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Hepatitis B surface antigen seroprevalence among children in the Philippines, 2018

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Abstract

The World Health Organization Western Pacific Region (WPR) set a hepatitis B virus (HBV) control target to achieve HBV surface antigen (HBsAg) prevalence of <1% among children aged 5 years by 2017. The estimated HBsAg prevalence in the Philippines among adults was 16.7% during the pre-vaccine era. We estimated the HBsAg seroprevalence among children aged 5–7 years to measure the impact of vaccination.

We conducted a household serosurvey, using a three-stage cluster survey methodology (provinces, clusters, and households). We estimated HBsAg prevalence using a rapid, point-of-care HBsAg test and calculated vaccination coverage by reviewing vaccination records or by caregiver recall. A questionnaire was administered to assess demographic variables for the child and family. We assessed the association between chronic HBV infection, vaccination coverage, and demographic variables, accounting for the complex survey design.

Of the 2178 children tested, HBsAg was detected in 15 children [0.8%, 95% confidence interval (CI): 0.4, 1.7]. Only two of the HBsAg-positive children had been fully vaccinated against HBV. Based on documented vaccination or caregiver recall for the survey population, hepatitis B vaccine

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Author contributions

AM, MS, AS, MC, RT, MQ, and MJ, and JW were involved in the conception and design of the study. AM, MS, AS, MC, MQ, MJ, and JW participated in the implementation of the project. AM conducted the analysis. AM and JW drafted the manuscript, and all authors reviewed the manuscript and approved the final version. All authors attest they meet the ICMJE criteria for authorship.

Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily reflect the position of the U.S. Centers for Disease Control and Prevention nor the World Health Organization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

birth dose (HepB-BD) coverage was 53%, and the third dose hepatitis B vaccination (HepB3) coverage was 73 percent. Among the 1362 children with documented HepB-BD, timely HepB-BD coverage (given within 24 h of birth) was 43%; children born outside a health facility were less likely to receive a timely HepB-BD than those born in a health facility (adjusted odds ratio 0.10, 95% CI: 0.04, 0.23).

HBsAg prevalence among children in the Philippines has decreased compared to the prevalence among adults in the pre-vaccination era. Strategies to further reduce HBsAg prevalence include ensuring that all children, whether born in health facilities or at home, receive a timely HepB-BD, and increasing HepB-BD and HepB3 coverage to reach the WPR goals of ≥95% coverage.

Keywords

Hepatitis B virus; Philippines; Seroprevalence; Vaccine

1. Introduction

In 2013, all member states within the World Health Organization (WHO) Western Pacific Region (WPR), including the Philippines, set a regional target to reduce the hepatitis B surface antigen (HBsAg) prevalence to <1% by 2017 among children 5 years of age. Vaccination coverage targets are set at ≥ 5% for timely (within 24 h of birth) hepatitis B birth dose vaccination (HepB-BD) and a third dose hepatitis B vaccination (HepB3) [1]. As of October 2020, 21 countries and areas in the WPR, as well as the WPR as a whole, have been verified as having achieved the <1% HBsAg goal [2]. The Philippines has not yet been verified as having met the HBV control goal. The “Regional Action Plan for Viral Hepatitis in the Western Pacific Region 2016–2020” and the “Regional Framework for the Triple Elimination of Mother-to-Child Transmission of Human Immunodeficiency Virus (HIV), Hepatitis B, and Syphilis in Asia and the Pacific 2018–2030” aligned the HBV control and elimination targets with the “Global Health Sector Strategy on Viral Hepatitis 2016–2021” targets of HBsAg prevalence ≤1% by 2020 and ≤0.1% by 2030 among children aged 5 years [3].

The Philippines is considered highly endemic for hepatitis B virus (HBV) with 16.7% of its adult population chronically infected with HBV in 2003 [4]. Based on WHO guidance to universally administer the hepatitis B vaccine (HepB) to children as soon as possible after birth, followed by at least two additional hepatitis B-containing vaccine doses, the Philippines initiated a phased introduction of the HepB vaccine into their national immunization programme from 1992 through 1996. The current schedule, which has been nationally adopted since 1996, includes a timely HepB-BD followed by HepB doses at 6, 10, and 14 weeks of age as part of the pentavalent vaccine (diphtheria, tetanus, pertussis, HBV, and *Hae-mophilus influenzae* type b) [3]. In 2019, HepB-BD coverage was 50% and HepB3 coverage was 65 percent [5].

