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Willingness to pay for hepatitis B immunoglobulin among pregnant women in Enugu metropolis, South-East, Nigeria: a cross-sectional study

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Abstract

Background Hepatitis B immunoprophylaxis reduces the rate of mother-to-child transmission of hepatitis B virus infection and has effectively reduced the global burden of the hepatitis B virus infection. However, the cost of hepatitis B immunoglobulin could be prohibitive hampering adequate utilization in pregnancy and childbirth. Cost may affect pregnant women's willingness to pay (WTP) for the immunoglobulin. The WTP for hepatitis B immunoglobulin has not been critically studied in Enugu, Nigeria. The objective of the study was to determine the willingness of pregnant women to pay for hepatitis B immunoglobulin and to identify the predictors of the level of WTP among pregnant women in Enugu, Nigeria.

Methods A cross-sectional study that involved 379 pregnant women who were selected through a multi-stage sampling technique from the health facilities in Enugu between March and November 2019 was conducted. A structured pre-tested interviewer-administered questionnaire was used for data collection. The contingent valuation technique was utilized for eliciting values attached to hepatitis B immunoglobulin by the pregnant women while the bidding game technique was used to determine the maximum amounts the participants were willing to pay. Data were analyzed using SPSS version 23. A p-value of 0.05 was regarded as significant.

Results Most respondents (86.2%) were willing to pay for the hepatitis B immunoglobulin. The mean maximum amount of WTP was ₦23178.34 (62.64 USD). The price of hepatitis B immunoglobulin (48.8%) was a major hindrance to WTP and 36.9% of the respondents believed that the government should pay for the vaccines. Predictors of the average WTP amount were the level of education ($p=0.038$, AOR = 2.645 CI: 1.055–6.630), participants' husbands' occupation, and weekly expenditure on food items ($P=0.041$; AOR = 3.828, CI: 1.055–13.893).

Conclusions The rate of WTP for hepatitis B immunoglobulin was 86.2%, however, the mean WTP amount was far below the market value of hepatitis B immunoglobulin. The major hindrance to WTP was the cost of the vaccine as most participants believed that the vaccine should be administered freely and financed by the government and its

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agencies. The predictors of willingness to pay were the participant's level of education, husband's occupation and weekly expenditure on food.

Trial registration Not applicable.

Highlights

- Hepatitis B immunoprophylaxis reduces the rate of mother-to-child transmission of hepatitis B virus infection remarkably.
- The cost of the immunoglobulin could be prohibitive to adequate utilization in pregnancy and childbirth.
- The willingness of pregnant women to pay for hepatitis B immunoglobulin can determine factors that affect utilization.
- The majority of the respondents (86.2%) in Enugu were willing to pay for the hepatitis B immunoglobulin.
- The mean maximum amount the respondents were willing to pay was ₦23178.34 (62.64 USD) which was far below the market value of hepatitis B immunoglobulin.
- The price of hepatitis B immunoglobulin (48.8%) was a major hindrance to willingness to pay and 36.9% of the respondents believed that the government should pay for the vaccine.
- Predictors of the average willingness to pay amount were the level of education, participants' husbands' occupation, and weekly expenditure on food items.

Keywords Hepatitis B immunoglobulin, Willingness-to-pay, Pregnant women, Enugu

Background

Hepatitis B virus (HBV) infection is an inflammatory condition of the liver that runs a chronic cause in humans. The disease in its chronic form leads to liver cirrhosis and primary liver cell carcinoma. Globally, about 2 billion people are infected and the disease was responsible for the primary cause of 887,000 deaths in 2015 [1]. The prevalence of hepatitis B varies worldwide [2, 3]. The prevalence was low, 0.1 -2% in countries like the United States of America, Canada, Eastern Europe, Australia, and New Zealand; moderate, 3–5% in countries like Japan, Central Asia, Middle East, South America and Mediterranean countries; and high, 19–20% in countries like China, Sub-Saharan African countries, and South East Asia countries [3].

HBV is primarily transmitted sexually, and also via the transplantation of organs, the exchange of body fluids like blood and perinatally (during pregnancy and childbirth). In the absence of immunoprophylaxis with hepatitis B immunoglobulin and hepatitis B vaccination at birth and in the presence of a serologic marker for active HBV replication, hepatitis B e antigen (HBeAg), the rate of chronic infection in the baby is 70–90% at 6 months after birth [4, 5]. This risk of chronic infection is drastically reduced to 10 – 40% when the mother has negative HBeAg [6].

Currently, immunoprophylaxis is done with the combination of administration of hepatitis B immunoglobulin (HBIG) within the first 24 h of birth and administration of the three-dose series of hepatitis B vaccines. The effectiveness of immunoprophylaxis is as high as 90–100% in protection against acute and chronic HBV infection in infants of mothers positive for both HBsAg and HBeAg [7]. The provision of immunoprophylaxis to the newborn at birth provides an excellent opportunity for the global reduction of the burden of HBV infection [8]. HBIG is a substance that is rich in antibodies against the hepatitis B virus and is prepared from human blood. It can be administered to both pregnant mothers and newborns. HBIG crosses the placental barrier easily to the baby to help prevent prenatal HBV transmission and this form of effect is expected to work best during the first trimester.

Welfare economics focuses on the optimal allocation of scarce resources and goods and how these allocations affect the social welfare of the individual. It studies how income distribution affects the common good of people. Welfare economics creates different models by assigning units of welfare or utility to measure improvements of the individual based on their scales. Different optimal states of the economy in the forms of the allocation of resources are evaluated and the best model that creates the highest level of social satisfaction of consumers is chosen.

In other words, allocative efficiency is achieved when models for allocating resources achieve the maximum level of social welfare. At this point, the economy is said to be functioning in a manner that further changes to raise the feelings of well-being in one area would require the lowering of the well-being of another individual. At this point, Pareto optimality/efficiency is achieved. This happens when the further possible allocation of resources is impossible to reallocate resources to make any one individual or preference criterion better off without making at least one individual or preference criterion worse off [9].

Utility is the perceived value of satisfaction a consumer obtains from the consumption of a good or service. This perceived value or satisfaction is intrinsic and it involves the fact that the buyer feels that the amount of value/

satisfaction he got from consuming a certain good or service is at least equal to or greater than the funds used to procure the good or service. The monetary equivalent of this utility of consumption of the good and service is assumed to have similar value to all consumers irrespective of how the money was obtained.

The cost of hepatitis B immunoglobulin may have affected the proportion of pregnant women who will administer this immunoglobulin to their newborn babies. In addition, the cost is related to the willingness to pay for this vaccine. The process of procuring this vaccine in low- and middle-income countries has to be planned by families and the current price of the vaccine is prohibitive in Nigeria, ₦85,000 (USD230). Several studies in low- and middle-income countries revealed low willingness to Pay (WTP) for the HBIG. In a cross-sectional study in Cameroun [10], only 11.5% were willing to pay for HBIG out of 94.6% of the participants who agreed to vaccinate their children. This poor willingness to pay has a lot of negative implications on the ability of women to give this immunoglobulin to their babies and this will ultimately lead to increased mother-to-child transmission (MTCT) of HBV in the population and the number of babies that will come down with chronic hepatitis B infection and its sequelae in the population.

Furthermore, most mothers are unaware of the cost implications of this hepatitis B immunoglobulin making it difficult for them to afford the money to procure this vaccine when needed in their pregnancy [10]. Secondly, some mothers do not consider immunoprophylaxis with HBIG as better to no action due to so many reasons which include poor knowledge of hepatitis B and its preventive measures, religion, poverty, lack of education, and unavailability of the vaccine among others [11]. In our environment, most mothers receive information on hepatitis B immunoglobulin as emergencies, when the need for the purchase of the vaccine arises. This creates chaos during this very important moment as an immediate source of cash to purchase the expensive but important medication is limited.

