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Maternal reasons for non-receipt of valid Hepatitis B birth dose among mother-infant pairs attending routine immunization clinics, South-east, Nigeria

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ABSTRACT

Background: Hepatitis B vaccine (HepB) is an effective tool in prevention of hepatitis B virus (HBV) infection. When administered at birth, it prevents mother-to-child transmission of acute and chronic HBV infection. However, despite a decade and half of implementation of HepB birth dose (HepB-BD), uptake has remained persistently low in Enugu State, Nigeria. We assessed the uptake of valid HepB-BD and the reasons given by mothers of infants for not receiving the HepB-BD in Enugu State, South-east Nigeria.
Methods: An hospital-based cross-sectional survey was conducted among mother-infant pairs attending immunization clinics at randomly selected health facilities in Enugu State, Nigeria. Overall, 344 mothers and their infant children in this study were interviewed using structured questionnaire. Data on maternal reasons for non-receipt of valid HepB-BD by their infants and their recommendations on ways to improve valid HepB-BD uptake, were collected. We defined valid birth dose as the receipt of first dose of HepB within 24 h of birth.
Results: Overall, 254 (73.8%) infants did not receive valid HepB-BD. Major reasons for its non-receipt were vaccine not available at place of delivery (91.3%, n = 232), delivery did not take place on immunization day (75.6%, n = 192), lack of awareness on timing of valid HepB-BD (72.8%, n = 185), long distance from the health facility (5.1%, n = 13) and fee payment for immunization (6.3%, n = 16). Of the 384 maternal recommendations, 143 (37.2%) emphasized female literacy while 87 (22.7%) indicated pre-positioning the vaccines at labor rooms to improve valid HepB-BD uptake.
Conclusion: The low receipt of valid HepB-BD among infants attending routine immunization clinics, found in this study were attributed to lack of maternal awareness on timing of HepB-BD and poor integration of child delivery and immunization services. We recommend educating mothers on benefits of a timely HepB-BD and pre-positioning the vaccines at the labor rooms.

1. Background

Hepatitis B virus (HBV) infection is a highly infectious and potentially life-threatening disease, 50–100 times more infectious than HIV and can cause both acute and chronic disease [1,2]. According to the World Health Organization (WHO), one-third of the global population have been infected with the HBV worldwide and about 4–6% of the world population are chronic carriers [3]. In 2017, WHO Western Pacific and African regions, each with estimated prevalence of 6%; jointly accounted for 68% of the global burden [4]. Nigeria has a pooled prevalence estimate of 13.6% and thus is classified as hyper-endemic for HBV infection [5]. Areas with high prevalence of HBV infection such as Nigeria has mother-to-child-transmission (MTCT) as the major route of transmission. Notably, 90% of the HBV-infected infants are at increased risk of developing chronic HBV [6–8].

HepB vaccination at birth reduces the incidence of the HBV infection through prevention of MTCT. However, the efficacy of the vaccine in preventing perinatal transmission declines with increasing interval between birth and the administration of the vaccine [9]. This underscores the need for timely vaccination of infants with the HepB birth dose (HepB-BD). Accordingly, WHO recommended that "all infants should receive their first dose of HepB vaccine as soon as possible after birth, preferably within 24 h" [6], irrespective of endemicity of HBV infection in countries, i.e. valid HepB-BD. HepB at birth is a monovalent dose which is followed by additional two or three doses depending on the country's

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immunization schedule. In Nigeria, the birth dose is followed by additional three doses with a minimum interval of four weeks which are given in combination with Diphtheria Pertussis and Tetanus vaccine and Haemophilus influenza type B vaccine as pentavalent vaccine. National Primary Health Care Development Agency (NPHCDA), an agency responsible for implementation of primary health care in Nigeria, recommended that all infants should receive their first dose of HB vaccine as soon as possible (less than 24 h) after birth and up to 2 weeks [10]. However, the timeliness of HepB-BD vaccination remains neglected.

Despite a decade and half implementation of HepB-BD in Nigeria, uptake has remained persistently low in Enugu State, with a probable high risk of mother-to-child-transmission of HB in fetuses and chronic HBV in newborns and eventual death [7]. The 2017 Nigeria National Immunization Coverage Survey revealed that 31% of the infants received valid HepB-BD in Enugu State [11]. In order to avert the inherent risk of mother-to-child-transmission of HBV, we assessed the uptake of valid HepB-BD and the maternal reasons for its non-receipt among infants attending immunization clinics in Enugu State, South-east Nigeria.