The Philippines Department of Health decided to conduct a nationally representative survey in 2018 to (1) determine whether the Philippines met the WHO WPR target of <1% HBsAg

prevalence among children aged 5 years, and (2) recommend appropriate strategies for prevention, control, and eventually elimination of HBV.

2. Methods

From May to August 2018, a nationally representative cross-sectional survey was conducted, using a multi-stage sampling strategy to assess the prevalence of HBsAg among children. Children aged 5–7 years (born May 2011–May 2013), residing in a selected household at the time of data collection, and whose caregiver (parent or legally authorized representative) in the household consented to the child's participation and venipuncture were eligible for inclusion. Exclusion criteria included children unable to give blood due to severe illness or haemophilia and children whose caregiver did not give consent for participation, including blood sampling. The survey design was based on WHO guidance for performing hepatitis B immunization surveys [6].

2.1. Sample size and sampling

Based on an estimated 1% HBsAg seroprevalence, precision of ±0.5%, 95% confidence interval (CI), and design effect of 1.5, we calculated a minimum required sample size of 2283 using the simple asymptotic calculation [7,8]. The estimated HBsAg prevalence of 1% was selected because the primary objective of the project was to assess progress towards the <1% target for the WPR. To account for an expected 15% refusal rate, the target sample size was determined to be 2686 children aged 5–7 years.

The sampling method was a three-stage cluster design. The three stages were province, barangay (the smallest administrative division in the Philippines), and household (defined as a group of people who live and eat together). In order to reach the target sample size of 10 children per cluster; 25 provinces, 12 barangays per province, and 50 households per barangay were required. The sampling frame consisted of lists provided by the Philippines Statistics Authority of projected population size per province and the number of households per barangay for 2017, which were extrapolated from the most recent census in 2015. Of the 81 provinces, five provinces were inaccessible due to security issues and were excluded from the sampling frame.

As a first step, 25 provinces were selected by the probability-proportional to size sampling (PPS) method [9]. Twelve barangays were selected from each province by PPS. Finally, 50 households were visited per barangay, using a skip pattern based on the estimated household size per barangay, for a total of 15,000 households. Because barangays vary considerably in size, barangays with more than 500 households were segmented on a map. For the segmented barangays, a random number table or phone application was used to randomly select a segment, and a skip pattern of 10 households was used to select 50 households.

WHO vaccination cluster survey methodology was used to determine the number of households needed per barangay to reach the target sample size of approximately 10 children per barangay [9]. Based on the birth rate, average household size, and infant mortality in the Philippines [10], an estimated one out of five households would include a child 5–7 years of age. Therefore, 50 households were visited per barangay. Only one child

was eligible per household; if more than one age-eligible child was present, one child was randomly selected for inclusion, using a random number table or phone application. Up to three attempts were made to contact a household member.

2.2. Data collection

After informed consent was obtained, caregivers of 5–7-year-old children were asked to complete a brief face-to-face interview. The interviews were conducted in the participant's preferred language of either English, Tagalog, Visayan, Ilocano, or Waray. The interview consisted of a child portion (age, gender, location of the birth, and hepatitis B virus infection status), a caregiver portion (education level, age, employment, PhilHealth Insurance status, enrollment in *Pantawid Pamilyang Pilipino* Program (4Ps), religion, and knowledge of hepatitis B), and the child's vaccination history. PhilHealth insurance is the national government insurance, which is available for free to low-income women of childbearing age, or for a fee for any Filipino regardless of income. PhilHealth provides payment to health facilities for the provision of maternity and newborn care, including HepB-BD [11]. *Pantawid Pamilyang Pilipino* Program (4Ps) is a government assistance program for low-income families, and receipt of all vaccines recommended by the Philippines' immunization program, including HepB-BD, is a condition for receiving the financial incentives.

