

Association between delay of first hepatitis B vaccine and delayed completion of hepatitis B vaccination in the Military Health System, 2014-2017

Jessica Fung Deerin^a, PhD, MPH, Rebecca Clifton^a, PhD, Angelo Elmi^b PhD, Paul Lewis^c, MD, MPH, Irene Kuo^a, PhD, MPH

^aThe George Washington University, Milken Institute School of Public Health, Department of Epidemiology, ^bThe George Washington University, Milken Institute School of Public Health, Department of Biostatistics and Bioinformatics, ^cDefense Health Agency, Armed Forces Health Surveillance Branch

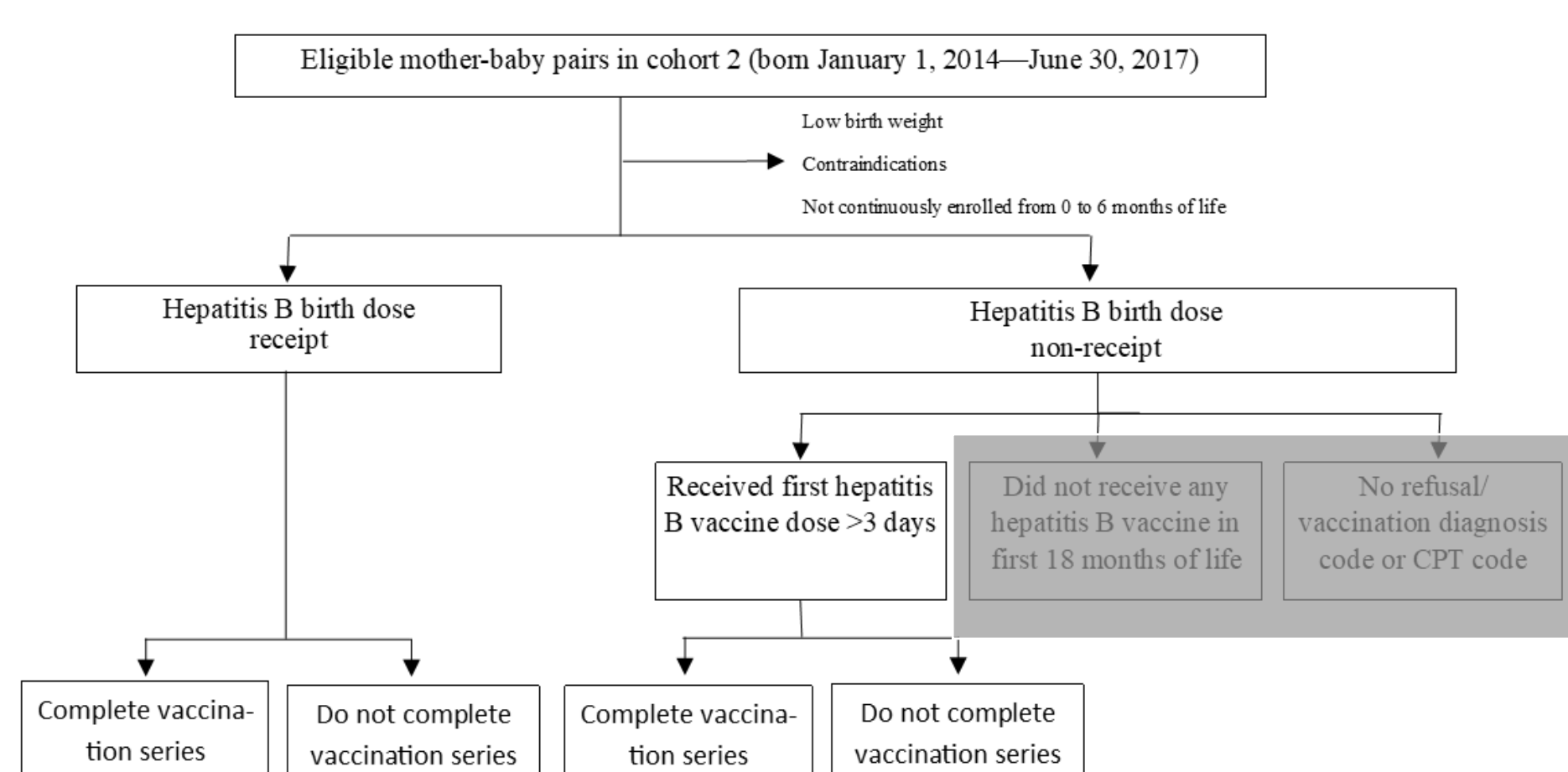
Background

The first dose of the hepatitis B (HepB) vaccine is recommended to be given within 24 hours of birth for all medically stable children. Parents may consider not receiving the birth dose and delaying the first dose. However, delay of the first HepB vaccine is associated with incomplete vaccination by the up-to-date time frame. Annual vaccination coverage rates for HepB vaccination completion are typically based on completion at the time of evaluation (age 19 to 35 months), called up-to-date vaccination coverage. The up-to-date vaccination coverage rates do not take into consideration whether the vaccines were completed by age-appropriate Advisory Committee on Immunization Practices (ACIP) recommendations. The children may have completed the vaccine series at the time of the survey, but may have been undervaccinated the majority of their first year of life when exposure to the hepatitis B virus is more likely to lead to chronic hepatitis B. Age-appropriate vaccination was defined as completing the series by 7 months and up-to-date vaccination was defined as completing the series by 19 months. There is little known on timeliness of completing the vaccination series at an age-appropriate time in a U.S. population. This study assesses the impact of delaying the first HepB vaccine on timeliness of completing the series.

Methods

