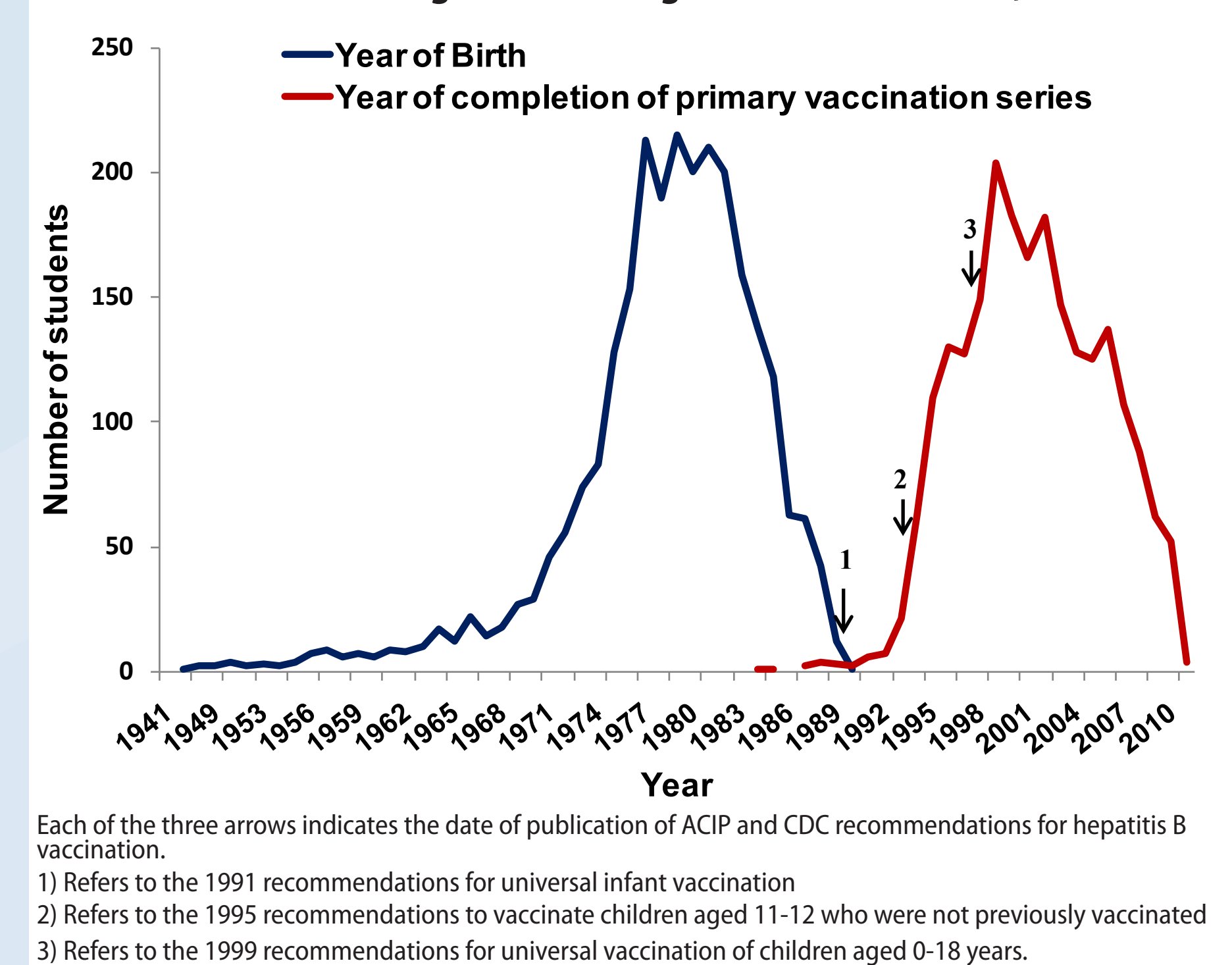


Table 3. Response to booster dose(s) among students with anti-HBs < 10 mIU/mL after completion of the primary vaccine series

No. booster doses	No. students ¹	No. students with anti-HBs results after each booster dose ²	Anti-HBs ≥ 10 mIU/mL n (%) ³
1	184	100	95 (63.3)
2	32	19	17 (11.3)
3	39	28	20 (13.3)
≥ 4	3	3	3 (2.0)
Total	258	150	135 (90.0)

¹ Number of students with a recorded value and date for receipt of a booster dose
² The number of students with available anti-HBs results after that particular booster dose
³ Percentages calculated out of the 150 students with available anti-HBs levels after booster doses

Conclusions

- This study is the first to assess hepatitis B vaccination coverage and seroprotection among US healthcare students since the expansion of vaccination recommendations.
- Of 4,075 health care students
 - 40.2% lacked complete documentation of vaccination
 - 83.8% had evidence of anti-HBs ≥ 10 mIU/mL.
- These numbers have significant implications as health care students are at risk for exposure to hepatitis B virus during their training and later during their career.
- Vaccination and documentation of anti-HBs concentration upon matriculation helps decrease risk of infection and guide the need for post exposure prophylaxis in case of exposure.
- Only a small proportion of health care students were vaccinated according to ACIP recommendations in effect during their childhood and adolescence.
 - 4.3% of students aged 11-12 years between 1995 and 1997, were vaccinated during that time period
 - 15.3% of students aged <18 years between 1999 and 2001 were vaccinated according to the 1999 ACIP recommendations
- High rate of response to booster doses consistent with literature

Recommendations

- The ease of accessibility to health care students at the beginning of their studies, before their exposure to blood borne pathogens, provides an opportunity for educational institutions to protect the future health care workforce and the public against hepatitis B.
- For health care student vaccination databases, collection of serologic data to exclude the possibility of previously-acquired hepatitis B infection among non-responders in addition to post-vaccination test results, could provide a resource to enrich our understanding of long-term protection provided by hepatitis B vaccine in future studies.

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