HepB vaccination status was obtained from immunization card documentation, when available. When an immunization card was unavailable, staff recorded the child's immunization history as recalled by caregivers, and when feasible, visited the child's health facility to review vaccination registries. Information from the interview, review of vaccination status, and the HBsAg test result were recorded onto handheld tablets using the Open Data Kit program (https://opendatakit.org/software/, Seattle, Washington, USA) with preprogrammed skip patterns.

2.3. Specimen collection and testing

Approximately 100 μL of blood collected by venipuncture from each participant was tested in the field, using the WHO pre-approved SD Bioline WB™ HBsAg point-of-care test strip (Korea) (reported sensitivity: 98–100%; reported specificity: 99.5–100%) [12,13]. Possible test results were positive, negative, or invalid. The test was repeated once if the result was invalid.

2.4. Data management and analysis

Data were uploaded into a Microsoft Excel spreadsheet (Red-mond, Washington, USA) and analyzed using SAS software v 9.4 (Cary, North Carolina, USA). If the caregiver answered "I don't know" or refused to answer a question, the response was coded as missing. Frequency and percentages were used to describe the characteristics of the population. HBsAg prevalence and vaccination coverage estimates were weighted to account for survey design (response rate and probability of selection of the province, barangay, household, and child) using the PROC SURVEYFREQ function with cluster and weight functions.

Vaccination data were analyzed by taking into account documented vaccination status (card or clinic records), verbal recall by caregivers, and either source. Timely HepB-BD coverage

was calculated for children with documented dates for HepB-BD by subtracting the date HepB-BD was received from the date of birth. HepB-BD received on the day of birth or the day after birth were considered timely. Total HepB-BD coverage included any HepB received prior to six weeks of life when the first dose of pentavalent vaccine is scheduled. If the child's caregiver did not have a vaccination card and the record could not be located at the child's clinic, the caregiver's recall information was used to estimate vaccination coverage for total HepB-BD, HepB1, HepB2, and HepB3. If the caregiver remembered that the child received at least one dose of vaccine prior to six weeks, the child was coded as having received HepB-BD. If the first dose was after six weeks, it was coded as HepB1. If the caregiver could not recall whether the child ever received a dose of HepB, or could not provide enough information to determine when the child received the first dose of HepB, or how many doses of HepB the child received, the child's vaccination data for that dose were coded as missing. Wilson 95% CI were calculated for proportions. Rao-Scott chi-square test was used to compare factors potentially associated with HBsAg status and timely HepB-BD coverage. Rao-Scott chi-square test is used to account for the weighted, complex survey design [9]. Multivariable analysis for factors associated with timely HepB-BD was conducted via PROC SURVEYLOGISTIC, including variables with p-value < 0.1 in bivariate analysis and variables with a possible association (such as sex of child). P-values of <0.05 were considered statistically significant.

2.5. Ethics

The survey protocol was approved by the Philippines Research Institute for Tropical Medicine Ethics Review Committee and the WHO-Western Pacific Regional Office Ethics Review Committee. The survey protocol was approved by the U.S. Centers for Disease Control and Prevention under human research protection procedures.

3. Results

3.1. General characteristics

Out of the 15,000 visited households, contact was made at 14,300 households (95.5%). Out of all contacted households, 2621 of 14,330 (18.3%) households included an eligible child aged 5–7 years old and 2203 (84.1%) caregivers of eligible children gave consent for the child to participate in the survey. Among all consented children, 2178 (98.9%) successfully had blood drawn for HBsAg testing and were included in the survey. Among these 2178 enrolled children, 1130 (51.9%) were male and 2132 (98.0%) attended school (Table 1). The majority (n = 1547, 71.3%) of children were born in a health facility; 230 (10.6%) were born at home with a skilled birth attendant, and 390 (18.0%) were born at home without a skilled birth attendant. Among the caregivers, 1710 (78.6%) had secondary or higher education, and 1703 (78.3%) were not employed. Most families (n = 1553, 71.4%) were part of the PhilHealth Insurance. When asked about HBV infection, 1199 (56.5%) caregivers responded that they were aware of HBV; of those, 43 (3.6%) reported that someone in the household had been diagnosed with HBV infection.

