

Knowledge, attitudes and practices regarding prevention of hepatitis B virus mother-to-child transmission among health professionals in a semi-rural health district of Cameroon: a cross-sectional study

Guy-Roger Ebanda Enamba

guyrogerbandaenamba@gmail.com

University Institute of Science and Technology of Yaounde

Manelle Ida Toukem Tegum

University Institute of Science and Technology of Yaounde

Tatiana Mossus

Faculty of Medicine and Biomedical Sciences, University of Yaounde I

Rose Emmanuelle Abomo Enamba

Faculty of Medicine and Pharmaceutical Sciences, University of Dschang

Mbinyui Nyiniwou Sidiki

Faculty of Medicine and Biomedical Sciences, University of Yaounde I

Edmond François Tchago

Faculty of Medicine and Biomedical Sciences, University of Yaounde I

Gérard Nkeunen

University Institute of Science and Technology of Yaounde

Marie-José Essi

Faculty of Medicine and Biomedical Sciences, University of Yaounde I

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Abstract

Background

Hepatitis B virus (HBV) infection remains a major public health problem in Cameroon, a country of high endemicity where mother-to-child transmission accounts for a substantial proportion of chronic infections, with more than 90% of infections acquired at birth progressing to chronicity compared with less than 5% among adults. Prevention of HBV mother-to-child transmission (PMTCT) depends directly on the knowledge, attitudes, and practices of health workers providing maternity and immunization services, which remain poorly documented in semi-urban and rural health districts of Cameroon. This study aimed to assess these three dimensions among health professionals in the Obala Health District and to identify the factors associated with each.

Methods

An analytical cross-sectional study was conducted from April to June 2026 among health workers providing antenatal, maternity, and immunization services across the 33 health facilities of the Obala Health District, Centre Region, Cameroon. All 145 eligible staff were approached exhaustively; data were collected using a structured, pre-tested questionnaire under strict conditions of anonymity and confidentiality, and analyzed using IBM SPSS version 27.0. Scores were expressed as a percentage of the theoretical maximum and dichotomized at the 85% threshold (good/appropriate/adequate versus the remaining categories combined) for multivariable analysis. Multivariable binary logistic regression identified factors associated with good knowledge, appropriate attitudes, and adequate practices at $p < 0.05$.

Results

Of 145 eligible professionals, 118 (81.4%) participated; the sample was predominantly female (68.6%) and young (≤ 35 years: 76.3%), with nurses the largest professional group (59.3%). Mean scores were $80.1 \pm 13.0/100$ for knowledge, $85.5/100$ for attitudes, and $62.8 \pm 22.8/100$ for practices. While 36.4% had good knowledge and 56.8% held appropriate attitudes, only 19.5% reported adequate practices; 21.2% of reported practices were classified as harmful, a pattern most pronounced among general practitioners (40%) and nursing aides (33.3%). The leading barriers were unavailability of vaccines or immunoglobulins (84.7%), lack of staff training (63.6%), and the cost of immunoglobulins for patients (62.7%). Working in the Essong (aOR = 0.10, 95% CI 0.01–0.88; $p = 0.039$) or Etoud-Ayos (aOR = 0.07, 95% CI 0.007–0.68; $p = 0.022$) health areas was associated with insufficient knowledge. Appropriate attitudes were associated with good knowledge (aOR = 8.23, 95% CI 1.70–39.74; $p = 0.009$) and more than five years of professional experience (aOR = 2.23, 95% CI 1.02–4.86; $p = 0.044$). Recent in-service training was the only factor associated with adequate practices (aOR = 3.03, 95% CI 1.15–7.98; $p = 0.032$).

Conclusions

Health professionals in the Obala Health District had acceptable knowledge and generally favorable attitudes toward HBV PMTCT, but adequate clinical practice remained the exception, and a striking share of reported practices were frankly harmful, particularly among physicians and nursing aides. This disruption of the knowledge-attitudes-practices continuum is driven primarily by structural barriers rather than staff motivation, and jeopardizes national progress toward the WHO's 2030 viral hepatitis elimination targets. Securing the monovalent vaccine and immunoglobulin supply chain, intensifying in-service training and supervision in the most isolated health areas, and specifically targeting physicians and nursing aides for retraining are priority, actionable levers for this district and comparable settings.