The review conducted suggested that works on this subject (WTP for HBIG) especially as it concerns the willingness to pay among pregnant mothers is scarce in Nigeria and other Sub-Saharan African countries. This limited information and knowledge gap on WTP studies on hepatitis B immunoglobulin underscores the need for this research. Scarce information on hepatitis B immunoglobulin has made the government largely not involved in making the procurement of this vaccine easy for pregnant mothers who need the immunoglobulin for their babies. Unlike the other vaccines which are part of the National Programme on Immunization (NPI) and given to children free, this vaccine is not free and is very expensive. The price of HBIG that could be easily affordable for pregnant mothers is also not explicitly known in studies in Nigeria and many countries of the world [10, 12–15].

The objectives of the study were to determine the willingness of pregnant women to pay for hepatitis B immunoglobulin in the Enugu metropolis and to identify the predictors of the level of willingness to pay for hepatitis B immunoglobulin among pregnant women in the Enugu metropolis. This study is a key approach towards determining the value attached to hepatitis B immunoglobulin by pregnant mothers in Enugu. This study will be key in decision-making to efficiently allocate scarce resources to the consumption of hepatitis B immunoglobulin. The range and average maximum willingness to pay (WTP) amount obtained in this study will help guide governments and organizations to efficiently allocate their scarce resources towards the production of hepatitis B immunoglobulin to make it affordable to pregnant mothers when it is needed. And this will go a long way in the reduction of the high global burden of hepatitis B virus infection.

This information generated in this study will be useful in justifying the need to subsidize this vaccine to make it accessible to exposed babies like other forms of vaccination in the NPI schedule. The information obtained may equally be utilized by private individuals, non-governmental organizations, and governments to help in their planning to strengthen increasing access to hepatitis B immunoglobulin for babies of hepatitis B-positive mothers and in policy formulation. The STROBE criteria were utilized in the report of this manuscript [16].

Methods

Study design and setting

This study utilized a cross-sectional design and was conducted between March and November 2019. The study was carried out in public and private faith-based healthcare facilities in the Enugu metropolis, the capital city of Enugu state. Enugu state covers a land area of approximately 8727.1km^2 and is located in the semi-tropical rainforest of southern Nigeria, spreads towards the middle belt region of Nigeria [17]. The state is bounded by six states with Anambra State on the west, Imo and Abia States on the south, Kogi in the north and Benue states and Ebonyi State on the east. There are 17 local government centres and three major towns (Enugu metropolis, Nsukka and Orji River) in the state. Subsistence farming and civil service are mainly practised in the rural and urban centres respectively. The state is predominantly inhabited by the Igbo tribe and the population is about 3.26 million [17].

The health facilities utilized in the conduct of the research were primary (Uwani Health Centre and Primary Health Centre, Abakpa Nike, Enugu), secondary (Poly Clinic and Mother of Christ) and tertiary (Enugu

State University of Science and Technology Teaching Hospital (ESUTTH), Parklane) health facilities all in the Enugu metropolis. These healthcare facilities were purposely selected from the list of all the maternity tertiary, secondary, and primary health facilities in the Enugu metropolis. The healthcare facilities were selected to reflect the distribution of pregnant women in Enugu State. They were also selected because they were known to conduct maternity care services for pregnant women in the three local governments in the Enugu metropolis.

Study design

Structured interviewer-administered questionnaires were administered to get the appropriate data from systematically selected consenting respondents. Pregnant women were drawn from antenatal clinics of the selected healthcare facilities in the Enugu metropolis.

Study population

All the pregnant women in the selected study sites in the Enugu metropolis were eligible to be selected to participate in the study. Pregnant women who gave their written informed consent for this research from all the selected hospitals were recruited for this study while those who were not in the selected hospitals or that withheld their consent for this study were excluded from this study. Likewise, pregnant mothers with reduced mental capacity to clearly understand questions in the questionnaire due to illness were equally excluded from this study.

Sampling and sample size calculation

Sampling technique

Multi-staged sampling technique was utilized in the selection of the participants used in the study. At the first level of sampling, a purposive sampling technique was used to select healthcare facilities for this research. The allocation of study participants to each study site reflected a proportionate distribution of pregnant women in the maternity health facilities in the Enugu metropolis. An allocation of 35% of the questionnaires was given to clients in the tertiary maternity institution, 20% in secondary healthcare facility and the remaining 45% in the three selected primary healthcare centres.

At the second level of the sampling, one tertiary institution in the Enugu metropolis offering maternity services was chosen by purposive sampling technique. Also, one secondary healthcare facility was equally purposively chosen. Lastly, two primary health centres were chosen purposively from the sample frame of all the primary health centres offering maternity services in the Enugu metropolis. This purposive sampling technique was chosen to make sure it was only busy maternity hospitals where the majority of antenatal women in the Enugu metropolis go for maternity services were chosen for this research.

At the third and last level of the sampling, a systematic sampling technique was used to choose the participants at the selected health facilities. This was carried out by choosing consenting participants after determining the number present in each antenatal clinic and developing a sampling frame. The sampling frame was generated from the number tally given to the pregnant women before they started seeing their doctors and other health personnel. Where such was not possible, every other consenting participant was selected from a particular health facility until the number allotted for such facility was reached. No participant was sampled more than once.

Sample size Estimation

The minimum sample size (n) was determined by using the formula: [18] $n = Z^2\ pq/E^2$, where Z = coefficient of Z statistics obtained from the standard normal distribution table. Using a willingness to pay rate (p) of 91.6% for the HPV vaccine for a similar study carried out in Onitsha, Anambra state [19], at a confidence limit of 95%, and a sampling error of 5%. The calculated sample size (n) was 314. Assuming a non-response rate of 10% (31), the minimum sample size was 345 female secondary school teachers. This study was part of a bigger study whose sample size was 368, this minimum sample size was used.

Data collection tools and technique

An interviewer-administered questionnaire using the exit interview approach was utilized for data collection. The participants were assisted by the research assistants to complete the questionnaires. The questionnaires had 3 sections and each section was targeted at addressing each of the research questions. They were designed based on the objectives of the research. Validity testing (Content, face, criterion, construct) was done by making sure that many teachers thoroughly read the questionnaire. The questionnaire was also given to selected clients to correct noted gaps in the questionnaire. Also, the questionnaires were pretested by initially administering 10% of the sample size of the questionnaire to the participants.

The first section contained questions on the sociodemographic characteristics of the participants. This section contained questions trying to ascertain the basic demography of the participants like the age, educational level, employment status or occupation of the participants and the husband's marital status, etc. The second section contained questions that tested the willingness to pay for hepatitis B immunoglobulin among pregnant women. The section had questions on the willingness to pay for hepatitis B immunoglobulin by participants. It had questions that determined the WTP of the participants and the maximum amounts they were willing to

pay. It also had questions that elicited the participant's levels of constraints to pay for this vaccine. Lastly, the third section contained questions on the household economic status of the participants. These questions helped to determine if the reasons for participant's willingness to pay matched their economic status and levels of consumption of other goods.

The members of the research team were well trained by the researchers on the method of data collection technique before the commencement of the research. Data collection was commenced from the hospitals selected for this study after approval by the Ethics Committee of Enugu State University of Science and Technology Teaching Hospital, Parklane, Enugu. Following individual counselling well-structured interviewer-administered questionnaires were given to selected consenting pregnant mothers for response and completion. The exit interviewer-administered approach was adopted. The questionnaires were given to the participants after they had finished seeing their doctors for that day.

