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Prevalence and Associated Factors of Hepatitis B Birth Dose Vaccination in Vietnam: Where Should we Start?

Anh Ngoc Nguyen*, Doanh Quoc Nguyen*, Thanh Van Nguyen , Nhung Thi Kim Ta, Xuan Thi Thanh Le**

School of Preventive Medicine and Public Health, Hanoi Medical University, Hanoi, Vietnam

*These authors have contributed equally to this work

***Corresponding author:** Xuan Thi Thanh Le, School of Preventive Medicine and Public Health, Hanoi Medical University, Hanoi 100000, Vietnam

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Abstract

Background: Exploring the Hepatitis B vaccine birth dose coverage may contribute to developing a policy to expand prevention interventions for transmission of Hepatitis B.

Objectives: This paper analyses the prevalence of hepatitis B birth dose vaccination in a vaccination department and explores its associated factors among children under six months of age.

Study design: A cross-sectional study.

Methods: Data was collected using face-to-face interviews with mothers with children under six months of age who visited the vaccination department, Hanoi Medical University, in 2017.

Results: Around 14% of mothers had sufficient knowledge of vaccination against hepatitis B. The prevalence of children who had received the birth dose of hepatitis B vaccine was 69%. Education level, occupation, and sufficient knowledge of hepatitis B were the associated factors of mothers' knowledge. Factors associated with the prevalence of children having received the birth dose of the vaccine against hepatitis B included children's place of birth, birth weight, state of being born with congenital pathology, and having family members infected with hepatitis B.

Conclusions: Further similar studies among health workers in both public and private healthcare facilities are needed to better investigate the factors associated with the prevalence of hepatitis B birth dose vaccination.

Keywords: Associated factors; Children under six months of age; Hepatitis B birth dose; Prevalence

Abbreviations: WHO: World Health Organization; HBV: Hepatitis B Virus; HbsAg: Hepatitis B surface Antigen; GAVI: Global Alliance for Vaccines and Immunization

Introduction

Hepatitis B is a globally common and dangerous disease. According to the World Health Organization (WHO), about two billion people worldwide have been infected with hepatitis B virus (HBV), and about 600,000 people die from HBV each year [1]. Vietnam is located in Asia, where the prevalence of Hepatitis B surface Antigen (HbsAg) is highest in the world. The prevalence of positive HBsAg in Vietnam ranges from 10% to 25% [2]. An estimated 8.8% of women and 12.3% of men in Vietnam are infected with chronic hepatitis B [3]. Mother-to-child transmission is an important transmission route of HBV, particularly in Asia, where the prevalence of perinatal HBV transmission among chronic HBV infected patients is 40% [4]. For those reasons, giving HBV vaccine to infants is the key to reducing the burden of diseases related to HBV. The World Health Organization recommends that all infants should receive the first shot of vaccine against hepatitis B as soon as possible after birth, preferably within the first 24 hours [5].

With support from the Global Alliance for Vaccines and Immunization (GAVI), since 2003, hepatitis B vaccine has been given to children under one year of age living in all districts in

Vietnam [6]. However, due to the negative impact from the cases of death that happened in 2013 in the number of children after they had received hepatitis B vaccine, the coverage of hepatitis B birth dose vaccine was critically low in the following years, dropping from 64.3% in 2006 to 29% at the end of 2007 [7], 20% in 2008 [8], 28% in 2009 [9], and 21.4% in 2010 [1]. After the deaths of three newborns in Quang Tri in July 2013 following their first shot of HBV vaccine, the hepatitis B birth dose vaccination coverage across the country dropped to 44% in 2013 [9]. In Hanoi, the prevalence of HBV vaccination within 24 hours after birth among infants was 83.4% in 2016, higher than that recorded nationwide (68%) [10]. Barriers that affected the birth dose vaccine included children being sick, premature infants, child's birth weight, mother's age, mother's education, socioeconomic status, and ethnicity, or reasons related to physicians such as misinterpretation of pre-vaccination screening criteria, lack of HBV knowledge and awareness and barriers language, health care access, cost [11-16]. Recently, antivaccine group has been available which also limiting the coverage of the uptake of HBV vaccine among newborns. It raises the question about what factors associated with the prevalence of birth dose of HBV vaccine? The information about the prevalence and associated factors can help policy-makers, health implementers find suitable interventions for increasing hepatitis B birth dose vaccination coverage, to reduce the disease burden for newborn, family and health care systems.

