



A cross-sectional survey on the rate of awareness of hepatitis B virus (HBV) infection and the prevention of mother-to-child transmission among hepatitis B surface antigen (HBsAg)-positive pregnant women

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Background: Mother-to-child transmission (MTCT) remains the main transmission route of hepatitis B virus (HBV) in China. Hepatitis B surface antigen (HBsAg) positive pregnant women were the main participants in MTCT of HBV. Nevertheless, little was known about their knowledge and awareness of HBV infection and MTCT. We intended to evaluate their knowledge of HBV infection and MTCT prevention, and to clarify the emphasis of health education to improve the control of MTCT of HBV.

Methods: We invited 164 HBsAg-positive pregnant women, who were aged ≥ 18 years old, had basic literacy skills and visited the Outpatient Clinic of Infectious Disease of the Sun Yat-Sen Memorial Hospital from May 2019 to January 2020, to independently and anonymously complete a self-administered survey regarding their knowledge of HBV infection and MTCT prevention. The correct rate of the questions was calculated and analyzed. A multivariate regression was conducted to identify predictors of HBV and MTCT knowledge and awareness.

Results: The average awareness rate of the 164 respondents was 52.56%, among which the awareness rates of basic knowledge and the transmission route of HBV were 80.49% and 53.29%, respectively. The awareness rates of knowledge about the interruption measures of MTCT during pregnancy, delivery, and postpartum were 43.78%, 49.75%, and 31.25%, respectively. The respondents who had a college education level or above, were employed, and had visited the outpatient Department of Infectious Disease before pregnancy had a significantly higher awareness rate. Previous visits to the Department of Infectious Disease were the only influencing factor for the higher awareness rate (OR =3.108, P=0.049).

Conclusions: A lack of knowledge about the transmission route and interruption measures of MTCT of HBV is still common among HBsAg-positive pregnant women. Health education should be directed toward HBsAg-positive mothers to further improve the control of HBV infection.

Keywords: Hepatitis B surface antigen-positive pregnant women (HBsAg-positive pregnant women); hepatitis B; mother-to-child transmission (MTCT); knowledge; awareness rate

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Introduction

Hepatitis B virus (HBV) infection is a serious global public health problem. China is the country with the heaviest burden of mother-to-child transmission (MTCT) infection in the world, and it will also be a major contributor to achieving the global goal of eliminating hepatitis B by 2030 (1). Currently, the seroprevalence of the hepatitis B surface antigen (HBsAg) in the general population in China is 5–6% (2,3). In Guangzhou, which is located in the southern Chinese province of Guangdong, the figure is as high as 9.5% (4). For women of childbearing age, the seroprevalence rate of HBsAg is 4.87–9.51% (5–7). The transmission routes of HBV mainly include blood, mother-to-child, and sexual contact.

MTCT accounts for 30–50% of HBV transmissions in China (8). It mainly occurs in the perinatal period and is transmitted through the blood and body fluids of HBV-positive mothers (8). In traditional Chinese societies, mothers, as the main caregivers of infants and young children, may also contribute to the horizontal transmission of HBV within the family when they are in close contact with infants and young children (9). More than 90% of HBV infection will become chronic when occurring in newborns and infants under 1 year old (10), and serious complications can arise, including cirrhosis and liver cancer. Thus, cutting off the main transmission route of HBV and blocking MTCT is an important measure in eliminating the HBV.

Previous studies indicated that knowledge and awareness of HBV and MTCT among pregnant or childbearing-age women were comparatively inadequate (11,12). Poor knowledge may contribute as a risk factor for HBV transmission (13). During pregnancy and the first year of postpartum, the risk of hepatitis flare increased. Meanwhile, viral hepatitis was associated with postpartum hemorrhage, infection, fetal distress, premature delivery, stillbirth and neonatal asphyxia. HBsAg-positive pregnant women are the main individuals involved in the MTCT of HBV, however, investigations on the knowledge of HBV and blocking MTCT among this particular group of people are rare.

Our study investigated the awareness rate and basic knowledge of HBV and the MTCT of HBsAg-positive pregnant women in the Outpatient Clinic of the Department of Infectious Disease and discussed the focus of health education in the prevention of the MTCT of HBV. We present the following article in accordance with the SURGE reporting checklist (available at <https://atm.amegroups.com/article/view/10.21037/atm-22-2748/rc>).

Methods

Research subjects

This was a cross-sectional survey. HBsAg-positive pregnant women treated at the Outpatient Clinic of the Department of Infectious Disease of the Sun Yat-Sen Memorial Hospital from May 2019 to January 2020, who were aged ≥ 18 years old, had basic literacy skills, and agreed to complete the survey were included in our study. Those with mental illness or who were not cooperative were excluded from the study. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Institutional Review Board of the Sun Yat-sen Memorial Hospital, Sun Yat-sen University (No. 2017-16). Informed consent was taken from all the respondents.