Willingness to pay among the participants was determined by using the contingent valuation approach using a bidding game technique to estimate the maximum amount each participant was willing to pay for the Hepatitis B immunoglobulin. A hypothetical scenario describing hepatitis B immunoglobulin was created to the participants. They were then iteratively asked to propose a price they were willing to pay for a dose of hepatitis B immunoglobulin if prescribed for their babies. The prices they proposed were adjusted upwards or downwards based on their responses until they reached a point where they were indifferent between buying the hepatitis B immunoglobulin at that price and not buying it at all. The participants essentially, "bid" until they found their maximum WTP. The efficiency of the bidding game in eliciting WTP was increased by repeated questions that were put forward to the respondents. Respondents were iteratively asked to state their maximum WTP. They were first asked if they were willing to pay a certain amount for the hepatitis B immunoglobulin. If the answer was 'yes', a higher amount for the hepatitis B immunoglobulin was asked. The bidding game continued until the respondent said 'no' or from 'no' to 'yes'. This double-bound format helped to overcome econometric precision which closed-ended questions lose compared to open-ended questions [20]. The flow chart is seen in Fig. 1.

Data analysis

Measurement of variables

The study examined dependent/outcome variables (average willingness-to-pay amount) and independent variables (socio-demographic characteristics of respondents, socio-economic index of the respondents, total family income (respondent's husband income) and total family expenses. The demographic characteristics of respondents such as age, sex, class, family structure, and the total number of persons in the household were analyzed. Each respondent's socioeconomic status was determined using the 'International Wealth Index Scale' [21]. The International Wealth Index (IWI) verifies about ownership of some vital household properties (such as television, refrigerator, car, etc.) to reflect the standard of living of the household. It is an asset-based index that measures household long-term economic status used internationally in low- and middle-income countries. The index measures the extent to which the household possesses basic assets, valued highly by people across the world [21]. The wealth indexes are regarded as an effective long-term indicator of socioeconomic position, living standard, or the material well-being of households [22]. The index is easy to compute, has intuitive appeal, and is widely used in household surveys in Demographic and Health surveys of developing countries and United Nations International Children's Emergency Fund (UNICEF) Middle-income country surveys [21]. The data is also shown to be more reliably measured than those needed to compute the income and expenditure of households especially where estimation of expenditures among households is difficult to compute [23]. The obtained values are regarded as relative wealth levels. Most Wealth Index divides wealth distribution into quintiles with the lowest 20% of the population defined as the poor, and the upper 20% defined as the rich or the best of the population [24].

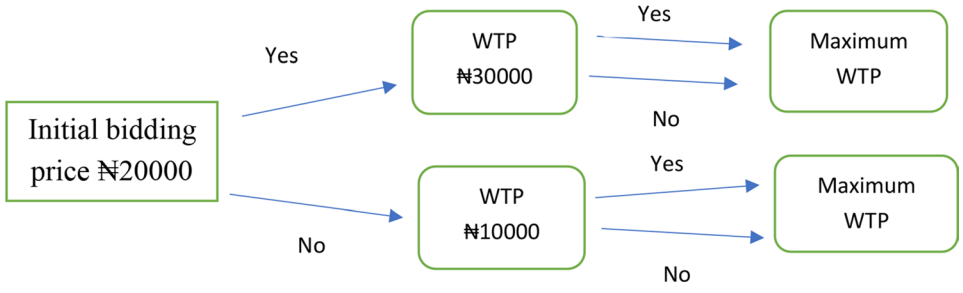

Fig. 1 Flowchart of how willingness to pay for hepatitis B immunoglobulin was measured during the survey bidding process

The IWI formula was formed based on the data set that was collected from 165 household surveys that were conducted between 1996 and 2011 in 95 low and middle-income countries involving 2.1 million households. The possession of consumer durables, access to basic services, and housing characteristics were entered into a principal component analysis (PCA), and asset weights were derived and subsequently brought together and used to generate an IWI formula [25, 26]. This formula was used in getting the individual IWI of each participant. The position of households on the IWI scale from calculated IWI shows the extent to which the households or their members own basic sets of assets that are valued highly by people worldwide. The scale ranges from 0 to 100 as shown in Table 1, where 0 indicates a household that owns none of the consumer goods, with lowest quality of housing, and has no connection to public utilities. Conversely, 100 means that the household owns all including consumer durables, has the highest quality housing and access to public utilities [21].

Statistical analysis

The data collected were entered and analyzed with Statistical Package for Social Sciences (SPSS) version 23. Data were presented using tables, graphs, charts, etc. as appropriate. Univariate statistics were used to analyze quantitative and qualitative variables. Means and standard deviations were reported for numeric (quantitative) variables while frequencies, percentages, and proportions were used to report categorical variables. Bivariate statistical analysis was performed to determine the factors that were significantly associated with WTP for hepatitis B immunoglobulin. The chi-square test was used to establish an association of independent variables like socioeconomic characteristics with willingness to pay for hepatitis B immunoglobulin. Multivariate analysis were done using Binary logistic and Tobit regression to determine predictors of willingness to pay for the vaccine. Fisher's exact test was applied where Chi-square was not appropriate such as where > 20% of the cells have expected counts of less than 5 [27]. Statistical significance was set at a p-value of less than 0.05 ($p < 0.05$).

Table 1 Socio-economic status classification according to international wealth index [21]

S/No	International wealth index	Classification
1	1–20	Poorest 20%
2	21–40	Second 20%
3	41–60	Middle 20%
4	61–80	Fourth 20%
5	81–100	Best-off 20%

Ethical considerations

The study adhered strictly to the Declaration of Helsinki. The ethical clearance certificate for this research was obtained primarily from Enugu State University of Science and Technology Teaching Hospital, Parklane, Enugu. Also, clearance was obtained from the Ministry of Health to cover other hospitals used for this study. A written informed consent was read and signed by each participant in the presence of the interviewer and a witness. Women below 18 years (minors) had their written informed consent forms signed and granted by their parents or legal guardians. The participants were assessed for competency to give consent before they signed the informed consent forms. This was done by making sure they had full disclosure of information about the study, they had the competency to make a decision based on their choices, and that the choices that determined their decisions were voluntary.

Exchange rate for calculation of costs

All calculations of costs were based on the exchange rate of ₦370 for US$1 which was the average exchange rate of the local currency in Nigeria for a United States of American Dollar within the time (between March to November 2019) the study was conducted.

Outcome measures

The primary outcome measure is the rate of willingness to pay while the secondary outcome variables were the maximum willingness to pay amounts (mean, median and range) and the predictors of willingness to pay.

Results

A total of 379 participants were interviewed and all the questionnaires (100%) were filled out and used for analysis.

Socio-demographic characteristics of participants

The mean age of the participants was 28.84 ± 4.74years. The majority of the participants were married (99.6%), had tertiary education (64.4%), were Christians (97.1%), and approximately half (45.6%) of the participants were employed. Most of the husbands of the participants had secondary education (51.7%) and their occupations were mostly professional/technical/managerial jobs (28.5%) and sales/services jobs (35.4%). Only 3.2% of the husbands were unemployed and therefore earned approximately nothing monthly. The details of the socio-demographic characteristics of the participants are shown in Table 2.