Background

Hepatitis B virus (HBV) infection remains one of the leading causes of chronic liver disease worldwide, with approximately 254 million chronic carriers and more than one million deaths annually attributable to its complications, primarily cirrhosis and hepatocellular carcinoma ¹. Mother-to-child transmission (MTCT) is the principal pathway sustaining this global reservoir of chronic infection: infection acquired during the perinatal period progresses to chronicity in more than 90% of cases, compared with less than 5% when acquired in adulthood ². Interrupting this route of transmission is therefore central to the WHO's goal of eliminating viral hepatitis as a public health threat by 2030 ¹. WHO has defined a coordinated set of interventions for the prevention of HBV mother-to-child transmission (PMTCT): systematic antenatal screening for hepatitis B surface antigen (HBsAg), antiviral prophylaxis with tenofovir for pregnant women with high viral load, and administration of a monovalent vaccine dose within 24 hours of birth, supplemented if necessary by hepatitis B immunoglobulin ^{2,3}. When fully implemented, this strategy prevents more than 90% of vertical transmissions ². However, in the WHO African Region, birth-dose coverage rose only from 10% to 17% between 2016 and 2021, and only 14 of 47 countries had introduced this dose nationally by 2021 ⁴. In February 2025, Cameroon's Ministry of Public Health authorized administration of the birth dose to newborns of mothers known to be HBsAg-positive ⁵; this remains a selective, risk-based policy rather than a universal one, and a recent policy analysis indicates that national timely birth-dose coverage was still close to 0% as of 2024, reflecting how recently and incompletely this measure has been operationalized ⁶. Cameroon is a country of high HBV endemicity: a recent systematic review and meta-analysis pooling more than 212,000 individuals estimated the national HBV seroprevalence at 9.98% (95% CI 9.00–11.02) ⁷. However relevant a national policy may be, its translation into effective protection of the newborn depends entirely on the health workers who deliver antenatal, maternity, and immunization services on a daily basis. Their knowledge, attitudes, and practices (KAP) regarding HBV PMTCT are therefore a direct determinant of its success. KAP studies conducted in Cameroon and neighboring African countries have repeatedly documented the same pattern: acceptable theoretical knowledge and favorable attitudes coexisting with inadequate clinical practices, themselves attributable more to systemic constraints (vaccine and immunoglobulin stockouts,

insufficient in-service training, geographic isolation of rural facilities) than to a lack of willingness among staff^{8,9,10,11,12,13,14,15}.

To our knowledge, no study has yet documented the KAP of health workers regarding HBV PMTCT in the Obala Health District, a semi-urban and rural district of Cameroon's Centre Region, where peripheral integrated health centers often operate with limited staff and incomplete technical resources. This context makes Obala a relevant setting in which to examine how professional and geographic disparities shape the implementation of HBV PMTCT at the periphery of the health system. This study aimed to assess the knowledge, attitudes, and practices of maternity and immunization staff in the Obala Health District regarding HBV PMTCT, and to identify the factors associated with each of these three dimensions.

Methods

Study design and setting

This was an analytical cross-sectional study conducted in the Obala Health District, Lekié Division, Centre Region, Republic of Cameroon, located approximately 45 km north of Yaoundé. The district covers 475 km², serves an estimated population of 79,929 inhabitants, and is organized into 12 health areas served by 33 health facilities of varying levels (district hospital, subdivisional medical centers, integrated health centers, private and faith-based facilities), each providing maternal health and immunization services in accordance with the standards of Cameroon's Expanded Programme on Immunization. The district has a semi-urban and rural epidemiological profile, with rural integrated health centers generally operating with limited staff.

Survey duration

Data collection took place over three months, from April to June 2026.

Study population

The target population comprised all health workers providing antenatal, maternity (delivery and postpartum), and immunization services across the district's 33 health facilities. Eligible professional categories included general practitioners, midwives, state-registered nurses, and nursing aides. Inclusion criteria were active practice in one of these services at the time of the survey and free, informed consent. Excluded were staff absent during data collection (leave, mission, illness), any participant who withdrew after enrollment, and any questionnaire with more than 20% missing responses or clearly inconsistent responses.

Sample size and sampling

Using Cochran's formula for an unknown proportion ($Z = 1.96$; $p = 0.5$; precision = 5%), the minimum theoretical sample size was 385; after correction for a finite source population of 145 eligible staff (identified through the District Health Chief), the corrected minimum sample size was 105 health professionals. Because the eligible population (145) exceeded this corrected minimum but remained small, an exhaustive census of all 145 eligible staff across the 12 health areas was conducted rather than subsampling, in order to maximize statistical power and to ensure the representativeness of every health area, including the most isolated.

Data collection tool

The data collection tool was a structured questionnaire.