2. Methods

2.1. Study area

This study was conducted between October 2017 and January 2018 at the health facilities offering immunization services in Enugu State, Nigeria. The state has 291 wards in its 17 local government areas (LGA) with five largely urban, while 12 are rural. These LGAs are distributed across three senatorial zones, namely; Enugu-East (6 LGAs), Enugu-West (5 LGAs) and Enugu-North (6 LGAs). There are 912 health facilities, of which overall 602 (public, mission and private hospitals) offer routine immunization services. The number of immunization sessions per month per health facility varies from daily to monthly based on the target population of their catchment areas. The immunization services entail giving every newborn an immunization card where National program on immunization (NPI) vaccinations and dates of administration of the vaccines are recorded by immunization staff. The immunization cards also contain information such as birth record, vaccination schedules, growth monitoring charts as well as the address of parents.

2.2. Study population and design

A hospital-based cross-sectional survey was conducted among mother-infant pairs attending immunization clinics in Enugu State, Nigeria. The mother-infant' pairs were attendees of 18 health facilities selected from 18 different wards spanning six of the 17 LGAs of the state.

2.3. Sample size calculation and sampling strategy

The estimated sample size (N = 366) for the study was calculated using formula for cross-sectional study ($n = Z^2\ p(1-p)/d^2$) with 31% Enugu State's valid HepB-BD coverage [11] and 10% non-response rate factor.

Study participants were selected using multi-stage probability sampling technique. In the first stage we selected six LGAs from 17 LGAs of the state (two per a senatorial zone) using a simple random sampling by balloting. In the second stage, the wards in each of the six selected LGAs were stratified into urban and rural based on the list of wards (obtained from the Local-Government Immunization Officer (LIO)); one urban and two rural wards were selected per LGA using a simple random sampling by balloting. Stage 3: We selected one health facility offering routine immunization using a simple random sampling by balloting from each of the 18 wards based on the list of health facilities (HFs) obtained from the LIO. Finally, in the fourth stage, mother-infant pairs were selected using systematic sampling technique, See Fig. 1.

2.3.1. Selection of mother-infant pairs

The average monthly number of mother-infant pairs and the immunization sessions in a month in each of the selected health facilities were collected from the LIOs. The average number of each of the selected HFs were summed up to obtain the sample frame of 1039. Using probability proportional by size, the proportion of mother-infant pairs per HF (n) was obtained. We divided the average number per HF by the sample frame and then multiplied by the sample size (N). Thereafter, the sampling interval was calculated by dividing the 'N' by 'n', (N/n) and selected the first mother-infant pair by simple random sampling by balloting. Subsequently, every n^{th} mother-infant pair was selected by systematic sampling at each immunization session of the selected HFs until the sample size for that HF was completed. The number of mother-infant pairs recruited in an immunization session was calculated by dividing the number allocated in a month by the number of sessions for each of the HFs (Table 1).

2.4. Data collection

The questionnaire was pretested among 18 mother-infant pairs in two health facilities not selected for the study and checked for comprehension, reliability, validity and necessary modifications made. Trained research assistants administered pretested structured questionnaire to collect information on the mother's sociodemographic characteristics, their reasons for non-vaccination of their infants and recommendations on ways to improve valid HepB-BD uptake. Additionally, information on infants' date of birth and time of HepB-BD vaccination was collected. These were confirmed in the infants' immunization card and hospital immunization register where available and applicable.

2.5. Data processing and analysis

Data entry, cleaning and analysis was conducted using Epi-info version 7.2 and Microsoft Excel. Age of participants was presented in mean and standard deviation. Categorical variables including respondents with valid dose of HepB and the reasons for non-vaccination were presented in frequencies and proportions. Valid Hepatitis B vaccine birth dose was defined as the receipt of first dose of HBV within 24 h of birth.

2.6. Ethical consideration

The ethical approval for the study was obtained from the Research Ethics Committee of State Ministry of Health, Enugu (reference number MH/MSD/REC/0238, date: 20th July 2017). Written informed consent was obtained from each study participants. Confidentiality of information provided was maintained. None personal identifiers were used at data entry and analysis. Data was stored securely in a password protected computer for which the principal investigator has sole access.