Economic characteristics of participants

The participants were evenly distributed in the wealth index strata with approximately 20% of the participants

Table 2 Socio-demographic characteristics of participants

Variable	Subgroups	Frequency	Per cent
Age groups	< 20	7	1.8
	20–24	55	14.5
	25–29	155	40.9
	30–34	116	30.6
	35–39	42	11.1
	> 39	4	1.1
Level of education	No school	10	2.6
	Primary	7	1.8
	Secondary	118	31.1
	Tertiary	244	64.4
Employed in the last year	No	206	54.4
	Yes	173	45.6
Occupation	None	148	39.1
	Professional/technical/managerial	88	23.2
	Clerical	51	13.5
	Sales and services	54	14.2
	skilled manual workers	15	4.0
	Unskilled manual worker	20	5.3
	Farming	3	0.8
Marital status	married	366	96.6
	separated	2	0.5
	divorced	3	0.8
	widowed	1	0.3
	Single	7	1.8
Religion	Christian	368	97.1
	Moslem	3	0.8
	African Traditional Religion	4	1.1
	others	4	1.1
Husband's level of education	no formal education	5	1.3
	primary	18	4.7
	secondary	103	27.2
	tertiary	196	51.7
	postgraduate	57	15.0
Husband's occupation	professional/technical/managerial	112	29.6
	clerical	60	15.8
	sales and services	134	35.4
	skilled manual	26	6.9
	unskilled manual	35	9.2
	agriculture	5	1.3
	unemployed but worked in the last one year	5	1.3
	unemployed but didn't work in the last year	2	0.5

belonging to each wealth index category. Most of the participants earned < ₦50,000 ($135.14) per month. The majority of the participant's families had a total household income that was below ₦100,000 ($270.27) per month. Most of the participants spent more than ₦200,000 ($540.54) yearly on non-food items. Most of the participant's husbands earned ₦100,000 ($270.27) and less per month. Table 3 shows the details of the economic characteristics of participants.

Table 3 Economic characteristics of participants

Variables	Subgroups	Frequency (*n* = 379)	Percent (%)
Wealth Index	Poorest	78	20.6
	Second	73	19.3
	Middle	79	20.8
	Fourth	78	20.6
	best off	71	18.7
Wealth Index in 3 categories	Poor	151	39.8
	Middle	79	20.8
	Rich	149	39.3
Average monthly income of participants (₦)	None	121	31.9
	10,000-50000	211	55.7
	> 50,000	47	12.4
Household monthly income (total) (₦)	≤ 50,000	108	28.5
	51,000–100,000	115	30.3
	101,000–150,000	63	16.6
	151,000–200,000	31	8.2
	> 200,000	62	16.4
Weekly food expenditure (₦)	5000 and below	85	22.4
	6000–10,000	150	39.6
	11,000–15,000	44	11.6
	16,000–20,000	19	5.0
	> 20,000	81	21.4
Annual non-food expenditure (₦)	≤ 50,000	13	3.4
	51,000–100,000	20	5.3
	101,000–150,000	25	6.6
	151,000–200,000	37	9.8
	> 200,000	284	74.9
Monthly income status of participant's husbands	0	12	3.2
	1-50000	153	40.4
	51,000–100,000	114	30.1
	101,000–150,000	37	9.8
	151,000–200,000	26	6.9
	> 200,000	37	9.8

Exchange rate USD1 = ₦370

Participant's willingness to pay (WTP) for hepatitis B Immunoglobulin

A large proportion of the participants (86.2%) demonstrated a willingness to pay for hepatitis B immunoglobulin as shown in Fig. 2. The majority of the participants (93.1%) were willing to recommend the vaccine to their close contacts. The modal maximum amount the participants were willing to pay was ₦5000 ($13.51) while the majority of the participants (63.1%) were willing to pay between ₦10,000 ($27.03) and lower. Most participants (48.8%) identified cost as a hindrance to the maximum amount to be paid while about 36.9% of the participants believed that government should pay for the vaccines. Other details are in Table 4.

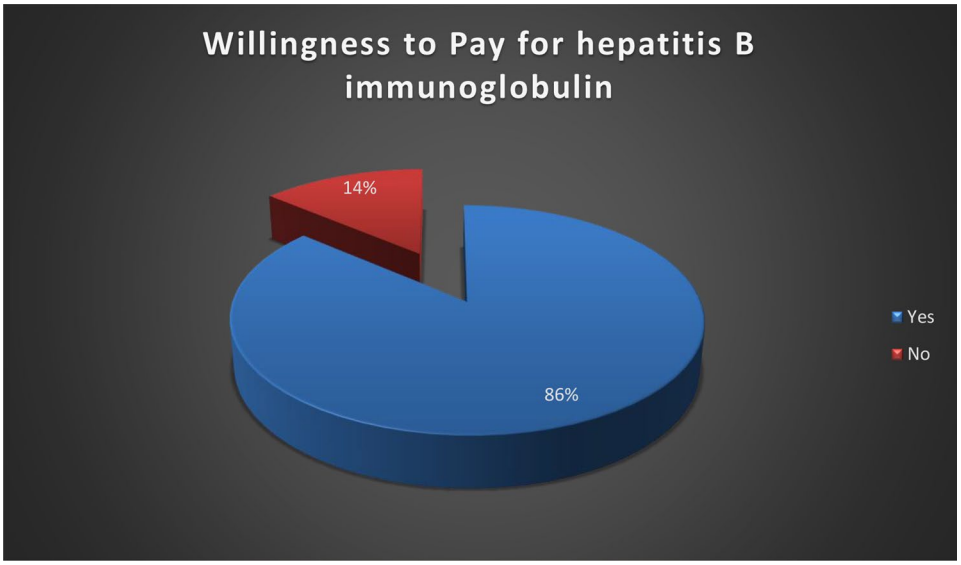

Fig. 2 The distribution of respondents who were willing to pay for hepatitis B immunoglobulin

Table 4 Participant's willingness to pay for hepatitis B Immunoglobulin

Variables	Frequency (*n* = 379)	Per cent (%)
Willing to recommend hepatitis B immunoglobulin to contacts		
Yes	353	93.1
No	26	6.9
Average (mean) maximum amount willing to pay (₦)	23,178.34 ± 38,503.830	
Modal maximum WTP	5000.00	
Median maximum WTP	5000.00	
(Inter-quartile Range IR)	1000–30,000	
Categories of maximum amount willing to pay (₦)		
10,000 and below	239	63.1
11,000–50,000	90	23.7
>50,000	50	13.2

Reason for degrees of willingness to pay	Yes	%	No	%
Can't afford it	185	48.8	194	51.2
Believe the vaccine might cause chronic hepatitis	0	0.0	379	100.0
Leads to promiscuity	5	1.3	374	98.7
Believe the government should pay for the vaccine	140	36.9	239	63.1
Cultural reasons	3	0.8	376	99.2
Associated side effects	3	0.8	376	99.2
Ignorance	11	2.9	368	97.1

Exchange rate USD1 = ₦370

Association of participant's socio-demographic characteristics and WTP for hepatitis B Immunoglobulin Among all the sociodemographic variables, only the educational status (X^2 = 7.710, $p = 0.021$) of the participants was significantly associated with willingness to pay for hepatitis B immunoglobulin. Details are in Table 5.

Association of economic characteristics of respondents and their WTP for hepatitis B Immunoglobulin The economic variable of the participants showed that it was only the total annual amount spent on non-food items (X^2 = 25.918, p = < 0.001) was significantly associated with willingness to pay for hepatitis B immunoglobulin. Details are shown in Table 6.

Association of respondent's husband characteristics and WTP for hepatitis B Immunoglobulin None of the husband's characteristics was significantly associated with willingness to pay for hepatitis B immunoglobulin among the respondents. Details are shown in Table 7.