Theoretical foundations and questionnaire development

Questionnaire development drew on an integrative theoretical framework combining three complementary models: 1. The KAP model (Knowledge, Attitudes, Practices), which postulates a hierarchical relationship between the acquisition of knowledge, the formation of attitudes, and the adoption of practices. This model structured the questionnaire's three main sections. 2. Bandura's Social Cognitive Theory (1986), centered on the concept of self-efficacy, guided the wording of items relating to participants' confidence in their ability to perform PMTCT-related technical procedures (vaccine administration, immunoglobulin prescription) ¹⁶. 3. Bronfenbrenner's Ecological Systems Theory (1979) informed the exploration of perceived barriers, distinguishing individual constraints (ontosystem), organizational constraints (microsystem and exosystem), and policy-level constraints (macrosystem) ¹⁵. 4. Virginia Henderson's model of fundamental needs (1966) guided the wording of items relating to counseling and support for mothers, particularly around the needs to learn, to avoid danger, and to communicate ¹⁷.

Data were collected using a structured questionnaire, developed specifically for this study and organized into four sections: (i) sociodemographic and professional characteristics; (ii) knowledge of HBV PMTCT (virology, routes of vertical transmission, antenatal screening, birth-dose vaccination, immunoglobulin administration, follow-up of exposed infants); (iii) attitudes toward HBV PMTCT (perceived severity, adherence to preventive protocols, willingness to counsel HBsAg-positive women, position on breastfeeding); and (iv) clinical practices (antenatal screening, administration of the birth dose, referral, postnatal follow-up).

Scoring system

A standardized scoring system was applied to each section of the questionnaire, allowing calculation of a continuous score for each of the three domains assessed. For the knowledge domain, each item was scored as follows: 3 points for a correct answer, 2 points for a partially correct answer, 1 point for an

incorrect answer, and 0 points for "I don't know." This graduated weighting allows finer discrimination of mastery levels, avoiding the bias of a binary system that would fail to capture partial knowledge. For the attitude domain, a three-point Likert scale was used: "Strongly agree" (3 points), "Agree" (2 points), and "Disagree" (1 point). One item relating to breastfeeding was reverse-scored (Disagree: 3 points, Agree: 2 points, Strongly agree: 1 point), in accordance with WHO recommendations, which encourage breastfeeding among HBsAg-positive mothers when the newborn has received the vaccine birth dose. This reversal ensures that the score reflects adherence to scientific recommendations rather than personal opinion. For the practices domain, responses were scored as follows: 3 points for good practice, 1 point for approximate practice, and 0 points for absence of practice. This categorization reflects the gradation of clinical behaviors observed in routine care, consistent with a graduated scoring approach previously used to assess health students' adverse drug reaction reporting skills in Cameroon¹⁸.

For each domain, the raw score was converted into a percentage of the theoretical maximum score. For descriptive purposes, the percentages obtained were classified according to the KAP grading scale proposed by a previous study in Cameroon^{18,19}: good/appropriate/adequate (> 85%), acceptable/approximate/inadequate (65–85%), insufficient/erroneous/poor (50–65%), or weak/harmful/very poor (< 50%). For the specific purposes of multivariable analysis, each score was further dichotomized into two categories: ≥85% (good knowledge/appropriate attitudes/adequate practices) versus < 85% (combining the three lower categories).

Questionnaire reliability

Internal consistency of the questionnaire was assessed using Cronbach's alpha coefficient, calculated separately for each of the three domains. For the knowledge domain (12 items), alpha was 0.640. For the practices domain (7 items), alpha was 0.660. Although below the ideal threshold of 0.70, these values are considered acceptable in the literature for exploratory questionnaires or those measuring complex constructs^{20,21}. In contrast, the attitudes domain (8 items) showed more limited reliability (alpha = 0.343), which may be explained by the multidimensional nature of the attitude construct, encompassing distinct dimensions (perceived severity, adherence to preventive protocols, beliefs about breastfeeding). In accordance with Streiner's recommendations, results for this domain were analyzed item by item rather than through a global score²¹. Questionnaire reliability was further strengthened by pre-testing and content validation by domain experts.

Questionnaire pre-test

The questionnaire was pre-tested among 10 health workers in the Monatélé Health District, allowing assessment of clarity, administration time, and internal consistency; pre-test data were not included in the final analysis.

Data collection procedure

Data collection was carried out by the principal investigator, who obtained written informed consent from each participant after presenting the study objectives, and administered the questionnaire predominantly face-to-face; when participants' workload did not allow continuous face-to-face administration, the questionnaire was left for self-completion and retrieved the same day, with subsequent verification of completeness. Anonymity and confidentiality were strictly maintained throughout the study.