3. Results

3.1. Sociodemographic characteristics

Overall, 344 mothers were enrolled in the study. Mean age was 27.8 ± 4.7 years, 67.2% (231) were between 25 and 34 years, 55.2%

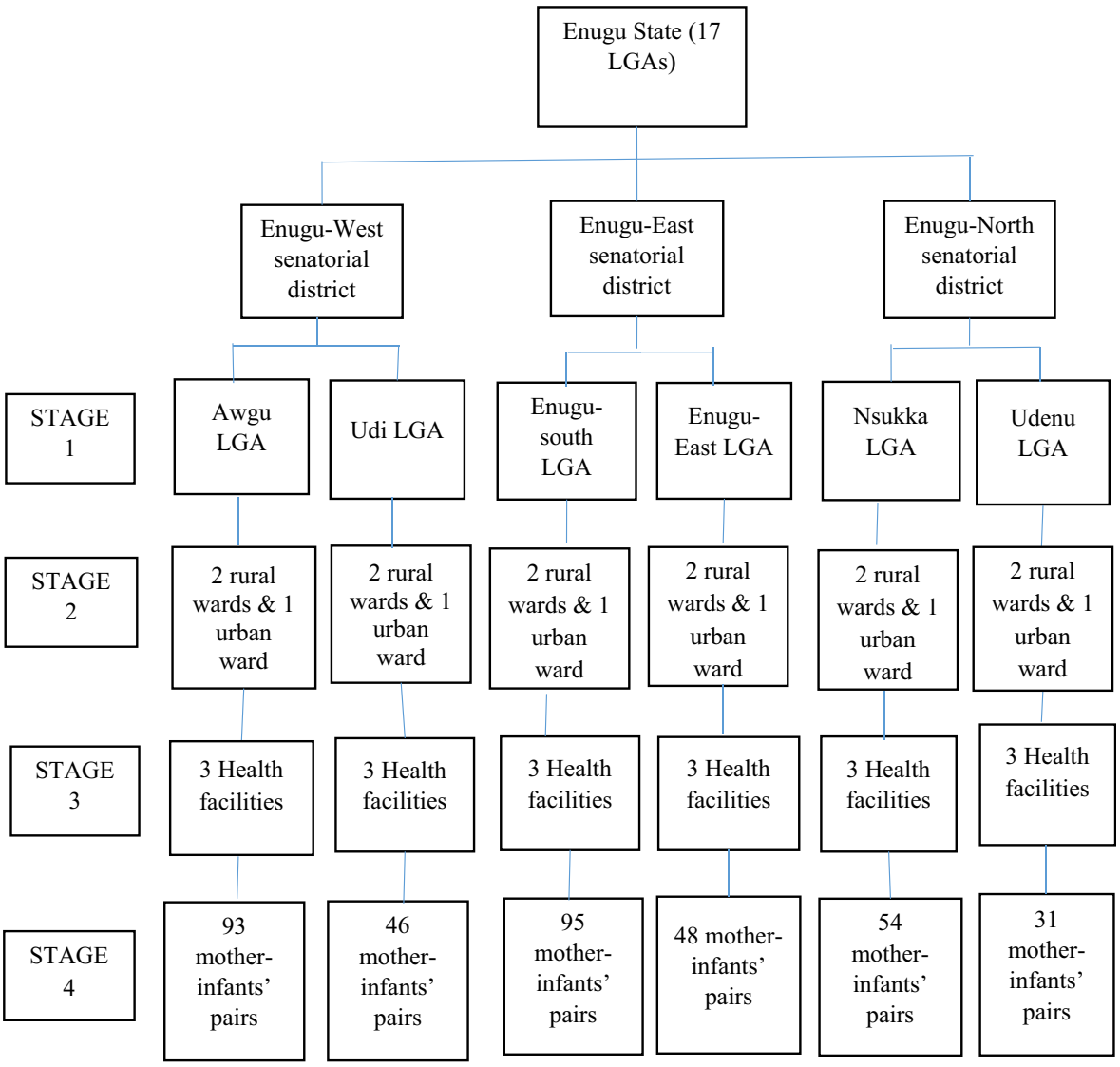

Fig. 1. Flow chart of sampling strategy of mother-infants' pairs attending routine immunization clinics, Enugu State, South-east Nigeria, 2018.

(190) reside in urban area, 96.2% (331) were currently married, and 30.2% (104) had attained tertiary education (Table 2).

3.2. Valid HepB doses and reasons for nonreceipt

Of the 344 mother-infant pairs, only 90 (26.2%) had received valid doses of HepB. Major reasons for non-vaccination were lack of vaccines at the labor rooms or maternity wards (91.3%, n = 232), not giving birth on health facility-designated immunization day (75.6%, n = 192), lack of awareness on timing of valid HepB-BD (72.8%, n = 185), vaccine stock-out at the immunization unit (20.1%, n = 51), fee payment for immunization (6.3%, n = 16) and long distance from the health facility (5.1% n = 13), see Table 3.