We utilized survival analysis methods on administrative claims data from the Military Health System (MHS) among children who received the first dose of the HepB vaccination series and who were born from January 1, 2014 through June 30, 2017. We assessed HepB vaccination coverage rates by 7 months and 19 months. We compared Kaplan-Meier survival curves of children who received and delayed the birth dose. Multilevel Cox proportional hazards models were used to determine factors associated with delayed timeliness of completing the HepB vaccination series.

Figure 1. Data generation flow chart



Results

Overall, 97% of children received the HepB birth dose, 57.9% of children completed the HepB vaccine series by 7 months and 69.1% of children completed the series by 19 months. Of the 92,744 children who received the birth dose, 58% completed the series by 7 months of age. Of the 2,409 children who delayed the first HepB vaccine >3 days of life, 43% completed the series by 7 months of age. Children who delayed the first HepB vaccine >3 days were 40% less likely to have timely completion of the HepB vaccination series compared to those who received the birth dose (aHR=0.60, 95% CI: 0.57, 0.63). Other factors associated with delayed completion of the HepB vaccination series include later birth order, earlier year of birth, white maternal race, younger maternal age, and being in the Air Force.

Table 1. Timeliness of completing hepatitis B vaccination series over time, January 1, 2014 – June 30, 2017

Year of Birth	Total	Complete HepB vaccination by 7 months	Complete HepB vaccination by 19 months	Censored
2014	29,885	16,590 (55.5%)	20,771 (69.5%)	9,114 (30.5%)
2015	28,893	16,600 (57.5%)	20,457 (70.8%)	8,436 (29.2%)
2016	25,612	15,476 (60.4%)	18,570 (72.5%)	7,042 (27.5%)
2017	10,763	6,421 (59.7%)	7,710 (71.6%)	3,053 (28.4%)
Overall	95,153	55,087 (57.9%)	67,508 (69.1%)	27,645 (29.1%)

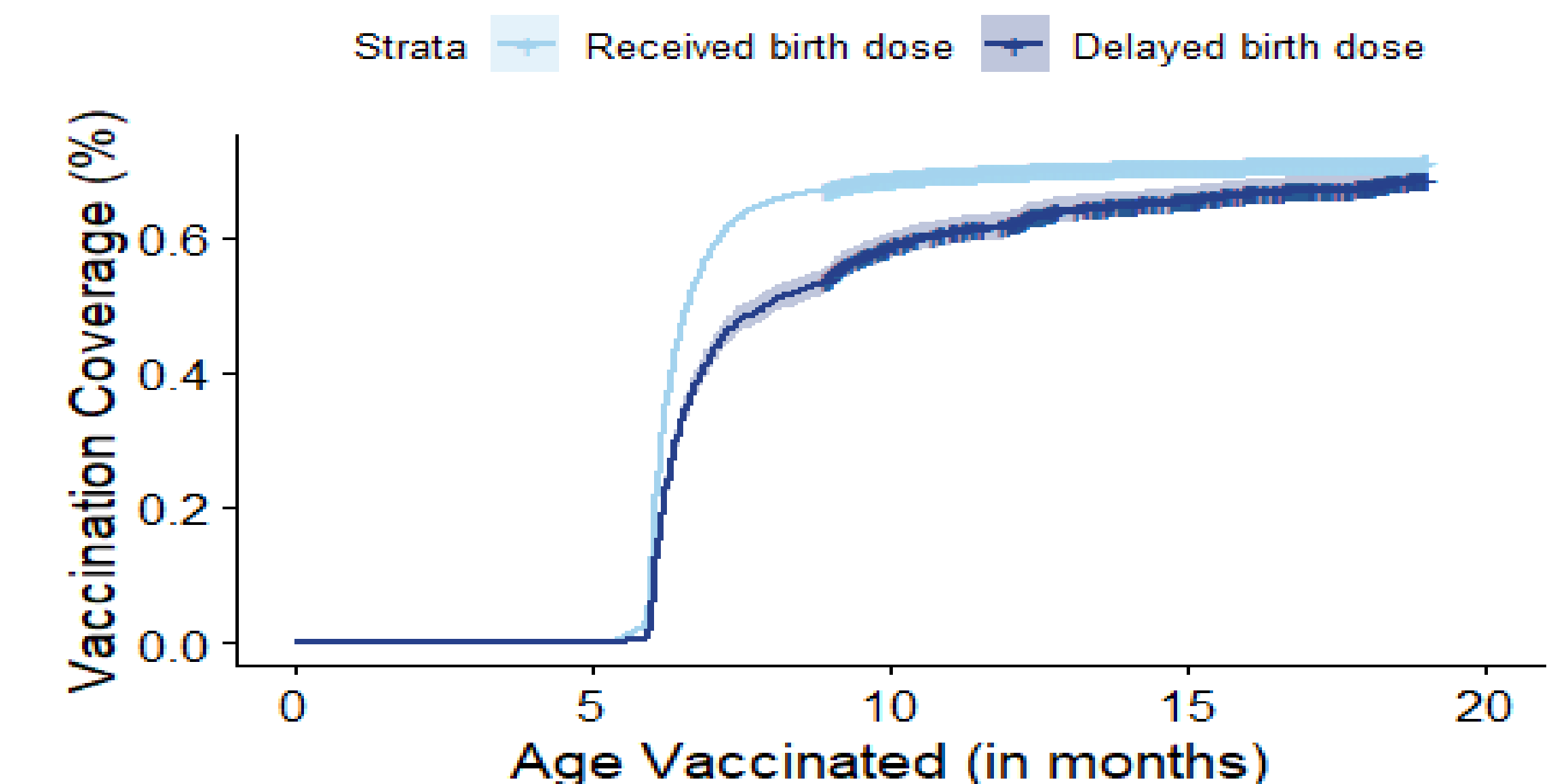
Table 2. Factors associated with timely receipt of hepatitis B completion among children born in the Military Health System, January 1, 2014 - June 30, 2017