Consent and assent

A rigorous informed consent process was implemented. Each potential participant received a written information sheet detailing the study objectives, procedures, potential risks and benefits, confidentiality measures, and the voluntary nature of participation. The investigator then answered all questions raised by participants. Consent was formalized through the signature of a dedicated form, separate from the questionnaire, prior to any data collection. Participants were informed of their right to withdraw from the study at any time without negative consequences for their professional status. No assent was required, as the study involved only adult participants.

Potential sources of bias

To limit social desirability bias in self-reported practices, anonymity and confidentiality were systematically reiterated to participants, the questionnaire was completed without normative feedback from the investigator, and the tool was pre-tested to eliminate ambiguous items likely to bias responses. Selection bias was minimized through exhaustive sampling of the entire eligible staff rather than a subsample.

Statistical analysis

Data were entered and analyzed using IBM SPSS Statistics version 27.0. Qualitative variables were described using frequencies and percentages; quantitative variables (knowledge, attitude, and practice scores) were described using means, medians, and standard deviations. Normality of distributions was tested using the Kolmogorov-Smirnov test. The normality hypothesis was rejected for all quantitative variables ($p < 0.001$), justifying the use of nonparametric statistics for inferential analyses: the median was used as the preferred measure of central tendency, and associations were tested using the Mann-Whitney test (comparison of two groups) or the Kruskal-Wallis test (comparison of more than two groups). Bivariate associations between categorical variables and dichotomized KAP levels were tested using the chi-square test or Fisher's exact test, as appropriate to expected cell counts. All variables significantly associated with each outcome in bivariate analysis ($p < 0.05$) were entered into a multivariable binary logistic regression model, with adjusted odds ratios (aOR) and their 95% confidence intervals (95% CI) presented. The threshold for statistical significance was set at $p < 0.05$. No sample-size-based power calculation was performed a priori beyond the Cochran's-formula-derived minimum described above, as the entire eligible population was surveyed exhaustively.

Manuscript preparation

The first draft of this manuscript was prepared with the assistance of a large language model (Claude, Anthropic PBC), used under the direct supervision of the authors to support drafting and language editing of a manuscript based on the authors' own study design, data, and analysis. The tool played no role in study design, data collection, statistical analysis, or interpretation of findings. All authors reviewed, edited, and take full responsibility for the scientific content, accuracy, and conclusions of the final manuscript.

Ethical considerations

Ethical approval

was obtained from the Regional Ethics Committee for Human Health Research of the Centre Region (Ethics Clearance N°2991/CRERSHC/2026). Administrative authorizations were obtained from the Chief of the Obala Health District and the heads of all participating health facilities. All participants provided written informed consent after receiving detailed information about the study. Participation was voluntary, and data were collected and stored under strict conditions of anonymity and confidentiality.

Results

Participation and sociodemographic characteristics

Of the 145 eligible staff, 118 completed the questionnaire, a participation rate of 81.4%; among the 27 non-participants, 11 were absent during the survey period (mission, leave, illness), 10 declined to participate, and 6 questionnaires were excluded during data quality control for exceeding the 20% threshold for missing responses (Fig. 1). Table 1 summarizes the sociodemographic and professional characteristics of the 118 participants.

Table 1
Sociodemographic and professional characteristics of participants (N = 118)

Variable	Category	n	%
Age (years)	≤ 35	90	76.3
Age (years)	> 35	28	23.7
Sex	Female	81	68.6
Sex	Male	37	31.4
Professional experience	≤ 5 years	62	52.5
Professional experience	> 5 years	56	47.5
Profession	General practitioner	5	4.2
Profession	Midwife	19	16.1
Profession	Nurse	70	59.3
Profession	Nursing aide	24	20.3
Service(s) provided*	Antenatal care	83	70.3
Service(s) provided*	Maternity	78	66.1
Service(s) provided*	Immunization	52	44.1
Recent HBV PMTCT training (≤ 3 years)	Yes	26	22.0

**Percentages for services exceed 100% because staff could report activity across more than one service (cross-service polyvalence).*

The sample was predominantly female (68.6%) and trained as nurses (59.3%), with substantial cross-service involvement across antenatal care (70.3%), maternity (66.1%), and immunization (44.1%). Mean age was 31.9 ± 8.1 years (median: 30 years; range: 19–56 years), and mean professional experience was 7 ± 6.3 years (median: 5 years). Only 22.0% of participants had received specific training on HBV PMTCT within the previous three years. Participants were distributed across all 12 health areas of the district, most heavily represented in the Obala health area (39.0%), followed by Batchenga (16.1%) and Nkometou (12.7%); by facility type, private and faith-based facilities (40.7%) and integrated health centers (35.6%) together accounted for over three-quarters of participants, ahead of medical centers (13.6%) and the district hospital (10.2%).