3.3. Maternal recommendations for improving valid Hepatitis B vaccine birth dose uptake among infants

Of the 384 opinions expressed by 232 (67.4%) mothers when asked about how best to improve the immunization of infants with HepB birth dose, 143 (37.2%) emphasized ensuring improved awareness on HepB vaccine while 87 (22.7%) indicated pre-positioning the vaccines at labor rooms to improve valid HepB-BD uptake. Fifty-seven (14.8%), 17 (4.4%) and 5 (1.3%) of the recommendations were in favor of making the vaccine available at every health facility conducting delivery, daily vaccination especially the birth dose vaccines and having a policy mandating vaccinating HepB within 24 h of birth respectively (Table 4).

4. Discussion

Receipt of valid HepB-BD was low (26.2%) among infants attending routine immunization clinics in Enugu State, Nigeria. This is slightly lower than the 31% seen two years ago in Enugu State [11]. The low uptake in this study is far below the uptake of valid HepB-BD of 87% and 97% found in hospital-based studies in the Philippines and China respectively [12,13], where there was a policy in place that mandates the vaccination of newborns few hours after birth and vaccines were pre-positioned at the labor and or maternity wards. HepB-BD can prevent up to 90% of perinatal transmission [9]. Its efficacy in preventing perinatal transmission of HBV infection decreases as the time period between birth and its vaccination increases [14]. Thus, a low uptake as seen in our study may allow MTCT of HBV infection among the infants resulting in their not only being at risk of developing chronic HBV and liver diseases but also at risk of transmitting it to others [3].

Table 1
Sampling of mother-infant pairs attending immunization clinics in Enugu State, South-east, Nigeria by probability proportional to size (PPS), 2018.

LGA	Ward	Health facility	Average no in a month (N)	Proportion	The proportion allocated in a month (n)	No of immunization sessions in a month	No allocated in a session	Sampling interval, K = N/n
			N		n	B	C = n/B	K = N/n
Awgu	Awgu 1	MCH Awgu	100	(100/1039) × 366 = 35	35	4	9	3
	Mgbowo	Mgbowo PHC	70	(70/1039) × 366 = 25	25	4	6	3
	Awgu 2	Ugwulesi PHC	93	(93/1039) × 366 = 33	33	4	8	3
Udi	Udi Agbudu	MCH Udi	50	(50/1039) × 366 = 18	18	4	4	3
	Ngwo-uno	Model PHC Ngwo-uno	48	(48/1039) × 366 = 17	17	4	4	3
	Abor	Abor PHC	30	(30/1039) × 366 = 11	11	4	3	3
Enugu-east	Abakpa 1	Abakpa PHC	200	(200/1039) × 366 = 70	70	8	9	3
	Emene	Chukwuasokam hospital	44	(44/1039) × 366 = 15	15	4	4	3
	Mburujodo 2	Onuogba PHC	27	(27/1039) × 366 = 10	10	4	2	3
Enugu-South	Uwani-East	Uwani PHC	84	(84/1039) × 366 = 30	30	8	4	3
	Ugwuaji	Eke PHC Ugwuaji	31	(31/1039) × 366 = 11	11	4	3	3
	Amaechi-East	Amaechi	20	(20/1039) × 366 = 7	7	4	2	3
Udenu	Obollo-Afor	Obollo-afor PHC	58	(58/1039) × 366 = 20	20	4	5	3
	Orba 2	Model PHC Orba	42	(42/1039) × 366 = 15	15	4	4	3
	Amalla	Early-bird clinic, Amalls Egazi	54	(54/1039) × 366 = 19	19	2	10	3
Nsukka	Owerre umuoyo	Nsukka PHC	47	(47/1039) × 366 = 17	17	4	4	3
	Ibagwa-ani	Ibagwa-ani PHC	20	(20/1039) × 366 = 7	7	1	7	3
	Diogbe-ozalla	Opi PHC	21	(21/1039) × 366 = 7	7	4	2	3
			1039		366			

Table 2
Socio-demographic and delivery characteristics of mothers of infants attending immunization clinics in Enugu State, South-east, Nigeria, 2018 (N = 344).