3.2. Hepatitis B surface antigen prevalence

Of the 2178 children tested, 15 (0.8%, 95% CI: 0.4–1.7%) were positive for HBsAg (Table 2). The children who were positive for HBsAg were distributed across 11 provinces. The HBsAg prevalence was significantly higher among children with PhilHealth Insurance than those without PhilHealth (1.0%, 95% CI: 0.5–2.2% vs 0.1%, 95% CI: 0.0–0.8%, p = 0.03). Children who shared a household with a person infected with HBV were more likely to be HBsAg positive (11.6%, 95% CI: 4.7–25.9%) than those without a household contact infected with HBV (0.4%, 95% CI: 0.1–1.9%); however, this difference was not statistically significant (p = 0.07) (Table 2). There was no difference in HBsAg prevalence among children who received HepB-BD plus HepB3 compared to partially vaccinated or unvaccinated children (p = 0.3).

Of the 15 children who were HBsAg positive, 12 had a vaccination card or clinic records of their vaccination status. Only two of these children were completely vaccinated against HBV (including HepB-BD) according to the schedule in the Philippines. The rest of the children were partially vaccinated, including six children who received the infant series of HepB but did not receive HepB-BD, or were unvaccinated. None of the three HBsAg positive children with vaccination data provided by caregiver recall were completely vaccinated.

3.3. HepB coverage

HepB-BD coverage by documentation or recall was 52.5% and HepB3 coverage was 73.2% (Table 3). Documented vaccination data (vaccination cards or clinic records) were available for 1370 out of the 2178 enrolled children (weighted percent: 61.4%). Among the children with documented vaccination, 1362 (99.4%) had valid dates for HepB-BD. Of the 1362 children with documented vaccination coverage and valid dates for HepB-BD, total HepB-BD coverage and timely (within 24 h of birth) coverage were 48.8% and 42.7%, respectively. Among the 1370 children with documented vaccination data, HepB3 coverage was 80.2 percent.

In bivariate analysis (Table 4), the proportion of children who received a timely HepB-BD was higher among children born in a health facility compared to children born outside of a health facility (55.5% vs 8.5%, p < 0.001). Timely HepB-BD coverage increased with higher caregivers' education level. A higher proportion of children received a timely HepB-BD if they were not part of 4Ps (46.3% vs 33.7%, p = 0.002). Timely HepB-BD coverage was higher among children whose caregiver had heard of hepatitis B (46.7% vs 37.6%, p = 0.006), and among children who reportedly lived with a household member infected with hepatitis B (63.7% vs 46.0%, p = 0.04). The receipt of timely HepB-BD was not different by the child's sex, school attendance, caregiver employment status, PhilHealth Insurance enrollment status, or the family's religion (Table 4).

Multivariable logistic regression analysis for factors associated with the receipt of timely HepB-BD included the following variables: child's sex, where the child was born, caregiver's education, caregiver's age, whether the caregiver had heard of hepatitis B virus, and participation in 4Ps. The variable "Has anyone in the household been diagnosed with hepatitis B virus infection" was not included because the respondents were a subset of the

sample who replied “yes” to whether the caregiver had heard of hepatitis B. In this analysis, children born outside of a health facility had lower odds of receiving a timely birth dose than children born in a health facility (adjusted odds ratio 0.10, 95% CI: (0.04–0.23), p-value < 0.0001). None of the other variables were significantly associated with the receipt of timely HepB-BD.