Knowledge of HBV PMTCT

Health professionals' knowledge across the various components of HBV PMTCT in Obala is presented in Table 2.

Table 2
Summary of health professionals' knowledge of HBV PMTCT (N = 118)

Variable	Response	n	%
Route of HBV transmission	Blood, body fluids, sexual contact, and mother-to-child transmission	61	51.7
Route of HBV transmission	Contact with secretions of an infected person	52	44.1
Route of HBV transmission	Consumption of contaminated water or food	5	4.2
Route of HBV transmission	Don't know	0	0.0
Risk factors for HBV transmission	High viral load, HBeAg positivity, absence of newborn sero-vaccination	77	65.3
Risk factors for HBV transmission	High viral load and breastfeeding	33	28.0
Risk factors for HBV transmission	History of cesarean delivery	3	2.5
Risk factors for HBV transmission	Don't know	5	4.2
HBV screening	Systematically at first antenatal visit	111	94.1
HBV screening	Only during labor	4	3.4
HBV screening	Only if jaundice present	2	1.7
HBV screening	Don't know	1	0.8
HBV screening test	Rapid HBsAg test	95	80.5
HBV screening test	AST/ALT assay	6	5.1
HBV screening test	Rapid HIV test	12	10.2
HBV screening test	Don't know	5	4.2
Vaccination timing	Within 24 hours of birth	69	58.5
Vaccination timing	At 6 weeks (with pentavalent vaccine)	46	39.0
Vaccination timing	At 9 months	1	0.8
Vaccination timing	Don't know	2	1.7
Number of vaccine doses required for protection	Monovalent dose mandatory at birth, followed by two others	58	49.2
Number of vaccine doses required for protection	Yes, followed by the other two doses	42	35.6
Number of vaccine doses required for protection	Yes	9	7.6
Number of vaccine doses required for protection	Don't know	9	7.6

Variable	Response	n	%
Other HBV treatment	Specific immunoglobulins	70	59.3
Other HBV treatment	Antiretrovirals	37	31.4
Other HBV treatment	Antibiotics	10	8.5
Other HBV treatment	Don't know	1	0.8
Main risk to the newborn	Chronic viral carriage	55	46.6
Main risk to the newborn	Transient jaundice	33	28.0
Main risk to the newborn	Immediate death	23	19.5
Main risk to the newborn	Don't know	7	5.9
Serological follow-up of HBV	HBsAg testing and anti-HBs antibody titer between 9 and 12 months	52	44.1
Serological follow-up of HBV	PCR test at 6 months of age	35	29.7
Serological follow-up of HBV	No follow-up needed if vaccinated	13	11.0
Serological follow-up of HBV	Don't know	18	15.3
Timing of antiviral treatment	Very high viral load in 3rd trimester	21	17.8
Timing of antiviral treatment	Always, regardless of viral load level	69	58.5
Timing of antiviral treatment	Never (dangerous for the fetus)	10	8.5
Timing of antiviral treatment	Don't know	18	15.3
Precautions during delivery	Invasive procedures to be avoided	96	81.4
Precautions during delivery	Systematic cesarean delivery	17	14.4
Precautions during delivery	No specific precaution	2	1.7
Precautions during delivery	Don't know	3	2.5
Breastfeeding	No, if birth dose and HBIG administered to newborn	76	64.4
Breastfeeding	Only if mother is on antivirals	9	7.6
Breastfeeding	Yes, systematically	25	21.5
Breastfeeding	Don't know	8	6.8

Overall, 94.1% of participants correctly identified the indication for antenatal screening at the first antenatal visit, and 81.4% correctly identified the precautions to be taken at delivery; however, 49.2% were unaware of the need for a monovalent vaccine dose in addition to the pentavalent schedule. The mean overall knowledge score was 80.1 ± 13.0 out of 100. In total, 36.4% of participants had a good level

of knowledge and 52.5% had an acceptable level of knowledge, while 9.3% had insufficient knowledge and 1.7% had poor knowledge. Knowledge quality varied by profession: midwives were the most likely to reach a good level (47.4%), followed by general practitioners, whereas most nursing aides (66.7%) and nurses (52.9%) fell instead into the acceptable category.

In multivariable analysis, working in the Essong health area (aOR = 0.10, 95% CI 0.01–0.88, $p = 0.039$) or the Etoud-Ayos health area (aOR = 0.07, 95% CI 0.007–0.68, $p = 0.022$) was associated with an insufficient level of knowledge, compared with other health areas in the district; recent in-service training approached significance in the adjusted model (aOR = 1.16, 95% CI 1.07–1.26, $p = 0.069$) (Table 5).