Predictors of participant's willingness to pay for hepatitis B immunoglobin: Participants with secondary education were about 3 times more likely to pay compared to those with tertiary education ($p = 0.038$, AOR = 2.645 CI: 1.055–6.630). Also, the Participant's husband's occupation is a predictor of WTP for hepatitis B immunoglobulin as participants whose husbands have skilled jobs (professionals, clerical workers, sales and services, skilled manual workers) were more likely to pay for hepatitis B compared to the farmers. The participants whose husbands were professionals/technical/managerial workers were about 7 times more likely to pay compared to farmers ($p = 0.004$, AOR = 7.379, CI: 1.908–28.54), The participants whose husbands were clerical workers were about 6 times more likely to pay compared to farmers ($p = 0.021$, AOR = 5.673, CI: 1.295–24.845), The participants whose husbands were in sales and services were about 5 times more likely to pay compared to farmers ($p = 0.015$, AOR = 4.989, CI: 1.372–18.142). The participants whose husbands were skilled manual workers were about 8 times more likely to pay compared to farmers ($p = 0.031$,

Table 5 Association of participant's socio-demographic characteristics and willingness to pay for hepatitis B Immunoglobulin

Variables	Willing to pay for Immunoglobin				χ^2	*p*-value
	Yes		No			
	Freq	%	Freq	%		
Age in categories						
24 and below	54	87.1	8	12.9		
25–34	233	86.3	37	13.7	0.037	0.982
> 34	40	87.0	6	13.0		
Educational level						
Primary	12	66.7	6	33.3		
Secondary	105	90.5	11	9.5	7.710	0.021
Tertiary	210	86.1	34	13.9		
Marital status						
Married	1	50.0	1	50.0	FT	0.252
Others	326	86.7	50	13.3		
Religion						
Christianity	314	86.3	50	13.7	0.502	0.479
Others	13	92.9	1	7.1		
Employment status						
No	141	82.9	29	17.1	3.367	0.066
Yes	186	89.4	22	10.6		
Occupation						
Professional/technical/managerial	95	88.8	12	11.2		
Clerical	49	89.1	6	10.9		
Sales and services	117	87.3	17	12.7	9.967	0.076
Skilled manual	24	92.3	2	7.7		
Unskilled manual	28	80.0	7	20.0		
Agriculture	14	66.7	7	33.3		
Number in Household						
1 and below	7	100.0	0	0.0		
2	108	91.5	10	8.5		
3	70	84.3	13	15.7	5.399	0.249
4	61	82.4	13	17.6		
5 and above	81	84.4	15	15.6		

AOR = 7.944, CI: 1.215–51.942). Weekly expenditure on food shows that those who spent more than ₦20,000 ($54.05) per week are about 4 times more likely to pay for hepatitis B immunoglobulin compared to those spending ₦6000–10,000 ($16.21–27.03) on food items in one week ($P = 0.041$; AOR = 3.828, CI: 1.055–13.893). Details are shown in Tables 8 and 9.

Predictors of maximum amount willing to pay for hepatitis B Immunoglobulin (Tobit Regression)

Table 10 shows that those aged 25–34 years and those aged more than 34 years were about 299 times and 3,113 times respectively more likely to pay the maximum amount compared to those aged 24 years and below. Single/divorced/separated persons were about 19,257 more likely to pay the maximum amount compared to those married. Moslem/traditional religion members were about 10,942 less likely to pay the maximum amount compared to Christians. Those who had secondary and tertiary education were about 4,881 times and 4,951 times respectively more likely to pay the maximum amount compared to those who had primary education. Those that had 2 and 5 or more children were about 10,089 times and 19,312 times respectively less likely to pay the maximum amount compared to those that have 1 or no child. For every unit increase in the average amount the participants were willing to pay, there is about 5,321 times increase in the maximum amount willing to pay. The second and best-off classes were about 6,941 times and 2,859 times respectively more likely to pay the maximum amount compared to the poorest. Households that earn 51,000-100,000 and > 200,000 per month were about 13,660 times and 14,978 times respectively more likely to pay the maximum amount compared to those that earn 50,000 and below. However, the above findings on the predictors of the maximum amount willing to pay for hepatitis B Immunoglobulin by the respondents were not statistically significant.

Table 6 Association of economic characteristics of participants and their willingness to pay for hepatitis B Immunoglobulin

Variables	Sub-category	Willing to pay for Immunoglobin				χ^2	p-value
		Yes		No			
		Freq	(%)	Freq	%		
Wealth Index	Poorest	64	82.1	14	17.9		
	Second	65	89.0	8	11.0		
	Middle	71	89.9	8	10.1	2.756	0.600
	Fourth	67	87.0	10	13.0		
	best off	60	84.5	11	15.5		
Wealth Index in 3 categories	Poor	129	85.4	22	14.6		
	Middle	71	89.9	8	10.1	0.978	0.613
	Rich	127	85.8	21	14.2		
Average Monthly Income (₦)	None	100	83.3	20	16.7		
	10-50000	189	89.6	22	10.4	4.024	0.134
	> 50,000	38	80.9	9	19.1		
Monthly Household Income (total)(₦)	≤ 50,000	89	82.4	19	17.6		
	51,000–100,000	106	92.2	9	7.8		
	101,000–150,000	53	84.1	10	15.9	5.851	0.211
	151,000–200,000	28	90.3	3	9.7		
	> 200,000	51	83.6	10	16.4		
Weekly Food Expenditure(₦)	5000 and below	69	81.2	16	18.8		
	6000–10,000	126	84.6	23	15.4		
	11,000–15,000	41	93.2	3	6.8	6.241	0.182
	16,000–20,000	18	94.7	1	5.3		
	> 20,000	73	90.1	8	9.9		
Annual Non-Food Expenditure(₦)	≤ 50,000	13	100.0	0	0.0		
	51,000–100,000	12	60.0	8	40.0		
	101,000–150,000	24	96.0	1	4.0	25.918	< 0.001
	151,000–200,000	26	70.3	11	29.7		
	> 200,000	252	89.0	31	11.0		

Exchange rate USD1 = ₦370

Table 7 Association of respondent's husband characteristics and willingness to pay for hepatitis B Immunoglobulin

Variables	Willing to pay for Immunoglobin				χ^2	*p*-value
	Yes		No			
	Freq	%	Freq	%		
Educational level						
Primary	107	84.9	19	15.1		
Secondary	173	88.7	22	11.3	1.890	0.389
Tertiary	47	82.5	10	17.5		
Occupation						
Professional/technical/managerial	95	88.8	12	11.2		
Clerical	49	89.1	6	10.9		
Sales and services	117	87.3	17	12.7		
Skilled manual	24	92.3	2	7.7	9.967	0.076
Unskilled manual	28	80.0	7	20.0		
Agriculture	14	66.7	7	33.3		
Others	13	81.3	3	18.8		
Monthly Income Status (₦)						
≤ 50,000	141	85.5	24	14.5		
51,000–100,000	100	87.7	14	12.3		
101,000–150,000	33	89.2	4	10.8	5.345	0.254
151,000–200,000	25	96.2	1	3.8		
> 200,000	28	75.7	9	24.3		

Exchange rate USD1 = ₦370

Table 8 Predictors of participant's willingness to pay for hepatitis B immunoglobin

Variables	AOR	*p*-value	95% C.I.for AOR	
			Lower	Upper
Employment status				
No	0.137	0.217	0.006	3.217
Yes	1			
Occupation				
Professional/technical/managerial	1.168	0.905	0.091	14.946
Clerical	0.526	0.602	0.047	5.904
Sales and services	0.863	0.902	0.082	9.093
Skilled manual	2.605	0.533	0.128	53.023
Unskilled manual	0.336	0.403	0.026	4.317
Agriculture (farming)	1			
Wealth Index				
Poorest	0.232	0.235	0.021	2.587
Second	0.240	0.237	0.023	2.554
Middle	0.264	0.269	0.025	2.795
Fourth	0.238	0.232	0.023	2.509
best off	1			
Educational level				
Primary	0.512	0.360	0.122	2.149
Secondary	2.645	0.038	1.055	6.630
Tertiary	1			
Husband's Occupation				
Professional/technical/managerial	7.379	0.004	1.908	28.541
Clerical	5.673	0.021	1.295	24.845
Sales and services	4.989	0.015	1.372	18.142
Skilled manual	7.944	0.031	1.215	51.942
Unskilled manual	1.789	0.444	0.403	7.952
Agriculture (farming)	1			