Thus, this study aimed at investigating the prevalence of HBV birth dose among children under six months of age in the Vaccination department of Hanoi Medical University in 2017, as well as analyzing factors associated with the prevalence of Hepatitis B vaccine Birth Dose of study subjects.

Materials and Methods

Study Setting, Sample Size, and Sampling Method

A cross-sectional study was conducted from July 2017 to June 2018 in mothers with children under six months of age. We chose mothers with children under six months of age at the time of data collection, specifically those giving birth in the second quarter of 2017, and voluntarily participated by written consent form in the study. Data collection was implemented from October 2017 to December 2017 in Vaccination department, Hanoi Medical University. The Hanoi Medical University vaccination department is one of the largest vaccination departments in Northern Vietnam, with thousands of deliveries and vaccinations every year. This department also provided Hepatitis B vaccination services for children 2 months old but not for newborns.

Sample size was calculated using the sample size formula for estimating a proportion:

$$n = Z^2_{(1-\frac{\alpha}{2})} \frac{p.(1-p)}{d^2}$$

Where: - n: Sample size; α: Significance level (α = 0.05); $Z_{(1-\alpha/2)}$: 1.96 (95% confidence interval); d=0.05 (Desired precision)

p: 0.834, which was the prevalence of hepatitis B birth dose vaccination among infants in Hanoi in 2016 [17].

The sample size calculated using the above formula was 213 study subjects. We conducted the study with 242 mothers. A random sampling was applied to customers who visited the Vaccination department of Hanoi Medical University for immunization, using a structured questionnaire to interview caregivers when they waited for the 30-minute follow-up at the post-vaccination monitoring room. Customers were selected based on the inclusion criteria until the number of subjects met the sample size.

Measures and Instruments

This study used a predesigned questionnaire that was built based on previous researches and the current guideline of Ministry of Health, then tested in five customers and revised before its application in the official investigation. In this study, the maximum score for the assessment of knowledge regarding hepatitis B vaccination was 8, and respondents who scored below 6 were considered as insufficiently knowledgeable, while those scored 6 or above were sufficiently knowledgeable based on Bui Thi Dung's study in 2014 in HoaBinh [18]. The practice of giving hepatitis B birth dose vaccine to infants was recorded as "yes" for respondents whose children had received the first shot of hepatitis B vaccine within the first 24 hours after birth; then we verified that in the vaccination booklets or in National Immunization Information System.

Statistical Analysis

Quantitative data entry was conducted using EpiData, cleaned and analyzed using STATA 12.0. A 95% confidence interval was chosen. Descriptive analysis and logistic regression were applied to analyze the relationship between the independent variables and the dependent variables, which were the knowledge of hepatitis B vaccination (sufficient/ insufficient) and the practice of giving hepatitis B first dose vaccine to infants (yes/ no). Independent variables used in the model included the general information of study subjects (age group, occupation, education level, etc.), characteristics of children (gestational age, place of birth, delivery method, neonatal pathology, birth weight, etc.), mothers' knowledge of hepatitis B and hepatitis B birth dose vaccine, mothers and family members' medical history, and health care environment and services related to hepatitis B first dose vaccination. The significance level was set at $p<0.05$ in the logistic model.

Ethics approval

The study was conducted following the approval of the Science Council for the study proposal submitted by the Institute

for Preventive Medicine and Public Health, Hanoi Medical University, in August 2017. The questionnaire did not include any sensitive and private issues and did not cause any harm to the psychology and health state of the study subjects. Data was only collected for research purposes. Study results were used to improve the health of the population, not for any other purpose.