4. Discussion

This survey found a national HBsAg seroprevalence among children 5–7 years of age in the Philippines of 0.8% (95% CI: 0.4–1.7%). These results are reassuring given the high HBsAg prevalence of 16.7% among 2150 adults sampled in 2003, who were born prior to national HepB vaccination introduction in the Philippines [4]. Because vaccination is the cornerstone of HBV prevention, the decrease in HBsAg prevalence supports the effectiveness of the Philippines’ vaccination program; however, high and sustained vaccine coverage remains paramount to further decrease the HBsAg prevalence. Ensuring high vaccination coverage is especially important now, due to the recent controversy associated with the immunization campaign with Dengvaxia vaccine in the Philippines and the risk of adverse events among children who have not been exposed to Dengue virus prior to vaccination. Confidence in vaccines dropped from 93% to 32% among respondents in the 2015 to 2018 Vaccine Confidence Project™, which has been attributed to community concerns about the risks associated with the Dengvaxia vaccine [14,15]. In this survey, enrollment in PhilHealth was associated with higher HBsAg prevalence. The difference was small (0.1% vs 1.0%), and there was no association between timely HepB-BD and PhilHealth enrolment, so this finding may not be significant from a public health standpoint; however, the Philippines Department of Health plans to further explore this finding.

Interestingly, the national prevalence found in this survey is lower than expected, given the historically low hepatitis B vaccination coverage in the Philippines; although, the higher bound of the CI is above the 2017 target of HBsAg < 1% for WPR. Out of the 15 HBsAg-positive children, six children did not receive HepB-BD but received three doses of HepB as infants. Although the numbers are small, this pattern suggests that these children may have been infected with HBV at birth; therefore, the infant HepB series was administered too late to prevent infection.

In this survey, timely HepB-BD coverage was 42.7% by card documentation and HepB3 coverage was 73.2% by card or recall. HepB-BD coverage in the Philippines has increased since introduction in 2007; however, coverage remains low and has declined from a peak of 59% in 2016 to 50% in 2019 [5]. HepB3 coverage has fluctuated over time but has declined recently from 85% in 2016 to 65% in 2019 [5]. This coverage is lower than the WPR target of 95% for timely HepB-BD and HepB3. Of note, Cambodia, who was verified as reaching the WPR HBV control goal in 2018, only achieved this goal after attaining and maintaining high HepB-BD and HepB3 coverage [16,17]. The survey findings and evidence from countries in the region, such as Cambodia, highlight the importance of sustained high vaccination coverage to achieve elimination. Improving HepB-BD coverage provides a unique opportunity to sensitize families to the importance of vaccination and can lead to better engagement with the immunization program throughout the child’s early years.

In multivariable analysis, children born in a health facility were more likely to receive a timely HepB-BD, which has also been noted in other countries [16,18]. Increasing health facility deliveries is a recommended strategy to increase HepB-BD coverage [19]. The Philippines has made significant progress in increasing health facility births from 28% in 1993 to 78% currently [20]. Several strategies have been recommended to further increase health facility births, and these strategies can be reinforced to increase HepB-BD [3,16,21,22].

In addition to increasing health facility deliveries, it is imperative that every child born in a health facility has access to a timely HepB-BD. The Philippine government enacted the Mandatory Infants and Children Health Immunization Act of 2011, which required that regardless of where a child was born, all children receive a timely HepB-BD and all other routine vaccinations at no cost [23]. The current discrepancy between the relatively high proportion of health facility births of 78% and HepB-BD coverage of only 50% in 2019 indicate that many children born in health facilities are not receiving a timely HepB-BD. A health facility survey conducted in regions with the lowest HepB-BD coverage in the Philippines reported several impediments to timely HepB-BD, including lack of HepB-BD administration on the weekends, vaccine stockouts, false contraindications among health care workers, and lower coverage among private facilities (50%) compared to government hospitals (87%) and government clinics (90%) [11]. Findings of the facility survey were used to make several recommendations to increase HepB-BD coverage among children born in health facilities. Two of the recommendations—to incorporate HepB-BD into PhilHealth accreditation and to educate health care workers about HepB-BD [11]—have been incorporated into practice. Other practices, such as increasing engagement with the private sector and increasing the involvement of maternal child health staff in HepB-BD administration can be reinforced and more broadly implemented [11]. Additionally, WHO-Philippines is planning to update vaccine procurement and distribution strategies to prevent future stockouts.