Table 9 Economic predictors of participant's willingness to pay for hepatitis B immunoglobin

Variables	AOR	*p*-value	95% C.I.for AOR	
			Lower	Upper
Monthly Household Income (total)				
≤ 50,000	0.614	0.686	0.058	6.532
51,000–100,000	0.519	0.563	0.056	4.806
101,000–150,000	2.957	0.466	0.160	54.723
151,000–200,000	0.260	0.307	0.020	3.439
> 200,000	1			
Weekly Food Expenditure				
5000 and below	2.331	0.224	0.597	9.105
6000–10,000	3.828	0.041	1.055	13.893
11,000–15,000	1.609	0.452	0.466	5.552
16,000–20,000	2.184	0.312	0.480	9.933
> 20,000	1			

Exchange rate USD1 = ₦370

Discussion

This study was undertaken to assess the proportion of pregnant women willing to pay for the hepatitis B immunoglobulin and the average maximum amount they were willing to pay for the vaccine. It also determined the associated factors for this average maximum amount they were willing to pay and the predictors of the level of willingness to pay for hepatitis B immunoglobulin among pregnant women in the Enugu metropolis. The findings revealed that the willingness to pay for hepatitis B immunoglobulin was high as a large proportion of the participants (86.2%) demonstrated a willingness to pay for the

Table 10 Predictors of the maximum amount willing to pay for hepatitis B Immunoglobulin

Variables	Sub-category	Maximum amount willing to pay		95% CI of Coefficient (β)	
		Coefficient (β)	p-value	Lower	Upper
Age in categories	≤ 24	1			
	25–34	298.7	0.961	-11599.7	12197.1
	>34	3113.4	0.722	-14109.6	20336.4
Marital status	Married	1			
	Others	19256.9	0.559	-45461.7	83975.6
Religion	Christianity	1	0.368	-34,818	12934.2
	Others	-10,942			
Educational level	Primary	1			
	Secondary	4881.2	0.648	-25896.2	16133.8
	Tertiary	4951.3	0.651	-26427.7	16525.1
Husband Educational level	Primary	1			
	Secondary	4017.6	0.463	6730.6	14765.7
	Tertiary	11949.1	0.132	-27529.0	3630.7
Number in Household	≤ 1	1			
	2	-10088.8	0.524	-41198.1	21020.5
	3	-3971.0	0.805	-35583.8	27641.7
	4	-20628.6	0.205	-52609.3	11352.1
	≥ 5	-19312.3	0.235	-51260.3	12635.7
Wealth Index	Poorest	1			
	Second	6941.4	0.305	-6357.5	20240.3
	Middle	6600.5	0.337	-6914.3	20115.2
	Fourth	515.1	0.945	-14182.4	15212.7
	best off	2859.1	0.723	-12973.5	18691.7
Monthly Household Income (total)	50,000	1			
	51,000–100,000	13660.1	0.012	2980.6	24339.6
	101,000–150,000	11069.8	0.163	-4505.0	26644.6
	151,000–200,000	23632.4	0.010	5753.4	411511.4
	>200,000	14978.1	0.094	-2590.2	32546.4

Exchange rate USD1 = ₦370

immunoglobulin. The mean maximum WTP amount by the participants was ₦23178.34(62.64 USD). Cost of the immunoglobulin was identified among 48.8% of the participants as a hindrance to the maximum amount to be paid while about 36.9% of the participants believed that the government should make the vaccines free. The predictors of WTP were the respondent's level of education, the respondent's husband's occupation and weekly expenses on food items of the respondent's households.

After a thorough explanation of the hepatitis B immunoglobulin, a large proportion (86%) of the participants were willing to pay out-of-pocket. The reason for this level of acceptance and WTP for the immunoglobulin was not associated with the socio-demographic and economic characteristics (excluding level of education and weekly food expenditure) of the respondents. It is suggested that the amount of health education (that explained and assured respondents of protection from this vaccine) given to the participants in the course of the interview may have contributed to this finding. This further suggests that mass education of pregnant women and other members of the population irrespective of their educational levels and occupation on a health product may increase the consumption of that product as observed in this study.

In a different study in Hanoi, Vietnam [28] on the willingness of mothers to pay for the hepatitis B vaccine, 80.8% of the respondents were willing to pay for the three doses of the hepatitis B vaccine having understood the importance of vaccination and non-vaccination. In another study in Selangor State, Malaysia [29] only 37.5% of the respondents accepted to pay for hepatitis B vaccination, despite detailed education that was given to them on hepatitis B and hepatitis B vaccination. Although this current study, the Malaysian and Vietnam studies focused on different products for the prevention of hepatitis B infection, there was a contrast in the findings in this current study as a much higher proportion accepted to pay for the hepatitis B immunoglobulin. The difference may not be unconnected with the type of study populations (women in households vs. pregnant women in this current research.) that were used in the two research works.

The above research finding equally contrasts that of a study in North-west Cameroon where the proportion of women willing to pay-out-of-pocket for hepatitis B immunoglobulin at 8000 CFA franc (13.5USD) was only 11.5% [10]. The Cameroon study also noted that it was only women with tertiary education and belonging to the high-income group were willing to pay out-of-pocket for the hepatitis B immunoglobulin. Findings from our study show that irrespective of the educational level and socio-economic status, most of the participants counselled and educated on the benefit of the health product were willing to accept and pay for the health product. This may also show the pattern of disposable income distribution among the educated and non-educated in Nigeria.

The amount the majority of the study participants were willing to pay was ₦5000 (13.51 USD). The average amount the respondents were willing to pay was ₦23178.34 ± 38503.830 (62.64 USD). Both the modal and mean maximum WTP amounts were far below the market value of hepatitis B immunoglobulin (₦56000–₦85000 (151.4–229.7 USD)) depending on the brand of the product purchased). This shows that a raised perception of vaccine must occur for the participants and women in the general population to raise a huge amount to purchase the HBIG for their babies. A similar finding was reported in a related study in Selangor, Malaysia [29]. It also implies that there is a need for this important vaccine to be subsidized by the government to help reduce the rate of hepatitis B infection caused by MTCT in infected pregnant mothers, then at the long run reduce the global burden of hepatitis B virus infection.

In addition, the values for the modal and mean WTP were not surprising as 48.8% of the participants identified cost as a hindrance to the procurement of this vaccine. Also, 36.9%t of the respondents equally believed that the government should be the one responsible for the payment of the vaccines.

WTP was associated with some socio-demographic variables of respondents in previous studies [30–32]. Socio-demographic characteristics such as education have been associated with higher WTP for the consumption of health services related to infectious diseases in studies [29, 31]. Similarly, the educational level of the participants in this study was positively associated with their WTP for hepatitis B immunoglobulin. Other socio-demographic characteristics of the respondents were not significantly associated with WTP for HBIG. This may be because hepatitis B virus infection despite its known long-term complications and aggression, the infection was not well or equally appreciated the same way by the participants.

WTP for optional health-related services and non-health-related services are associated with the disposable income of the consumer [33, 34]. This income for married women comes from their own generated income, that of their husbands, and the combination of the two sources of income (family income). In contrast, a Hanoi, Vietnam study did not find any significant difference in WTP for a HBV vaccine (that was not given free to adults) among women of child bearing age in households with inequalities in family income [35].