Attitudes toward HBV PMTCT

Participants' attitudes were analyzed item by item, owing to the multidimensional nature of the attitude construct (Cronbach's $\alpha = 0.343$). This approach allowed specific trends to be identified for each component of HBV PMTCT. Health workers' views on each component of HBV transmission prevention and care are presented in Table 3.

Table 3
Summary of attitudes toward HBV PMTCT (N = 118)

Variable	Response	n	%
Perceived severity of HBV infection	Very serious	63	53.4
Perceived severity of HBV infection	Serious	38	32.2
Perceived severity of HBV infection	Not serious	17	14.4
Views on the importance of health education on HBV PMTCT during ANC visits	Very important	113	95.8
Views on the importance of health education on HBV PMTCT during ANC visits	Important	1	0.8
Views on the importance of health education on HBV PMTCT during ANC visits	Not important	4	3.4
Views on the effectiveness of systematic screening during ANC visits	Very effective	98	83.1
Views on the effectiveness of systematic screening during ANC visits	Effective	10	8.5
Views on the effectiveness of systematic screening during ANC visits	Ineffective	10	8.5
Views on the effectiveness of vaccine administration within the first 24 hours of life	Very effective	108	91.5
Views on the effectiveness of vaccine administration within the first 24 hours of life	Effective	7	5.9
Views on the effectiveness of vaccine administration within the first 24 hours of life	Ineffective	3	2.5
Views on the need for hepatitis B immunoglobulin (HBIG) administration to newborns of seropositive mothers	Very necessary	79	66.9
Views on the need for hepatitis B immunoglobulin (HBIG) administration to newborns of seropositive mothers	Necessary	24	20.3
Views on the need for hepatitis B immunoglobulin (HBIG) administration to newborns of seropositive mothers	Not necessary	15	12.7
Intention to refer screened women to a specialist	Strongly agree	66	55.9
Intention to refer screened women to a specialist	Agree	27	22.9
Intention to refer screened women to a specialist	Disagree	25	21.2
Intention regarding biological follow-up of the child at 9 months	Strongly agree	82	69.5
Intention regarding biological follow-up of the child at 9 months	Agree	20	16.9
Intention regarding biological follow-up of the child at 9 months	Disagree	16	13.6

Variable	Response	n	%
Views on breastfeeding contraindication	Strongly agree	46	39.0
Views on breastfeeding contraindication	Agree	11	9.3
Views on breastfeeding contraindication	Disagree	61	51.7

Attitudes were generally favorable: 95.8% of health professionals considered education of pregnant women on HBV PMTCT necessary during antenatal consultations, 91.5% considered early vaccination effective in reducing transmission risk, and 83.1% supported the effectiveness of systematic screening during antenatal visits. Regarding specific case management, 66.9% of participants considered administration of HBIG to newborns of seropositive mothers necessary, 69.5% were in favor of biological follow-up of the infant at 9 months, and 55.9% intended to refer screened women to a specialist. In contrast, only 53.4% of health professionals perceived HBV infection as a "very serious" public health problem in Obala, and 39.0% incorrectly believed that breastfeeding was contraindicated in HBsAg-positive mothers. The mean overall attitude score was 85.5 out of 100. In total, 56.8% of participants held appropriate attitudes toward HBV PMTCT, while 39.0% displayed approximate attitudes and 4.2% erroneous attitudes.

In multivariable analysis, a good level of knowledge (aOR = 8.23, 95% CI 1.70–39.74, $p = 0.009$) and greater professional experience (> 5 years; aOR = 2.23, 95% CI 1.02–4.86, $p = 0.044$) were independently and positively associated with appropriate attitudes (Table 5).

Practices related to HBV PMTCT

Table 4 details the practices reported by Obala Health District staff at each key stage of the HBV PMTCT protocol.

Table 4
Participants' reported practices (N = 118)