Research methods

A total of 169 HBsAg-positive pregnant women were invited to complete a self-administrated questionnaire. The questionnaire was designed by clinicians from the Department of Infectious Disease and Department of Obstetrics. It comprised 24 multiple-choice questions and divided into three parts: social demographic information, knowledge of HBV and knowledge of MTCT of HBV. The demographic information included age, educational level, occupation, obstetrical history, self-reported HBV infection status and history of previous visit the Infectious Disease Department. Among the 24 multiple-choice questions, 5 questions were related to general knowledge of HBV (Q1, Q2, Q3, Q4, Q5), another 5 questions were related to knowledge about the HBV transmission (Q6, Q7, Q8, Q9, Q10), and the rest of the questions were related to knowledge about the MTCT of HBV. The knowledge about MTCT consisted of knowledge about three period: pregnancy (Q11, Q12, Q13, Q14, Q15), delivery (Q16, Q17, Q18, Q19) and postpartum period (Q20, Q21, Q22, Q23, Q24).

Trained infectious disease outpatient nurses engaged in simple communications with the patients to confirm that they met the inclusion criteria, and then briefly introduced the purpose and significance of the study. After obtaining each patient's informed consent, the "Survey on basic knowledge of HBV and its mother-to-child transmission" (the survey) was issued. The respondents completed the survey independently and anonymously on the spot, and no access to any resources was allowed. If the respondents could not understand certain words and sentences, the

nurses provided the necessary explanations, but they did not disclose or imply the correct answers. Upon the completion of the survey, it was returned on the spot. The personal data of the respondents were strictly confidential. Questionnaire which all the 24 questions were totally completed was considered to be a valid one.

Grading

The questions and answers in the questionnaire were made by a team of infectious diseases doctors and obstetricians, and were formulated according to “*The Guideline of Prevention and Treatment for Chronic Hepatitis B: A 2015 Update*” (14) and the standardized follow-up protocol from a project named “Getting to Zero Mother-To-Child Transmission of Hepatitis B” in China. The survey comprised 24 questions, which were a mix of single-choice and multiple-choice questions. Each question was worth 1 point, and a total score of 24 points was possible.

Statistical analysis

SPSS 23.0 was used for the statistical analysis. The continuous variables are represented as the mean \pm standard deviation or median (interquartile range), and the categorical variables are represented as the frequency and rate. The chi-square test was used to compare the scores of each item between each group. A logistic regression analysis evaluated the factors influencing patients’ knowledge score of how to prevent the MTCT of HBV. The statistical test was 2-sided, and a P value <0.05 indicated that the difference was statistically significant.

Results

Patients’ data

In total, 169 HBsAg-positive pregnant women completed the survey, 164 of whom responded to all the questions (response rate: 97.04%). The average age of the respondents in our study was 30.93 years (21–43 years). Among the respondents, 42 (25.61%) had an education level of junior high school or below, 36 (21.95%) had an education level of senior high school, technical secondary school, or higher vocational education, and 86 (52.44%) had an education level of junior college or above. A total of 129 respondents (78.66%) were employed (including those employed as freelance employees), and 35 (21.34%) were unemployed.

Additionally, 97 respondents (59.15%) had been pregnant without giving birth, and 67 (40.85%) had 1 child or more. Most of the respondents had a history of chronic HBV infection for >1 year (92.07%, 151/164), and most were 1st-time visitors to the Department of Infectious Disease (81.71%, 134/164).

HBsAg-positive pregnant women’s awareness and general knowledge of HBV and its MTCT

Questions 1–5 and Questions 6–10 related to respondents’ basic knowledge of HBV and their knowledge of the transmission routes of HBV, respectively. The average scores of the 164 respondents for Questions 1–5 and Questions 6–10 were 4 ± 0.2 and 2 ± 0.6 , respectively, and the corresponding awareness rates were 80.49% and 53.29%, respectively (see *Table 1*).

Respondents’ awareness and knowledge about the prevention of the MTCT of HBV during pregnancy (Questions 11–15), delivery (Questions 16–19), and postpartum period (Questions 20–24) were investigated. The average scores of the 164 respondents for Questions 11–15, Questions 16–19, and Questions 20–24 were 2 ± 0.2 , 2 ± 0.5 , and 1 ± 0.2 , and the corresponding awareness rates were 43.78%, 49.75%, and 31.25%, respectively (see *Table 2*).