Characteristics	Frequency (n)	Percentage (%)
Age-group (years)		
15–24	83	24.1
25–34	231	67.2
35–44	30	8.7
Marital Status		
Single	12	3.5
Currently married	331	96.2
Divorced/Widowed	1	0.3
Educational level		
No formal education	4	1.2
Primary School	26	7.6
Secondary School	210	61.1
Tertiary School	104	30.2
Type of residence		
Rural	154	44.8
Urban	190	55.2
Infant's place of delivery		
Private health facility	184	53.5
Tertiary health facility	35	10.2
Secondary health facility	23	6.7
Primary health facility	85	24.7
At home	10	2.9
Traditional birth attendance	7	2.0
Delivery at Health facility offering immunization		
Yes	219	63.7
No	125	39.3

Unlike the general notion that distance of an individual to health facility affects uptake of services and what was obtained in a study in Gambia [15], most of the mothers in the current study reported that distance from the health facility was not a reason for not getting their newborns immunized with valid HepB-BD. This probably showed good attitude and health-seeking behavior of the mothers in this study.

Table 3
Maternal reason for non-receipt of valid Hepatitis B birth dose of their infants in Enugu State, South-east, Nigeria. (N = 254).

Reasons for non-vaccination	Frequency (n)	Percentage (%)
Vaccine not available at place of delivery	232	91.3
Delivery did not take place on immunization day of the facility	192	75.6
Mother not aware that child should receive HepB vaccine within 24 h of birth	185	72.8
Vaccine not available at the immunization unit	51	20.1
No money to pay for vaccination	16	6.3
Immunization post too far	13	5.1
Baby born on public holiday	4	1.6

In this study, the finding of lack of awareness of the timing of HepB-BD and its benefit was consistent with an earlier study in northern Nigeria [16]. This may raise questions on the quality of messages given to pregnant women during their ANC visits. Good knowledge of immunization among mothers and awareness of the need is positively associated with uptake of immunization [17,18]. This raises a strong need to improve on the awareness creation about the need and importance of birth dose vaccination of HepB in Enugu State.

Absence of HepB at the place of delivery such as the labor rooms and maternity wards was another main reason given by the mothers in this study for non-vaccination of their infants with the vaccine. This finding was similar to what was reported by WHO [19] and other studies that the unavailability of vaccines especially monovalent HepB was one of the reasons for non-vaccination of infants [12,20]. The uptake of valid HepB-BD was as high as 79% in Papua New Guinea where HepB were administered at the labor rooms or at the maternity ward at the time of recording the birth and other things done for the child [21]. Hence, majority of the maternal recommendations on major ways to improve timely HepB-BD uptake is to ensure coordination between immunization services and maternal health services.

Table 4
Maternal recommendations for improving valid Hepatitis B birth dose uptake among infants, Enugu State, South-east, Nigeria (N = 384).

Recommendations	Frequency (n)	Percentage (%)
Mothers and care-givers should be educated on HB infection and vaccination	143	37.2
Make HB vaccine available at the maternity or labor rooms	87	22.7
Make HB vaccine available at every health facility conducting delivery	57	14.8
All childhood vaccinations especially those given at birth should be truly free of any charge	31	8.1
Health workers should be educated on HB infection and vaccination	23	6.0
There should be public enlightenment on HB infection and prevention	18	4.7
Vaccination should be daily especially those given at birth	17	4.4
Policy to mandate immunization of newborns with HB vaccine within 24 h of birth	5	1.3
HB vaccination should form part of new born care immediately after delivery	3	0.8

Moreover, most mothers in our study reported that they failed to give their infants valid HepB-BD because they did not give birth on the day the health facility scheduled for immunization, which could be weekly or even monthly. This could have resulted in a lot of missed opportunities resulting in low uptake and possible vertical and horizontal transmission of HBV infection.

Feedback received from mothers in the study regarding education on HBV and its vaccination schedule showed that they could have desired for vaccination of their infants if they have adequate knowledge. Moreover, for mothers to recommend pre-positioning of the HepB vaccine at the labor or maternity after they have been told the rationale for giving HepB-BD within 24 h of birth indicate their willingness to get their infants vaccinated with the valid birth dose.

5. Conclusion

The low receipt of valid HepB-BD among infants attending routine immunization clinics, found in this study was attributed to lack of maternal awareness on timing of HepB-BD and poor integration of child delivery and immunization services. We recommend educating mother and health workers on benefits of timely HepB-BD, pre-positioning the vaccines at the labor rooms and daily immunization of birth dose vaccines.

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Authors contributions

UJO conceptualized and designed the study, conducted the field work, analyzed and interpreted the data and wrote draft manuscript. MD, BU and OA contributed to the study design, provided technical guidance on data analysis and interpretation. MD, BU and OA reviewed draft manuscript for intellectual content. All authors read and approved this manuscript.

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.

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