Variable	Response	n	%
Systematic screening at ANC	Systematically	96	81.4
Systematic screening at ANC	Sometimes/Rarely	12	10.2
Systematic screening at ANC	Never	10	8.5
Health education on PMTCT during ANC visits	Systematically	70	59.3
Health education on PMTCT during ANC visits	Sometimes/Rarely	40	33.9
Health education on PMTCT during ANC visits	Never	8	6.8
HBV vaccination within 24h	Systematically	51	43.2
HBV vaccination within 24h	Sometimes/Rarely	37	31.4
HBV vaccination within 24h	Never	30	25.4
Prescription of hepatitis B immunoglobulin (HBIG)	Systematically	43	36.4
Prescription of hepatitis B immunoglobulin (HBIG)	Sometimes/Rarely	54	45.8
Prescription of hepatitis B immunoglobulin (HBIG)	Never	27	17.8
Vaccine stockout: recourse to emergency stock	Uses available emergency stock	67	56.8
Vaccine stockout: recourse to emergency stock	Reopens the following day to vaccinate	25	21.2
Vaccine stockout: recourse to emergency stock	Asks the mother to return later when the service reopens	26	22.0
Vaccine stockout: patient referral	Systematic referral of the patient	60	50.8
Vaccine stockout: patient referral	Refers occasionally	49	41.5
Vaccine stockout: patient referral	Does nothing specific	9	7.6
Scheduling of follow-up appointment	Yes, systematically	52	44.1
Scheduling of follow-up appointment	Sometimes	19	16.1
Scheduling of follow-up appointment	Managed by another service	47	39.8

Despite acceptable knowledge and generally favorable attitudes, the mean overall practice score was only 62.8 ± 22.8 out of 100, and just 19.5% of participants reported overall adequate PMTCT practices. While 43.2% reported systematically administering the birth dose within 24 hours and 36.4% reported systematically prescribing immunoglobulin when indicated, common obstacles included postponing vaccination to the following day (21.2% of participants) and referring the mother elsewhere when the immunization service was closed (22.0%). Grading the remaining 80.5% of non-adequate practices further revealed that 32.2% were merely approximate, but 27.1% were classified as frankly poor and 21.2% as harmful. This harmful category was not evenly distributed across professional groups: it affected 40.0% of general practitioners and 33.3% of nursing aides, compared with lower proportions among nurses and midwives, among whom poor and harmful practices combined nonetheless still affected more than half of respondents (47.4%). Adequate practices were most frequent among nurses (24.3%) and general practitioners (20.0%), and least frequent among nursing aides (8.3%) (Fig. 2).

In multivariable analysis, recent in-service training was the only factor found to be protective against inadequate practices (aOR = 3.03, 95% CI 1.15–7.98, $p = 0.032$); neither seniority, professional category, nor knowledge level alone was sufficient to ensure adequate clinical practice (Table 5).

Table 5
Factors independently associated with knowledge, attitudes, and practices regarding HBV PMTCT (multivariable binary logistic regression)

Outcome ($\geq 85\%$ vs $< 85\%$)	Independent variable	aOR	95% CI	P
Knowledge	Essong health area (vs other areas)	0.10	0.01–0.88	0.039
Knowledge	Etoud-Ayos health area (vs other areas)	0.07	0.007–0.68	0.022
Knowledge	Recent in-service training	1.16	1.07–1.26	0.069
Attitudes	Good level of knowledge	8.23	1.70–39.74	0.009
Attitudes	Professional experience > 5 years	2.23	1.02–4.86	0.044
Practices	Recent in-service training (≤ 3 years)	3.03	1.15–7.98	0.032

Barriers perceived by health workers

The most frequently reported barriers to HBV PMTCT implementation were unavailability of vaccines or immunoglobulins (84.7%), lack of staff training (63.6%), high cost for parents (62.7%), heavy workload (27.1%), poor inter-service coordination (18.6%), and unavailability of screening tests (11.0%).

Discussion

This study showed that health workers in the Obala Health District had a good level of knowledge (36.4%) and generally appropriate attitudes (56.8%) toward HBV PMTCT, but that only one in five staff reported adequate clinical practices, with a further one in five reporting practices that were frankly

harmful. This dissociation between what staff know and think, on the one hand, and what they actually do, on the other, constitutes the central finding of this study.

The acceptable level of knowledge observed in Obala is encouraging and reflects a positive trend. This finding can be attributed to several factors. First, the integration of HBV PMTCT into the initial training curricula of midwives and nurses, although uneven across programs, is beginning to bear fruit. Second, the "spillover" effect of the long-established HIV PMTCT model, which has structured antenatal screening routines for more than a decade, has likely facilitated the assimilation of HBsAg screening protocols. This hypothesis is supported by the 94.1% rate of correct responses regarding the indication for systematic screening at the first antenatal visit, reflecting a now well-established practice. However, persistent and significant gaps were identified. Nearly one professional in two (49.2%) was unaware of the need for the monovalent birth dose, distinct from the pentavalent schedule administered at 6 weeks. This gap in knowledge is not trivial: it exposes newborns to an increased risk of vertical transmission during the first six weeks of life, a critical window during which the immature immune system cannot clear the virus, leading to chronicity in more than 90% of cases ². This knowledge deficit may be explained by two converging factors. First, the still-recent (February 2025) and, so far, selective introduction of the free monovalent birth dose ^{5,6} has not yet allowed complete dissemination of information across all health facilities, particularly those in peripheral areas. Second, in-service training for health workers, where it exists, is often focused on other priorities (HIV, malaria, tuberculosis), relegating hepatitis B to a lower priority among health concerns.