Results

Results from Table 1 show that the total number of mothers participating in the study was 242, of which the majority belonged to the age group of 25 to 29 years old (46.3%), the mean age was 29.6 ± 5.5 years old, the highest age was 50 years old, and the lowest age was 21 years old. A major part of the study subjects gave birth at central hospitals (56.2%). The prevalence of caesarean section was 53.5%. Most of the respondents worked as public servants (62.4%), and the rest were workers, business people, freelancers, or had other kinds of occupations. In this study, the education level of the study subjects was mostly university or after graduation (88.0%).

Information		Frequency	Percent (%)
Age group	20 – 24 years old	25	10.3
	25 – 29 years old	112	46.3
	30 – 34 years old	74	30.6
	≥ 35 years old	31	12.8
Education level	High school/ Vocational school/ College	29	12.0
	University/ After graduation	213	88.0
Occupation	Public servant	151	62.4
	Worker/ Business person/ Freelancer	74	30.6
	Others	17	7.0
Birthplace of children	Central hospital	136	56.2
	Provincial hospital	94	38.8
	District hospital	3	1.2
	General clinic	1	0.4
	Health station	3	1.2
	Private healthcare facility	5	2.1
Delivery method	Vaginal birth	112	46.3
	Caesarean section	130	53.7

Table 1: General information of study subjects (n=242).

Table 2 shows that the majority of the study subjects were aware that their children needed to have a checkup before they received the vaccine, that the first shot of hepatitis B vaccine should be given to their children within the first 24 hours after birth, and that their children had to be available at the vaccination site for 30 minutes after vaccination for monitoring, with the prevalence of accurate knowledge of 85.9%, 85.1%, and 96.7%, respectively. The prevalence of mothers having accurate knowledge of possible immunization reactions that might happen to their children after vaccination, for examples, having pain at the injection site, feeling sick or crying, and anaphylaxis ranged from 8.7% to 56.6%. Only 8.5% of respondents were aware that their children might feel painful at the injection site after they received the vaccine.

Items	Frequency	Percent (%)
Infants need to have a checkup before getting vaccinated	208	85.9
Hepatitis B vaccine should be giving to infants within the first 24 hours after birth	206	85.1
Infants may have pain at the injection site after vaccination	21	8.7
Infants may have fever after vaccination	137	56.6
Infants may feel sick or cry after vaccination	35	14.5
Anaphylaxis may happen to infants after vaccination	25	10.3
Infants must stay at the vaccination site for at least 30 minutes after vaccination	234	96.7
Hepatitis B vaccine is free of charge	146	60.3

Table 2: The prevalence of accurate knowledge of hepatitis B birth dose vaccination among subjects (n=242).

Chart 1 points out that out of 242 mothers with children under six months of age who participated in the study, 33 scored as having sufficient overall knowledge of vaccination against hepatitis B, accounting for 13.6%.

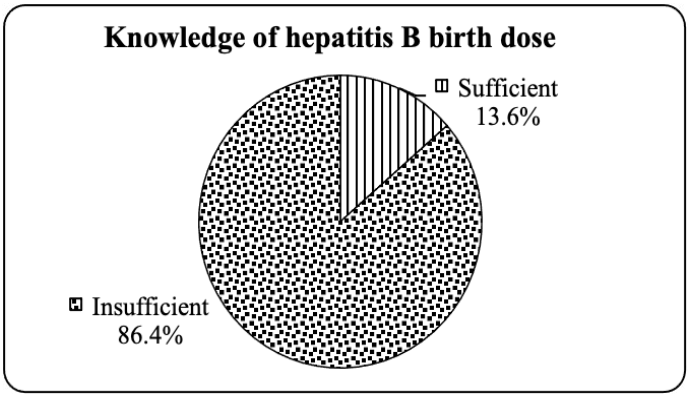

Chart 1: The prevalence of having sufficient knowledge of hepatitis B birth dose vaccination among mothers (n=242).