Factors influencing HBsAg-positive pregnant women’s awareness and knowledge of HBV and MTCT

After stratifying the basic data of the 164 respondents, a 1-way analysis of variance was conducted to evaluate the influence of each factor on the rate of awareness and knowledge about HBV and MTCT. The results showed that the respondents who had a college education level or above, were employed, and had visited the Outpatient Clinic of the Department of Infectious Disease before pregnancy had higher rates of awareness, and the difference was statistically significant ($P<0.001$, $P=0.009$ and $P<0.001$, respectively); however, no statistically significant differences were found in relation to reproductive history ($P=0.218$) and the length of chronic hepatitis B history ($P=0.219$) (see *Table 3*).

The total possible score for knowledge about MTCT was 14 points. In our study, the 164 respondents were divided into 3 groups based on intervals of 4 to 5 points. Specifically, respondents with a score of ≥ 9 were allocated to the high-score group, and those with a score of ≤ 4 were allocated to the low-score group.

Table 1 HBsAg-positive pregnant women's awareness and basic knowledge of HBV (n=164)

Items	Questions	Ratio of correct answers, n (%)
1	What is the cause of hepatitis B?	109 (66.46)
2	What does the chronic hepatitis B virus carrier refer to?	143 (87.20)
3	How often should chronic HBV carriers have follow-up visits?	126 (76.83)
4	Can hepatitis B be cured?	144 (87.80)
5	Will hepatitis B develop into cirrhosis and liver cancer?	138 (84.15)
6	What are the transmission routes of the hepatitis B virus?	72 (43.90)
7	Which of the following is the blood transmission route of the hepatitis B virus?	57 (34.76)
8	Which of the following refers to more infectious?	117 (71.34)
9	What are the main risk factors for the mother-to-child transmission of HBV?	101 (61.59)
10	What is the most effective way to prevent HBV infection?	90 (54.88)

HBsAg, hepatitis B surface antigen; HBV, hepatitis B virus.

Table 2 HBsAg-positive pregnant women's awareness of knowledge about MTCT of HBV (n=164)

Items	Questions	Ratio of correct answers, n (%)
11	What should be done to prevent the mother-to-child transmission of HBV?	120 (73.17)
12	How often should HBsAg-positive pregnant women check their HBV viral load and liver function?	32 (19.51)
13	When should antiviral therapy be started for HBsAg-positive pregnant women?	35 (21.34)
14	Can the use of antiviral therapy (e.g., tenofovir and telbivudine) in the 2nd or 3rd trimester of pregnancy reduce the risk of the mother-to-child transmission of HBV?	97 (59.15)
15	Will the medication of antiviral therapy in the 2nd and 3rd trimesters have adverse effects on pregnant women and fetuses?	75 (45.73)
16	Does caesarean section reduce the risk of the mother-to-child transmission of HBV?	75 (45.73)
17	Which is the most effective measure for preventing the mother-to-child transmission of HBV?	132 (80.49)
18	When is the best time for neonates to receive the hepatitis B immune globulin (HBIG) injection and HBV vaccine to prevent mother-to-child transmission?	87 (53.05)
19	If a HBV carrier receives antiviral therapy in the 2nd or 3rd trimester, can therapy be discontinued immediately after delivery?	38 (23.17)
20	Are HBsAg-positive mothers who did not receive antiviral therapy able to breastfeed?	76 (46.34)
21	When is it inappropriate for HBsAg-positive mothers to breastfeed?	55 (33.54)
22	When should HBsAg-positive mothers go back to the clinics to test their HBV status after delivery?	30 (18.29)
23	Which of the following is the neonatal HBV vaccination program?	90 (54.88)
24	When should children test their HBV status after the 3rd dosage of the HBV vaccine?	30 (18.29)

HBsAg, hepatitis B surface antigen; MTCT, mother-to-child transmission; HBV, hepatitis B virus.

The basic data of the 164 respondents were stratified and analyzed, and a logistic regression analysis was conducted to correct the confounding factors. The results showed that there were 27 respondents (16.46%) in the high-score

group and 55 respondents (33.54%) in the low-score group. A previous visit to the Department of Infectious Disease was the only independent influencing factor for achieving high scores [P=0.049, odds ratio (OR) =3.108, 95% confidence

Table 3 Influencing factors of HBsAg-positive pregnant women's awareness of knowledge about HBV and its MTCT (n=164)