Reaching children born at home with a timely HepB-BD is important. Health care workers attending home deliveries could be trained and encouraged to provide a timely HepB-BD [23]. One strategy to increase timely HepB-BD coverage that has been used successfully in several WPR countries, including Laos, China, Vietnam, and the Solomon Islands, is providing HepB-BD outside the cold chain (OCC) in areas with limited cold chain capacity and areas with a high proportion of home births [24–27]. HepB-BD is heat-stable, allowing its safe use in a monitored and controlled setting at temperatures above 2–8°C for a limited period of time [28]. Other interventions, such as educating pregnant women and village health volunteers (VHVs) about HepB-BD, training VHVs to inform health care workers about pregnant women in the community with or without the provision of mobile phones and credits to facilitate communication, and providing per diem to health care workers for home births and post-natal visits, have been associated with increased timely HepB-BD in WPR countries, such as the Republic of Kiribati and Laos [29,30]. The administration of timely HepB-BD is the most effective method to prevent mother-to-child transmission of HBV. However, if this is not possible, infants should be reached as soon as possible after birth by health care workers who can provide vaccinations during post-natal home or health facility visits.

This survey had some limitations. First, out of the 81 provinces in the Philippines, 5 provinces had to be excluded for the safety of the survey teams, and the children in these provinces may or may not be similar to the children in the rest of the Philippines. For example, most of the excluded provinces are located in the Autonomous Region in Muslim Mindanao, which is currently the region with the lowest HepB-BD (33.0%) and HepB3 (32.9%) coverage in the Philippines [20]. Second, the vaccination coverage estimates may be limited by the reliance on caregiver recall for some children, which is subject to recall bias, and 25% of caregivers could not remember the exact details of their children's HepB vaccination status. Documented vaccination status could have errors, such as implausible dates for vaccination or missing vaccination data; however, in this survey, only eight out of 1370 documented HepB-BD had missing or implausible dates. Furthermore, the small number of HBsAg positive children may have limited the ability to detect significant differences by demographic and vaccination variables in the bivariate analyses. Lastly, serosurveys do not typically collect detailed health information on participants and their mothers. As such, we do not definitively know why two children were HBsAg-positive despite having received the appropriate HepB series. The primary HepB series induces protective antibody concentrations in >95% of healthy infants [28], so it is biologically plausible for children who received the correct series to become infected due to health conditions of the mother or child.

In conclusion, the Philippines has made progress in reducing HBsAg prevalence in the country. While the point prevalence is below the 2017 WPR target of 1%, the upper bound of the 95% CI is higher than 1%, which indicates the potential of higher prevalence if a larger sample is included. Achieving high coverage with timely HepB-BD and HepB3 are needed to reduce the risk of mother-to-child transmission of HBV, reduce the HBsAg prevalence among children, and to reach HBV elimination.

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Table 1

Demographic characteristics of survey participants (children aged 5–7-years) and their caregivers – Philippines, 2018.

Variables	Total (N = 2178)	
	n	%
Sex		
Male	1130	51.9
Female	1048	48.1
Child in school		
Yes	2132	98.0
No	43	2.0
Where child was born		
Health facility	1547	71.3
Home (with skilled birth attendant)	230	10.6
Home (without skilled birth attendant)	390	18.0
Other	3	0.1
Education level of caregiver		
None/primary school	466	21.4
Secondary school	1189	54.6
University/higher education	461	21.2
Vocational school	60	2.8
Caregiver age		
<30 years	676	31.1
30–39 years	908	41.8
≥40 years	591	27.2
Caregiver is employed		
Yes	472	21.7
No	1703	78.3
Part of Pantawid Pamilyang Pilipino Program (4Ps)		
Yes	530	24.4
No	1646	75.6
PhilHealth Insurance		
Yes	1553	71.4
No	621	28.6
Family religion		
Catholic	1829	84.0
Non-Catholic Christian	303	13.9
Muslim	40	1.8
Other	5	0.2
Have you heard of hepatitis B?		
Yes	1199	56.5
No	922	43.5

Variables	Total (N = 2178)	
	n	%
Has anyone in the household been diagnosed with hepatitis B virus infection (of those who answered yes to previous question)?		
Yes	43	3.6
No	1139	96.4

Some responses were missing for all questions except child's sex.