Chart 2 showed that the prevalence of children who had received hepatitis B birth dose vaccine was 69%, with the equivalent distribution in boys (51.5%) and girls (48.5%).

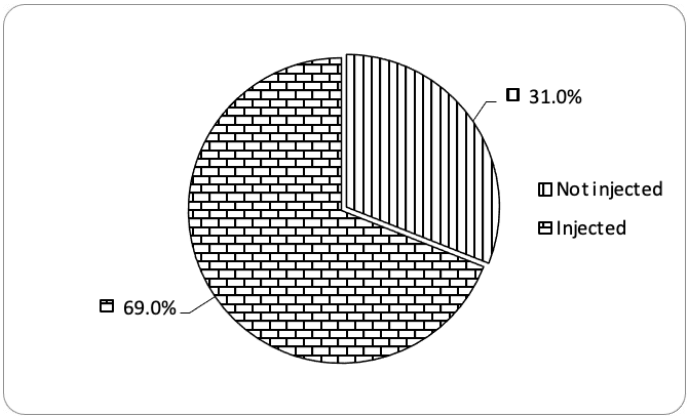

Chart 2: The coverage rate of hepatitis B birth dose vaccination among children (n=242).

Multivariate analysis results showed that the model was significant at $p<0.05$ (Table 3). The group of respondents who were sufficiently knowledgeable of hepatitis B had the prevalence of having sufficient knowledge regarding hepatitis B first dose vaccine 5.145 times higher than those of the other group, which was statistically significant with a confidence interval of (2.273 – 11.644) that did not contain the value of 1. Other factors including age group, occupation, family members infected with hepatitis B, and mothers getting tested for hepatitis B had no relationship with the prevalence of mothers having knowledge of hepatitis B birth dose vaccination.

(Multivariate Analysis Results)

Associated factors		Knowledge of hepatitis B birth dose vaccine		OR (95% CI)
		Yes (n,%)	No (n,%)	
Age group	≥ 30 years old	13 (12.4)	92 (87.6)	1
	< 30 years old	20 (14.6)	117 (85.4)	1.121 (0.747 - 1.683)
Occupation	Worker, business person, freelancer or others	7 (7.7)	84 (92.3)	1
	Public servant	26 (17.6)	122 (82.4)	1.961 (0.775 - 4.958)
Knowledge of hepatitis B	Insufficient	14 (7.7)	167 (92.3)	1
	Sufficient	19 (31.1)	42 (68.9)	**5.145 (2.273 - 11.644)**
Family members infected with hepatitis B	No	27 (12.9)	181 (87.0)	1
	Yes	6 (17.7)	28 (82.4)	1.185 (0.408 - 3.489)
Mother tested for HBV	No	3 (11.5)	23 (88.5)	1
	Yes	30 (13.9)	186 (86.1)	1.304 (0.332 - 5.115)
Model's coefficients			$\chi^2 = 21.06$; p-value = 0.0008	
Hosmer - Lemeshow goodness of fit test			$\chi^2 = 25.11$; p-value = 0.4089	
Adjusted R^2			10.97 %	

Table 3: Factors associated with mothers' knowledge of hepatitis B first dose vaccine.

Table 4 showed the results of multivariate regression analysis, which suggested that there were a number of variables having statistically significant correlations with hepatitis B birth dose vaccination among children. The multivariate analysis model pointed out that four variables (place of birth, birth weight, state of born with congenital malformations, and having family members infected with hepatitis B) had statistically significant correlations with hepatitis B birth dose vaccination. This model was consistent with the data (p-value of Hosmer-Lemeshow test >0.05). Children born at provincial hospitals or other places, children with birth weight above 2500 grams, children without congenital malformations, and children born to families members infected with hepatitis B had a higher prevalence of having received hepatitis B birth dose vaccine in comparison with those who did not have the listed characteristics ($p<0.05$).