Variable	N (%)	Awareness ratio (%)	P
Education level			<0.001
College or above	86 (52.44)	59.74	
Senior high	36 (21.95)	43.42	
Junior high and below	42 (25.61)	45.83	
Employment status			0.009
Unemployed	35 (21.34)	44.04	
Employed (including freelance)	129 (78.66)	54.87	
Previous live births			0.218
0	97 (59.15)	53.00	
≥1	67 (40.85)	51.93	
Length of hepatitis B history (years)			0.219
≥1	151 (92.07)	52.40	
<1	13 (7.93)	44.87	
Previous visits to the Department of Infectious Disease before pregnancy			<0.001
0	134 (81.71)	50.56	
≥1	30 (18.29)	61.52	

HBsAg, hepatitis B surface antigen; HBV, hepatitis B virus; MTCT, mother-to-child transmission.

interval (CI): 1.005–9.615]. The independent influencing factors for achieving low scores included an education level above college ($B=-1.461$, $P=0.002$, $OR=0.232$, 95% CI: 0.091–0.591) and a previous visit to the Department of Infectious Disease ($B=-2.486$, $P=0.003$, $OR=0.083$, 95% CI: 0.016–0.427) (see *Tables 4* and *5*).

Discussion

In our study, the average awareness rate of basic knowledge of hepatitis B among HBsAg-positive pregnant women was 80.49%, which reflects the working goal of >80%, which was set for the knowledge awareness rate for the “Prevention and Treatment of Hepatitis B in the National Hepatitis B Prevention and Control Plan for 2006–2010” (15). Our results indicated that most of the respondents were correct in their general knowledge of hepatitis B, and were aware that hepatitis B was a serious infectious disease that could cause great harm and progress to cirrhosis and liver cancer, and that HBsAg-positive patients should attend regular medical follow-up appointments. However, about half of the respondents had poor knowledge regarding the

transmission routes of HBV. Indeed, only 34.75% of the HBsAg-positive pregnant women were aware that the HBV can be transmitted through the poor disinfection of tattoos, eyebrows and ear piercings, acupuncture, and unprotected sexual intercourse. A lack of knowledge and awareness about the HBV transmission route is consistent with the findings of previous studies in China and other HBV-endemic countries (13,16–19).

Additionally, our study also found that the knowledge and awareness of the HBsAg-positive pregnant women about interruption measures of the MTCT of HBV was poor. Even though the HBV vaccine has been fully integrated into the expanded routine immunization program and has been freely available to all infants since 2002, only 54.88% of the respondents recognized that the hepatitis B vaccine was the most effective measure for preventing HBV infection; the figure in the present study was lower than that previously reported (13). Only 18.29% of the respondents were aware that the infants' serum markers of HBV should be detected at 7–8 months age to confirm whether MTCT had been successfully interrupted. For infants who were HBsAg negative, hepatitis B surface antibody negative or

Table 4 Factors associated with high knowledge scores about the prevention of the MTCT of HBV

Variable	B	P	OR (95% CI)
Education level (ref: junior high or below)			
Senior high school	0.787	0.419	2.197 (0.325–14.843)
College or above	1.579	0.066	4.852 (0.899–26.172)
Employment status (ref: unemployed)			
Employed (including freelance)	1.649	0.131	5.203 (0.612–44.205)
Previous live births (ref: 0)			
≥1	0.709	0.150	2.031 (0.774–5.327)
Length of hepatitis B history (years) (ref: ≥1)			
<1	–18.685	0.999	NA
Previous visits to the Department of Infectious Disease before pregnancy (ref: 0)			
≥1	1.134	0.049	3.108 (1.005–9.615)

MTCT, mother-to-child transmission; HBV, hepatitis B virus; OR, odds ratio; 95% CI, 95% confidence interval.

Table 5 Factors associated with low knowledge scores about the prevention of the MTCT of HBV

Variable	B	P	OR (95% CI)
Education level (ref: junior high or below)			
Senior high school	–0.350	0.481	0.705 (0.266–1.865)
College or above	–1.461	0.002	0.232 (0.091–0.591)
Employment status (ref: unemployed)			
Employed (including freelance)	–0.649	0.159	0.522 (0.212–1.291)
Previous live births (ref: 0)			
≥1	–0.218	0.597	0.804 (0.359–1.804)
Length of hepatitis B history (years) (ref: ≥1)			
<1	0.073	0.914	0.701 (0.125–3.917)
Previous visits to the Department of Infectious Disease before pregnancy (ref: 0)			
≥1	–2.486	0.003	0.083 (0.016–0.427)

MTCT, mother-to-child transmission; HBV, hepatitis B virus; OR, odds ratio; 95% CI, 95% confidence interval.

less than 10 mIU/mL, revaccination should be scheduled to reduce the risk of the horizontal transmission of HBV. Our findings emphasize the need to enhance health education efforts to improve HBV knowledge about the transmission routes and interruption measures for the MTCT of HBV among HBsAg-positive pregnant women.