Table 2

Hepatitis B surface antigen prevalence among 5–7-year-old children — Philippines, 2018.

Variables	No. of children tested	No. of children HBsAg positive	HBsAg prevalence weighted % (95% CI)*	p-value
Total	2178	15	0.8 (0.4–1.7)	–
Sex of child				
Male	1130	10	1.2 (0.5–2.9)	0.2
Female	1048	5	0.3 (0.1–1.2)	
Child in school				
Yes	2132	15	0.8 (0.4–1.7)	–
No	43	0	–	
Where child was born				
Health facility	1547	9	0.6 (0.2–1.6)	0.4
Not at health facility	623	6	1.1 (0.4–3.2)	
Education level of caregiver				
None or primary school	466	4	1.0 (0.3–3.2)	1.0
Secondary school	1189	9	0.7 (0.2–2.2)	
University/higher education	461	1	0.8 (0.1–4.9)	
Vocational school	60	1	1.2 (0.2–8.2)	
Caregiver age				
<30 years	676	4	0.6 (0.2–2.6)	0.8
30–39 years	908	7	0.7 (0.3–1.8)	
≥40 years	591	4	1.1 (0.3–3.7)	
Caregiver is employed				
Yes	472	2	0.9 (0.4–2.1)	
No	1703	13	0.4 (0.1–1.7)	0.3
Part of Pantawid Pamilyang Pilipino Program (4Ps)				
Yes	530	4	0.8 (0.3–2.0)	1.0
No	1646	11	0.8 (0.3–1.9)	
PhilHealth Insurance				
Yes	1553	13	1.0 (0.5–2.2)	0.03
No	621	2	0.1 (0.0–0.8)	

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Variables	No. of children tested	No. of children HBsAg positive	HBsAg prevalence weighted % (95% CI)*	p-value
Family religion				
Catholic	1829	12	0.8 (0.3–1.9)	–
Non-Catholic Christian	303	3	0.7 (0.1–2.9)	
Muslim	40	0	–	
Other	5	0	–	
Have you heard of hepatitis B?				
Yes	1199	8	0.9 (0.3–2.2)	0.3
No	922	5	0.4 (0.1–1.8)	
Has anyone in the household been diagnosed with hepatitis B virus infection (of those who answered yes to previous question)?				
Yes	43	4	11.6 (4.7–25.9)	0.07
No	1139	4	0.4 (0.1–1.9)	
HepB Vaccination status by documentation or recall (N = 1658)				
Unvaccinated	100	1	0.2 (0.0–4.0)	0.3
Incompletely vaccinated	1015	11	1.2 (0.5–3.2)	
Completely vaccinated (HepB-BD + HepB3)	543	2	0.5 (0.1–2.3)	

* Percentages account for cluster, weight, and response rate. Some responses were missing for all questions except child's sex.

Table 3

Hepatitis B vaccination coverage among 5–7-year-old children — Philippines, 2018.

Variables	*n*	Weighted % (95% CI)*
Vaccination card/clinic record available (N = 2178)	1370	61.4 (51.1–70.7)
Vaccination coverage by card or recall **		
Total HepB-BD (N = 1658)		
Vaccination card/clinic record	677	39.7 (31.7–48.2)
Caregiver report	203	12.8 (9.0–18.1)
Either source	880	52.5 (44.2–60.6)
HepB1 (N = 1636)		
Vaccination card/clinic record	1302	78.7 (71.9–84.2)
Caregiver report	212	14.3 (10.1–19.7)
Either source	1514	93.0 (89.0–95.6)
HepB2 (N = 1634)		
Vaccination card/clinic record	1261	76.6 (70.0–82.1)
Caregiver report	200	13.4 (9.5–18.6)
Either source	1461	90.0 (85.6–93.2)
HepB3 (N = 1634)		
Vaccination card/clinic record	1034	65.9 (57.4–73.5)
Caregiver report	122	7.3 (4.9–10.7)
Either source	1156	73.2 (63.3–81.2)
Received HepB-BD + 3 doses of pentavalent (N = 1634)	543	34.0 (23.7–46.0)
Vaccination coverage by documentation only (N = 1370)		
Total HepB-BD ***	669	48.8 (40.0–57.6)
Timely HepB-BD *** (within 24 h)	574	42.7 (35.2–50.7)
HepB1	1302	95.8 (92.2–97.8)
HepB2	1261	93.2 (88.9–95.9)
HepB3	1034	80.2 (71.2–86.8)
Age (in days) when received first dose of hepatitis B vaccine ***		
≤1 day	574	42.7 (35.2–50.7)
2–7 days	55	3.4 (2.4–4.9)