(Multivariate Analysis Results)

Associated factors		Children received vaccine		OR (95% CI)
		Yes (n,%)	No (n,%)	
Age group	< 30 years old	92 (67.1)	45 (32.9)	1
	≥ 30 years old	75 (71.4)	30 (28.6)	1.416 (0.740 - 2.708)

Occupation	Public servant	102 (67.6)	48(32.4)	1
	Worker, business person, freelancer, or others	65 (71.4)	26 (28.6)	1.370 (0.710 - 2.645)
Place of birth	Central hospital	80 (58.8)	56 (41.2)	1
	Provincial hospital or others	87 (82.1)	19 (17.9)	**4,718 (2.232 - 9.505)**
Birth weight (gram)	<2500	2 (25.0)	6 (75.0)	1
	≥ 2500	165 (70.5)	69 (29.5)	**20.954 (3.336 - 131.622)**
Neonatal pathology	Yes	3 (25.0)	9 (75.0)	1
	No	164 (71.3)	66 (28.7)	**9.306 (1.922 - 45.044)**
Family members infected with hepatitis B	No	137 (65.9)	71 (34.1)	1
	Yes	30 (88.2)	4 (11.8)	**4.310 (1.319 - 14.085)**
Heard of cases of post-vaccination reactions/ complications	No	28 (60.9)	18 (39.1)	1
	Yes	139 (70.9)	57 (29.1)	2.023 (0.929 - 4.405)
Got advice on hepatitis B during pregnancy	No/ Did not remember	138 (67.3)	67 (32.7)	1
	Yes	29 (78.4)	8 (21.6)	1.663 (0.554 - 4.487)
Got advice on hepatitis B right before giving birth	No/ Did not remember	154 (68.4)	71 (31.6)	1
	Yes	13 (76.5)	4 (23.5)	1.166 (0.304 - 4.472)
Got advice on hepatitis B vaccine during pregnancy	No/ Did not remember	144 (67.6)	69 (32.4)	1
	Yes	23 (79.3)	6 (20.7)	2.468 (0.654 - 9.320)
Model's coefficients			$\chi^2 = 55.55$; p-value = 0.0000	
Hosmer - Lemeshow goodness of fit test			$\chi^2 = 62.84$; p-value = 0.7089	
Adjusted R^2			18.54 %	

Table 4: Factors associated with the prevalence of hepatitis B birth dose vaccination among children.

Discussion

The prevalence of mothers having sufficient knowledge of hepatitis B vaccination recorded in this study only accounted for 13.6% of the study subjects, which means out of seven mothers who had children under six months of age, only one was sufficiently knowledgeable about the birth dose vaccine against hepatitis B. The prevalence of mother shaving sufficient knowledge recorded in this study was much lower than that of studies conducted by Nguyen Thi Xuan Loan (50.5%) [19], and Bui Thi Dung(25.3%) [20]. Most of the mothers who took their children to the Vaccination department of Hanoi Medical University for immunization lived in the urban area, whose opportunities to get access to different types of media were more plentiful compared to those living in other areas; however, their knowledge regarding hepatitis B birth dose vaccination was still limited. We believe the main reason behind this was the fact that hepatitis B birth dose vaccination remained a matter of little concern to mothers in the community. The prevalence of mothers having accurate knowledge of the ideal time for the birth dose of hepatitis B vaccine, recommended as within

the first 24 hours after birth, was 85.1%, much higher than that of Ngo Van Hien's study in Nghi Xuan rural district (40.9%) [21]. This could be explained by the fact that the subjects of Ngo Van Hien' study included mothers with children under five years of age, who could not recall their knowledge regarding hepatitis B birth dose vaccine as well as mothers with children under six months of age. Hence, further communication activities on vaccine against hepatitis B in general and birth dose vaccine against hepatitis B in particular are necessary for mothers who will visit the Vaccination department of Hanoi Medical University.