	aHR (95% CI)
Delay of HepB birth dose	
Receipt	Ref
★ Delay	0.60 (0.57, 0.63)
Birth Order	
1	Ref
2	0.85 (0.83, 0.86)
3	0.80 (0.78, 0.82)
4	0.77 (0.74, 0.79)
★ 5	0.75 (0.71, 0.79)
>5	0.71 (0.66, 0.77)
Other	0.33 (0.24, 0.45)
Year	
★ 2014	Ref
2015	1.02 (1.00, 1.04)
2016	1.12 (1.10, 1.14)
2017	1.11 (1.08, 1.14)
Maternal Race	
★ White	Ref
Asian	1.09 (1.05, 1.13)
Black	1.02 (0.99, 1.04)
Other/Unknown	0.98 (0.96, 0.1.00)
Maternal Age	
★ Under 20	Ref
20-24	1.13 (1.07, 1.18)
25-29	1.29 (1.23, 1.35)
30-34	1.38 (1.31, 1.45)
35 and over	1.43 (1.35, 1.51)
Military Branch	
Army	Ref
★ Air Force	0.23 (0.22, 0.24)
Marine Corps	0.96 (0.92, 1.00)
Navy	0.93 (0.90, 0.96)
Other	0.88 (0.82, 0.94)

Table 3. Overall Hepatitis B vaccination completion

Age	Received the HepB birth dose	Delayed the first HepB vaccine >3 days
7 months	58%	43%
19 months	71%	68%

Figure 2. Reverse Kaplan-Meier curves with 95% confidence intervals for completion of hepatitis B vaccination stratified by receipt of HepB birth dose among children in the Military Health System, January 1, 2014 – June 30, 2017



Conclusion

Delay of the first dose of the HepB vaccine was associated with delayed completion of the HepB vaccination series. Military children had lower vaccination coverage by 19 months of age compared to the general US population. Previous studies have shown that being a military child was associated with not being up to date on childhood immunizations. As families prepare for permanent change of station (PCS), education on the importance of timely vaccinations can potentially improve age-appropriate HepB vaccination coverage among military children. Medical providers who interact with pregnant parents and birthing facilities should continue to educate about the benefits of and encourage parents to provide the birth dose to their children within 24 hours of birth. Delay of the first HepB vaccine was associated with reduced hazard or delayed completion of the series and other studies have also demonstrated an association with timeliness of other childhood vaccinations. The first vaccine in a child's life impacts timeliness of completing the HepB vaccination series and potentially impacts timely completion of other vaccinations. Interventions to improve timely completion of the vaccination series starts with education during the prenatal period and the importance of receiving the birth dose

Table 4. Comparison of hepatitis B vaccination coverage

Age	Military Health System, 2017 (%)	National Estimate, 2016-2017 (%)
7 months	60	60
19 months	72	91