The money generated by women may still not be spent on the consumption of health services like procurement of HBIG due to socio-cultural factors. This has been implicated in the first level of the delay as a cause of maternal death in delays that lead to maternal death [36].

Here despite the woman's education and income, culture still makes it difficult for women to make important decisions without input from their husbands even when faced with the likelihood of death. Therefore, husbands still have a very important role to play in the making of decisions to consume the HBIG. The husband and participant's economic characteristics were not independently associated with WTP for HBIG in this study. These findings contrast that from studies in Gondar City, Ethopia [37], rural China [38] and a study in Enugu, Nigeria [34] where socioeconomic characteristics and monthly income of the participants significantly affected the WTP for HBV vaccine and WTP for.an antiretroviral (ARV) drugs, The nature of viral infection and public awareness created around human immunodeficiency virus infection may have affected the relationship between WTP and the socio-economic variables of the respondents. More so, the participants in the Enugu study were already suffering from the infection in question and this may have positively affected their appreciation of the disease and their WTP. Short-time experience and programme satisfaction may have equally affected the WTP of the participants in the Enugu study and this similar finding was also reported by Herens et al. a related study [39].

Important to note in this study was the fact that only the expenses made on non-food items were associated with the participant's WTP for hepatitis B immunoglobulin. Expenses made on non-food items most times determine the amount of disposable funds in the family. Therefore, the more cash that was available for expenses on non-food items after expenses on basics like food, the more the participants were willing to pay for HBIG. Expenses made on basic consumptions like food and the wealth index of the participants were not associated with WTP for hepatitis B immunoglobulin. The inability of the wealth index to separate those with expendable cash [40] in an economy where the middle class has been removed from the socio-economic class of Nigerians may have affected this finding.

The predictors of increased WTP for this health product were the participant's higher education and their husbands' skilled/professional occupations, likewise weekly expenditure on food items. On the other hand, the maximum amount the participants were willing to pay could not be predicted by the characteristics of the participants. Lack of information on hepatitis B immunoglobulin may have equally affected this pattern of behaviour of the participants. Since hepatitis B is a chronic infection and has an increased latency period, it gives room for only a few people to know about the infection and are also willing to pay for the prevention of such infection in their newborns. Our findings are in contrast to other diseases where the ailment allows the patient to pass through a lot of pain and agony making them willing to pay easily for such health solutions that could make them live healthier and pain-free lives [41]. The findings of this health care service did not follow the pattern of factors that regularly affect WTP for health services [42]. Unlike the regular hepatitis B vaccine that is included in the National Programme on the Immunization schedule, hepatitis B immunoglobulin is only mostly preached to those who tested positive for hepatitis B surface antigen who are not suffering the symptoms of the disease but are likely to transmit the infection to their newborn. This implies that there is a need for a targeted public enlightenment programme on this aspect of the prevention of hepatitis B infection from pregnant mothers to their neonates by involving local medical staff and the media [28]. The observed poor information available to expectant mothers is also reflected in the general public as there is a paucity of information among researchers on willingness to pay for the consumption of hepatitis B immunoglobulin among pregnant women globally [43].

Strengths and weaknesses of the study The questionnaires were administered by trained interviewers, therefore, helped to eliminate wrong responses from the pregnant women. The trained research assistants equally helped to educate those who were not aware of the topic to the extent that appropriate information was elicited from them so that their real willingness to pay was determined. Howerver, this study was limited by the frequent fluctuations of the US dollar which affects the purchasing power of workers at different times using the same salary, may also affect the willingness to pay of the respondents at different times. Sometimes it may be difficult to calculate the monthly income of workers; though many questions were asked to check false responses. The study was also limited by potential response bias due to self-reported willingness, and the influence of healthcare providers during data collection. The research assistants were trained to proficiency to reduce this effect to minimal levels. Also, the study was limited by the fact that the study was limited to Enugu metropolis geographical location and the cross-sectional nature of the study, potential social desirability bias in responses, and the focus on a single urban location, which may not capture rural perspectives. We propose that further similar studies to be tried at various locations of the state and Nigeria.

Conclusions

The rate of WTP for hepatitis B immunoglobulin was 86.2%, however, the mean WTP amount was far below the market value of hepatitis B immunoglobulin. The major hindrance to WTP was the cost of the vaccine and most believed the vaccine should be administered free by the government and its agencies. The predictors of

willingness to pay were the participant's level of education, husband's occupation and weekly expenditure on food.

Given that the study's average maximum WTP for the vaccine was well below the cost of production and given the critical need for this vaccine to prevent neonatal transmission of hepatitis B infection from infected mothers to their babies, we recommend that further studies are needed to assess the generalizability of our findings across different socioeconomic settings of Nigeria. This may provide the needed evidence for the government tosubsidize the provision of this vaccine to enable most mothers to easily procure this vaccine for their babies when needed. Therefore, similar studies on the willingness to pay for hepatitis B immunoglobulin should be replicated in other states and cities of Nigeria as this will help in policy formulation on the consumption of this vaccine in the country and globally.

Abbreviations

AOR	Adjusted Odds Ratio
ARV	Antiretroviral
CI	Confidence Interval
ESUTTH	Enugu State University of Science and Technology Teaching Hospital
HBIG	Hepatitis B immunoglobulin
HBeAg	Hepatitis B e antigen
HBV	Hepatitis B virus
IWI	International Wealth Index
NPI	National Programme on Immunization
MTCT	Mother-to-child transmission
SPSS	Statistical Package for Social Sciences
UNICEF	United Nations International Children's Emergency Fund
WTP	Willingness to pay

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

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Author contributions

JTE: Conceptualization and study design; Data collection and curation; Formal analysis; Writing– review & editing of final draft, research administration. NOE: Conceptualization and study design; Data curation; Formal analysis; Writing– review & editing of final draft. OEO: Conceptualization; Data collection; Writing– review & editing of the final draft.All authors reviewed the manuscript.

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Data availability

Data is provided within the supplementary information files.

Declarations

Ethical approval

The ethical clearance certificate for this research was obtained primarily from the research and Ethics Committee of the Enugu State University of Science and Technology Teaching Hospital, Parklane, Enugu with certificate number ESUTHP/C-MAC/RA/034/VOL.11/70. Also, the clearance certificate was obtained from the Ministry of Health with certificate number MH/MSD/REC18/042 to cover other hospitals used for this study.

Consent to participate

A written informed consent was read and signed by each participant in the presence of the interviewer and a witness. Women below 18 years (minors) had their consent forms signed and granted by their parents or legal guardians. The participants were assessed for competency to give consent before they signed the informed consent forms. This was done by making sure they had full disclosure of information about the study, they had the competency to make a decision based on their choices, and that the choices that determined their decisions were voluntary.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. World Health Organization (WHO). WHO| Hepatitis B. World Health Organization. http://www.who.int/mediacentre/factsheets/fs204/en/ (2017, accessed 25 January 2018).
2. Sheena BS, Hiebert L, Han H, et al. Global, regional, and National burden of hepatitis B, 1990–2019: a systematic analysis for the global burden of disease study 2019. Lancet Gastroenterol Hepatol. 2022;7:796–829.
3. Schweitzer A, Horn J, Mikolajczyk RT, et al. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. Volume 386. London, England: Lancet; 2015. pp. 1546–55.
4. Inoue T, Tanaka Y. Hepatitis B virus and its sexually transmitted infection - an update. Microb Cell (Graz Austria). 2016;3:420–37.
5. Hou J, Liu Z, Gu F. Epidemiology and prevention of hepatitis B virus infection. Int J Med Sci. 2005;2:50–7.
6. Stevens CE, Beasley RP, Tsui J, et al. Vertical transmission of hepatitis B antigen in Taiwan. N Engl J Med. 1975;292:771–4.
7. Shepard CW, Simard EP, Finelli L, et al. Hepatitis B virus infection: epidemiology and vaccination. Epidemiol Rev. 2006;28:112–25.
8. Navabakhsh B, Mehrabi N, Estakhri A, et al. Hepatitis B virus infection during pregnancy: transmission and prevention. Middle East J Dig Dis. 2011;3:92–102.
9. Nievergelt Y. The concept of 'efficiency' in economics. Siam Rev. 1983;25:261–5.
10. Abongwa LE, Kenneth P, Bamenda B. Assessing prevalence and risk factors of hepatitis B surface Antigen amongst pregnant women attending antenatal clinic in Northwest Region of Cameroun. European Journal of Research in Medical Sciences. 2016; 4: 32–43