The prevalence of children having received the first shot of hepatitis B vaccine within the first 24 hours after birth was 69.0%, much higher than that of Zhou Y's study (31.6%) [22]. The possible reason of this difference could be due to the place of child delivery. In the study implemented by Zhou Y, the rate of home births was extremely high (52%), much higher than those recorded at other places, specifically 3.5% at private healthcare facilities, 18% at district hospitals, and 26.5% at hospitals of higher levels; while the possibility of receiving hepatitis B birth dose vaccine among children born at healthcare facilities was remarkably greater than those born at home [22]. In the study conducted in the Vaccination department of Hanoi Medical University, of the respondents' children, none were born at home, 2.1% were born at private healthcare facilities, 1.2% were born at district hospitals, and the major part were born at central hospitals (56.2%) and provincial hospitals (38.8%). However, the prevalence of children having received hepatitis B birth dose vaccination recorded in the study was 69.0%, much lower than that of a number of studies conducted in Vietnam, such as Giao Huynh's in Ho Chi Minh City, in 2020 (71.6%) [13], Nguyen Thi Xuan Loan's in Long Xuyen city, An Giang in 2012 (88.8%) [19], Ngo Van Hien and Nguyen Canh Phu's in Nghi Xuan district, Ha Tinh in 2010 (71%) [21], and Duong Thi Hong's at several hospitals in Hai Duong province in 2010 (92.8%) [23]. This was also lower than that of Hanoi in 2016 (83.4%), but higher than that recorded nationwide in 2016 (68%) [24]. These differences might result from different socio-economic statuses, geographical areas, and data collection time of the studies. After the deaths of three newborns in HuongHoa, Quang Tri following the incident of giving them the wrong vaccines instead of a vaccine against hepatitis B, the coverage of hepatitis B vaccination within the first 24 hours after birth across the country continuously decreased at an alarming rate, as in the first six months of 2014, the prevalence of children getting vaccinated against hepatitis B within the first 24 hours after birth only reached 20%, which was critically low in comparison with those of the previous years. Therefore far, a certain part of the population still remainstheir disbelief of hepatitis B vaccine after a number of incidents that lead to deaths in children after they had received hepatitis B vaccination, even though medical experts denied the role of vaccines in these deaths. In addition, health workers at a number of hospitals and healthcare facilities where vaccination was legally supported hesitated to give hepatitis B vaccine to infants.

The multivariate analysis model suggested that the group of respondents whose knowledge of hepatitis was sufficient had a correlation with their vaccine knowledge, and their level of awareness was 5.145 times higher than that of the other group. The possible explanation for this could be the fact that mothers who were aware of hepatitis B tended to seek information regarding hepatitis B prevention, and hepatitis B birth dose vaccination was one of the best measures to create immunity against HBV in children. No differences were found between the group of mothers whose family members had been infected with hepatitis B and the other group, as well as between the group of mothers who had got tested for hepatitis B and the other one. This might be due to the fact that mothers who took their children to the vaccination department had a high level of awareness, were well-educated, and had acquired considerable knowledge of disease prevention, which leads to insignificant differences in their knowledge regarding the birth dose vaccine against hepatitis B. Other factors, specifically age group, occupation, family members infected with hepatitis B, and mothers getting tested for hepatitis B showed no correlation with the prevalence of knowledge of hepatitis B birth dose vaccine among mothers who used vaccination services in the vaccination department.

The multivariate analysis model showed that there were four factors which had statistically significant correlations with the prevalence of having received hepatitis B birth dose vaccine among children ($p<0.05$), including: place of birth, birth weight, being born with neonatal pathology, and being born to a family members infected with hepatitis B. The possibility of receiving the birth dose of hepatitis B vaccine among children born at provincial hospitals or other places was 4.7 times higher than that of those born at central hospitals. The reason to explain this could be due to the current guideline for immunization safety issued by the Ministry of Health, which recommends that vaccination should be delayed in a number of cases, including babies with low birth weight (<2000 grams) and babies born with neonatal pathology, whose birth places are likely to be at hospitals of higher levels, similar to the results drawn from our study. However, the results were different in several studies conducted in China and the United States of America [22,25,26]. In our study, the statistically significant differences between the prevalence of children having received hepatitis birth dose vaccine and their birth weight as well as their state of neonatal pathology were also proven. Hao Nguyen Si Anh et al. (2003) also reported that HBV vaccination rates could be affected by the infant's birth weight [14]. Infants with a weight of below 2500 grams may have a weaker immune response; therefore, the doctor may not request the Hepatitis