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Variables	*n*	Weighted % (95% CI)*
8–42 days	40	2.6 (1.6–4.2)
Never received	693	51.2 (42.4–60.0)
Completely vaccinated: Received timely BD + ≥3 doses of pentavalent***	388	31.6 (23.1–41.5)

* Percentages account for cluster, weight, and response rate.

** HepB-BD: hepatitis B birth dose vaccination, HepB1: first dose hepatitis b vaccination, HepB2: second dose hepatitis B vaccination, HepB3: third dose hepatitis B vaccination. For vaccination coverage by card or recall, recall data coded as missing if not enough information available to ascertain vaccination status for each vaccine (HepB-BD: 520 missing, HepB1: 542 missing, HepB2-HepB3: 544 missing).

*** Eight children with missing/implausible dates for HepB-BD coded as missing for “documented only” HepB-BD vaccination coverage (N = 1362)

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Table 4

Factors Associated with Timely HepB-BD Vaccination Status (documented only, N = 1362) — Philippines, 2018.

Variables	No. of children tested	No. of children with timely HepB-BD	Weighted % (95% CI)*	p-value
Sex of child				
Male	711	311	42.8 (35.1–50.9)	0.9
Female	651	263	42.6 (34.5–51.3)	
Child in school				
Yes	1339	568	43.0 (35.5–51.0)	0.2
No	21	5	27.3 (11.6–52.0)	
Where child was born				
Health facility	1000	540	55.5 (46.4–64.3)	<0.001
Not at health facility	359	32	8.5 (5.0–14.1)	
Education level of caregiver				
None or primary school	271	99	38.1 (28.8–48.4)	0.006
Secondary school	764	308	40.1 (32.6–48.0)	
University/higher education	289	145	53.6 (43.7–63.3)	
Vocational school	37	22	54.8 (35.4–72.9)	
Caregiver age				
<30 years	415	172	40.0 (31.9–48.6)	0.02
30–39 years	576	263	49.0 (39.0–59.0)	
≥40 years	370	139	36.7 (29.5–44.5)	
Caregiver is employed				
Yes	292	129	47.5 (38.8–56.4)	0.1
No	1068	444	41.3 (33.3–50.0)	
Part of Pantawid Pamilyang Pilipino Program (4Ps)				
Yes	336	112	33.7 (27.0–41.2)	0.002
No	1025	462	46.3 (37.9–55.0)	
PhilHealth Insurance				
Yes	1008	437	42.7 (35.1–50.8)	1.0
No	351	136	42.9 (33.8–52.4)	
Family religion				

Variables	No. of children tested	No. of children with timely HepB-BD	Weighted % (95% CI)*	p-value
Catholic	1154	485	43.1 (35.0–51.6)	0.7
Non-Catholic Christian	189	84	40.6 (30.6–51.4)	
Muslim	15	4	24.9 (9.8–50.2)	
Other	3	1	67.3 (21.1–94.0)	
Have you heard of hepatitis B?				
Yes	784	364	46.7 (39.5–54.1)	0.006
No	554	204	37.6 (29.3–46.8)	
Has anyone in the household been diagnosed with hepatitis B virus infection (of those who answered yes to previous question)?				
Yes	33	19	63.7 (46.7–77.9)	0.04
No	740	342	46.0 (38.7–53.5)	

*Percentages account for cluster, weight, and response rate. Some responses were missing for all questions except child's sex.