11. Chan OK, Lao TT, Suen SSH et al. Deficient Knowledge on Hepatitis B Infection in Pregnant Women and Prevalence of Hepatitis B Surface Antigen Carriage in an Endemic Area: A Review. Hepat Res Treat. 2012; 2012: 1–8.
12. Obi SN, Onah HE, Ezugwu FO. Risk factors for hepatitis B infection during pregnancy in a Nigerian obstetric population. J Obstet Gynaecol (Lahore). 2006;26:770–2.
13. Olokoba AB, Salawu FK, Danburam A, et al. Hepatitis B virus infection amongst pregnant women in North-Eastern Nigeria - A call for action. Niger J Clin Pract. 2011;14:10–3.
14. Eke AC, Eleje GU, Eke UA et al. Hepatitis B immunoglobulin during pregnancy for prevention of mother-to-child transmission of hepatitis B virus. Cochrane Database Syst Rev. 2017; 2017: S226.
15. Abdulai MA, Baiden F, Adjei G, et al. Low level of hepatitis B knowledge and awareness among pregnant women in the Kintampo North municipality: implications for effective disease control. Ghana Med J. 2016;50:157–62.
16. von Elm E, Altman DG, Egger M, et al. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol. 2008;61:344–9.
17. Enugu state government. About Enugu state– Enugu State Government. 2018.
18. Kale OO. BA. Methods of epidemiological studies. In: MA B, editor. Handbook of research methods in medicine. Lagos: Nigerian Educational Research & Development Council (NERDC); 1991. pp. 67–76.
19. Umeh IB, Nduka SO, Ekwunife OI, et al. Mothers' willingness to pay for HPV vaccines in Anambra State, Nigeria: a cross sectional contingent valuation study. Cost Eff Resour Alloc. 2016;14:8.
20. Hoyos D, Mariel P. Contingent Valuation: past, present and future. Prague Economic Papers. 2010; 07: 329–3
21. Smits J, Steendijk R. The International Wealth Index (IWI).Soc Indic Res. 2015; 122, 65–85 (2015).https://doi.org/10.1007/s11205-014-0683-x
22. McKenzie D. Measuring inequality with asset indicators. JPopul Econ. 2005;18: 229–260. https://doi.org/10.1007/s00148-005-0224-7
23. Filmer D, Scott K. Assess Asset Indices Demography. 2012;49:359–92.
24. Davidson R, Gwatkin S, Rutstein K, Johnson E, Suliman A, Wagstaff. and AA. Socio-economic differences in health, nutrition, and population within developing countries: An overview. JAMA. 2007;298(16):1943-1949. https://doi.org/10.1183/09031936.06.00061205
25. Global-Data-lab. Play With IWI - Global Data Lab. https://globaldatalab.org/iwi/ (2013, accessed 1 March 2020).
26. Smits J.International Wealth Index (IWI). Presentation at GlobalData Lab / Nijmegen Center for Economics Radboud University, the Netherlands.
27. Kirkwood Betty RSJAC. Epub ahead of print 2003. Essential medical statistics. Second. Malden. Massachusetts: Blackwell Science Ltd; 2003. https://doi.org/10.1002/sim.1961.
28. Tuan A, Nguyen L, Thanh X et al. Knowledge, Preference, and Willingness to Pay for Hepatitis B Vaccination Services among Woman of Reproductive Age in Vietnam.BioMed Research International., 2019; 2019:9154918
29. Rajamoorthy Y, Radam A, Taib NM, et al. Willingness to pay for hepatitis B vaccination in Selangor, Malaysia: A cross-sectional household survey. PLoS ONE. 2019;14:1–17.
30. Sopi X, Skreli E. Impact of Socio-Economic and demographic factors on willingness to pay for food safety attributes. Adv Business-Related Sci Res J. 2016;7:27–39.
31. Adebayo EF, Uthman OA, Wiysonge CS et al. A systematic review of factors that affect uptake of community-based health insurance in low-income and middle-income countries. BMC Health Serv Res; 15. Epub ahead of print 2015. https://doi.org/10.1186/s12913-015-1179-3
32. Onwujekwe O, Okereke E, Onoka C, et al. Willingness to pay for community-based health insurance in Nigeria: do economic status and place of residence matter? Health Policy Plan. 2010;25:155–61.
33. Kartman B, Andersson F, Johannesson M. Willingness to pay for reductions in angina pectoris attacks. Med Decis Mak. 1996;16:248–53.
34. Mbachu C, Okoli C, Onwujekwe O, et al. Willingness to pay for antiretroviral drugs among HIV and AIDS clients in south-east Nigeria. Heal Expect. 2018;21:270–8.
35. Le XTT, Nguyen NTT, Le HT, et al. Income inequalities in hepatitis B vaccination and willingness to pay among women of reproductive age in Hanoi, Vietnam. Glob Heal Sci Pract. 2021;9:523.
36. Sk MIK, Paswan B, Anand A, et al. Praying until death: revisiting three delays model to contextualize the socio-cultural factors associated with maternal deaths in a region with high prevalence of eclampsia in India. BMC Pregnancy Childbirth. 2019;19:314.
37. Abiye S, Yitayal M, Abere G, et al. Health professionals' acceptance and willingness to pay for hepatitis B virus vaccination in Gondar City administration governmental health institutions, Northwest Ethiopia. BMC Health Serv Res. 2019;19. https://doi.org/10.1186/s12913-019-4671-3. https://bmchealthservres.biomedcentral.com/articles/. accessed 18 March 2021).
38. Zhu D, Guo N, Wang J, et al. Socioeconomic inequality in hepatitis B vaccination of rural adults in China. Hum Vaccin Immunother. 2017;14:464.
39. Herens MC, Ophem JAC, Van, Wagemakers AMAE et al. Predictors of willingness to pay for physical activity of socially vulnerable groups in community–based programs. Springerplus. 2015;19;4:527. doi: 10.1186/s40064-015-1336-5. PMID: 26405646; PMCID: PMC4575679.. https://doi.org/10.1186/s40064-015-1336-5
40. Rutstein SO, Johnson KB. The DHS Wealth Index.. DHS Comparative Reports No. 6, ORC Macro Calverton,Maryland USA.2004 https://doi.org/10.13140/2.1.2806.4809
41. Cross MJ, March LM, Lapsley HM, et al. Determinants of willingness to pay for hip and knee joint replacement surgery for osteoarthritis. Rheumatology. 2000;39:1242–8.
42. Aizuddin AN, Sulong S, Aljunid SM. Factors influencing willingness to pay for healthcare. BMC Public Health. 2012;12:A37.
43. Abeje G, Azage M. Hepatitis B vaccine knowledge and vaccination status among health care workers of Bahir Dar City administration, Northwest Ethiopia: A cross sectional study. BMC Infect Dis. 2015;15:30.

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