B vaccine first dose [27]. Babies born without any neonatal pathology were 9.3 times more likely to receive a birth dose vaccine against hepatitis B compared to those born with neonatal pathology. This is completely consistent with the guideline for pre-vaccination screening examination for children, as vaccination must be delayed in children with acute illness, having a fever with body temperature above 37.5°C or having hyperthermia with body temperature below 35.5°C, and having a birth weight of below 2500 grams as mentioned above [28]. There have not been any recommendations for vaccination delay in premature babies or low-birth-weight babies; however, when dealing with babies born prematurely, babies born with low birth weight, and babies having congenital pathology and malformations, doctors should perform careful examinations to avoid cases of coincidence before hepatitis B birth dose vaccination. Study results also pointed out that babies born to families without any members infected with hepatitis B were at higher risk of not receiving the birth dose of hepatitis B vaccine in comparison with those born to families with hepatitis B infected members, as those belonging to families with infected members had a possibility of getting vaccinated 4.3 times higher than those of the other group. In families of which members were infected with hepatitis B, especially if the infected patient was the mother or the father, the risk of transmission to the children and other members was higher than that of families with no infected members. For this reason, people from families with infected members were more likely to actively protect their family members.

Our study had a number of limitations. Firstly, the study was conducted in a service vaccination facility, where visitors had to pay for their vaccination, and therefore the study subjects did not or hardly include those whose children had previously got vaccinated in the Expanded Program for immunization. Secondly, our study only focused on the prevalence of giving hepatitis B birth dose vaccine to children, and due to limited resources, data was collected in only three months, lasting from October 2017 to December 2017. Further studies that cover study subjects of both immunization services and the Expanded Program for Immunization with larger sample sizes are needed to better investigate the associated factors of hepatitis B birth dose vaccination in children.

Conclusions

13.6% of mothers who participated in the study had sufficient knowledge of hepatitis B vaccination. The prevalence of having received the birth dose of hepatitis B vaccine among children was 69%. Sufficient knowledge of hepatitis B was the associated factor of mothers' knowledge regarding hepatitis B birth dose vaccination. There were four factors which had statistically significant correlations with the prevalence of children having received a birth dose vaccine against hepatitis B, including their birth place, birth weight, the state of being born with neonatal pathology, and being born in families with members infected with hepatitis B.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication.