Due to the relative decrease of maternal blood flow to the liver and the increase of the metabolic burden on the liver, the risk of hepatitis flare in HBsAg-positive pregnant women during pregnancy is increased and can even develop

into liver failure. The risk of postpartum hemorrhage, infection, fetal distress, premature delivery, stillbirth, and neonatal asphyxia is also increased (20). Additionally, research has shown that 25–51.6% of postpartum women who are chronic HBV carriers may have increased alanine aminotransferase in the first year of delivery, which may be due to the reactivation of the immune system (20,21). Thus, for HBsAg-positive pregnant women, liver function, HBV serum markers, and HBV viral load should be carefully monitored (9,20,21).

Somewhat concerningly, most of the respondents in our study did not know about the increased risk of hepatitis flare during pregnancy and postpartum and the need for regular monitoring. The awareness rates of Questions 12 and 22 were only 19.51% and 18.29%, respectively. Similarly, only a small proportion of the respondents knew that antiviral therapy in mothers with a high HBV viral load in the 2nd and/or 3rd trimester of pregnancy can further reduce the risk of the MTCT of HBV, and has extensively been proven to be effective and safe for mother and baby. This may be related to the fact that healthcare workers, except for those from the Department of Infectious Disease, were deficient in their systemic and comprehensive knowledge about HBV and its MTCT (22-24), which could lead to the provision of incorrect information or limit the health education provided to the public. Continuing education training programs should be conducted to help health workers disseminate the correct knowledge and make correct decisions about the MTCT of HBV (22).

According to the stratified analysis of the basic data, respondents with a college education level or above, employed respondents, and those who had visited the Outpatient Clinic of the Department of Infectious Disease before pregnancy had a higher awareness rate of the knowledge of blocking the MTCT of HBV ($P < 0.001$). Previous visits to the Infectious Disease Clinic was the only independent influencing factor for achieving high scores (OR = 3.108, $P = 0.049$), while the independent influencing factors for achieving low scores included an education level above college ($B = -1.461$, OR = 0.232, $P = 0.002$) and a previous visit to the Department of Infectious Disease before pregnancy ($B = -2.486$, OR = 0.083, $P = 0.003$). Previous studies have shown that the level of education is positively correlated with the cognition of patients on disease prevention and their knowledge of treatment (25,26). The higher the level of education, the higher the degree of cognition of patients, which may be related to the fact that people with a higher level of education have wider access to information, a stronger understanding ability, and can correctly understand the importance of prevention and treatment of diseases according to the level of self-cognition (25).

Medical staff play an important role in educating people about blocking the MTCT of HBV. The respondents who had visited the Outpatient Clinic of the Department of Infectious Disease previously may have been actively or passively educated about the MTCT of HBV during the visit, and thus had a high awareness rate. This shows the necessity and significance of education in improving medical

staffs' awareness of the MTCT of HBV. However, the awareness rate was not significantly related to childbearing history or a previous history of chronic hepatitis B.

In our study, only HBsAg-positive pregnant women were involved, so healthcare providers can use these invaluable pieces of information to enhance HBV education, prenatal, and postnatal management. This study had some limitations. First, as a cross-sectional study base on a self-reported survey, this study had a recall bias. Second, sample collection is convenient method of sampling, but may not accurately represent the population. We encourage others to produce similar data and tailor their local health education model.

Conclusions

We found that HBsAg-positive women lacked knowledge of the transmission routes of HBV and the prevention of the MTCT of HBV. Education level, occupation, and previous visits to the Department of Infectious Disease were the influencing factors that affected the awareness and knowledge of the MTCT of HBV of HBsAg-positive pregnant women. Extensive, in-depth, and lasting health education should be directed toward HBsAg-positive mothers to better control HBV infection and achieve the World Health Organization's viral hepatitis elimination target.

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Footnote

Reporting Checklist: The authors have completed the SURGE reporting checklist. Available at <https://atm.amegroups.com/article/view/10.21037/atm-22-2748/rc>

Data Sharing Statement: Available at <https://atm.amegroups.com/article/view/10.21037/atm-22-2748/dss>

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://atm.amegroups.com/article/view/10.21037/atm-22-2748/coif>).

The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Institutional Review Board of the Sun Yat-sen Memorial Hospital, Sun Yat-sen University (No. 2017-16). Before completing the survey, each study participant had to sign an informed consent form that stated the study's purpose and that their contribution to the study was anonymous and voluntary. It was distributed to them along with a survey; thus, consent was obtained from all the respondents.

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