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References

1. WHO (2012) Practices to improve coverage of the hepatitis B birth dose vaccine, Geneva 2012.
2. Nguyen CH, Azumi I (2011) Prevalence of HBV infection among different HIV-risk groups in Hai Phong, Viet Nam. Journal of Medical Virology 83.
3. WHO (2006) Preventing Mother-to-Child Transmission of Hepatitis B: Operational Field Guidelines for Delivery of the Birth Dose of Hepatitis B Vaccine, Manila 2006.
4. Hwang E.W., Chueng R (2011) Global Epidemiology of Hepatitis B virus (HBV) Infection. North American Journal of Medicine of Science 4: 7-13.
5. WHO (2006) The World Health Report 2005.
6. National Institute of Hygiene and Epidemiology (2011) Achievements of the Expanded Programme on Immunization in 2011.
7. WHO (2008) Seoul International Expert Meeting on Hepatitis B control in the Western Pacific Region. Meeting Report, Manila 2008.
8. PATH Viet Nam Office (2010) Increasing the coverage of hepatitis B vaccination birth dose in Viet Nam, Ha Noi 2010.
9. UNICEF, WHO (2014) Immunization summary: A statistical reference containing data through 2013.
10. WHO Immunization Practices Advisory Committee (IPAC) (2011) Final meeting report and recommendations Geneva 2011.
11. Thanh Thi Le X, Ishizumi A, Thi Thu Nguyen H, et al (2020) Social and behavioral determinants of attitudes towards and practices of hepatitis B vaccine birth dose in Vietnam. Vaccine 38: 8343-8350.
12. Freeland C, Bodor S, Perera U, Cohen C (2020) Barriers to Hepatitis B Screening and Prevention for African Immigrant Populations in the United States: A Qualitative Study. Viruses 12.
13. Huynh G, Nguyen TB, Cao NN, et al (2020) Hepatitis B Birth Dose among Children in District 2 Hospital, Ho Chi Minh City, Vietnam: Prevalence and Associated Factors. Can J Infect Dis Med Microbiol 2020: 5680154.
14. Nguyen Si Anh H, Vo HL, Hoang Bao L, et al. (2019) Hepatitis B Birth Dose Vaccination among Vietnamese Children: Implications for the Expanded Program on Immunization. Biomed Res Int 2019: 3453105.
15. Dionne-Odom J, Westfall AO, Nzuobontane D, et al (2018) Predictors of Infant Hepatitis B Immunization in Cameroon: Data to Inform Implementation of a Hepatitis B Birth Dose. Pediatr Infect Dis J 37: 103-107.

16. Pham TT, Le HM, Nguyen DT, et al. (2018) Assessment of the timely administration of the hepatitis B and BCG birth dose and the primary infant vaccination schedule in 2015-2016 in the Mekong Delta, Viet Nam. Vaccine 36: 5760-5765.

17. The National Project on the Expanded Programme on Immunization - National Institute of Hygiene and Epidemiology (2017) Immunization in Vietnam 2017.

18. Bui Thi Dung, Doan Ngoc Hai, and Nguyen Bich Diep (2015) Knowledge of mothers of hepatitis B new born dose vaccination at Luong Son district, Hoa Binh province in 2014. Vietnam Journal of Preventive Medicine 12: 91.

19. Nguyen Thi Xuan Loan, Nguyen Thi Tu Van (2012) Knowledge, attitude and practice of mothers in getting HBV vaccination for infants in Long Xuyen, An Giang. Ho Chi Minh City Journal of Preventive Medicine 17.

20. Bui Thi Dung (2015) Knowledge and practice of mothers on heaptitis B birth dose vaccination and associated factors in Luong Son district, Hoa Binh province in 2014. Master thesis in Public Health, Hanoi University of Public Health 2015.

21. Ngo Van Hien, Nguyen Canh Phu (2012) The prevalence of hepatitis B vaccination among children under one year of age and associated factors in Nghi Xuan district, Ha Tinh. Journal of Practical Medicine 817.

22. Zhou Y (2009) Coverage of and influences on timely administration of hepatitis B vaccine birth dose in remote rural areas of the People's Republic of China. Am J Trop Med Hyg 81: 869-874.

23. Duong Thi Hong (2010) Interventions to increase the coverage of hepatitis B birth dose vaccine to prevent HBV mother-to-child transmission in some hospitals in Hai Duong. Journal of Practical Medicine 2010.

24. National Institute of Hygiene and Epidemiology (2017) Summary Report on the Extended Programme on Immunization in 2016.

25. Liang XF (2009) Evaluation of the impact of Hepatitis B vaccination among children born during 1992-2005 in China. Journal of Infectious Diseases 200: 39-47.

26. Luman ET (2004) Impact of thimerosal-related changes in hepatitis B vaccine birth-dose recommendations on childhood vaccination coverage. JAMA: Journal of the American Medical Association 291: 2351-2358.

27. D'Angio CT (2007) Active immunization of premature and low birth-weight infants: a review of immunogenicity, efficacy, and tolerability. Paediatr Drugs 9: 17-32.

28. Ministry of Health (2015) Decision 2301 / QD-BYT 2015 - Guidance for pre-vaccination screening examination for children 2015.