Multivariable analysis identified practice in the Essong and Etoud-Ayos health areas as significantly associated with an insufficient level of knowledge (aOR = 0.10 and aOR = 0.07, respectively). This finding is of major importance, as it documents a geographic disparity in the distribution of competencies within the district itself. These health areas, located in remote rural zones, suffer from a triple disadvantage: geographic distance from referral centers, limited access to supervision, and low staff turnover, which limits professional exchange. This situation is not unique to Cameroon. An assessment of the health workforce across the WHO African Region ²² established a regional density of only 1.55 health professionals per 1,000 population, well below the 4.45 threshold required for universal health coverage, with marked disparities between and within countries. In Cameroon, the concentration of qualified staff in urban centers, to the detriment of rural areas, is a well-documented phenomenon ²³. Rogers' Diffusion of Innovations theory ²⁴ provides a relevant analytical framework: health areas most distant from urban professional networks and supervisory visits are, almost by definition, the last to benefit from clinical updates. Accordingly, any strategy to strengthen competencies should prioritize these remote areas through mentoring and formative supervision approaches.

Attitudes were generally appropriate (56.8%). This finding is a positive signal, reflecting staff's willingness to implement PMTCT guidelines. The near-unanimous support for antenatal education (95.8%) and systematic screening (83.1%) shows that staff adhere to the principle of prevention. The significant association between appropriate attitudes and a good level of knowledge (aOR = 8.23)

confirms the theoretical sequence of the KAP model: knowledge informs judgment and shapes affective dispositions. The association with professional seniority (aOR = 2.23) suggests that clinical experience, through accumulated caseload and learning by doing, reinforces adherence to protocols. This finding is consistent with Bandura's Social Cognitive Theory ¹⁶, in which direct experience (mastery experiences) is a major source of self-efficacy.

However, two areas of concern warrant emphasis. First, only 53.4% of participants perceived hepatitis B as a "very serious" infection. This finding contrasts with a study conducted in Yaoundé, where 95.6% of staff perceived hepatitis B as a serious disease ⁸. This relative trivialization of HBV may be attributed to the historical prioritization of health concerns in Cameroon, where the fight against HIV and tuberculosis has long overshadowed viral hepatitis ³. Second, 39.0% of participants incorrectly believed that breastfeeding was contraindicated in HBsAg-positive mothers. This misconception, also documented in Nigeria, where 59.4% of staff had inadequate knowledge on this point ¹¹, may lead to unjustified early weaning practices, depriving the newborn of the immunological and nutritional benefits of exclusive breastfeeding. WHO nevertheless recommends breastfeeding for HBsAg-positive mothers, provided the newborn has received the vaccine birth dose and immunoglobulin if indicated ². From the perspective of Virginia Henderson's model of fundamental needs ¹⁷, this misconception illustrates a failure of the need to learn among healthcare workers themselves, which in turn compromises their ability to meet the need to communicate and properly counsel the mother; this suggests that a specific communication effort is needed to correct this misconception during staff training.

The most alarming finding of this study is the low rate of adequate practices (19.5%), compounded by the fact that a further 21.2% of practices were frankly harmful rather than merely inadequate. This finding is all the more striking given the contrast with the good level of knowledge (36.4%) and favorable attitudes (56.8%). This disruption of the knowledge-attitudes-practices continuum is at the heart of our scientific contribution. Several factors help explain this gap. First, the practices assessed required a higher standard of performance than knowledge. Antenatal screening, well mastered (81.4% systematic), is a well-established routine procedure. In contrast, administration of the birth dose (43.2% systematic) and prescription of immunoglobulin (36.4% systematic) are more recently introduced procedures requiring coordination between maternity and immunization services, 24-hour vaccine availability, and a prescription that is sometimes costly for families. Second, the structural barriers identified (unavailability of vaccines/immunoglobulins, lack of training, high cost) are exogenous constraints that health workers cannot overcome through competence or goodwill alone. This finding aligns with Bronfenbrenner's Ecological Systems Theory ¹⁵: the ontosystem (individual competence of healthcare staff) is undermined by failures at the exosystem level (supply chain, availability of inputs) and the macrosystem level (an incomplete, still-selective free-of-charge policy, and cost borne by families). Thus, a well-trained professional lacking vaccine supply cannot administer the birth dose; they are forced into workaround practices (postponement, referral elsewhere) that, while clinically risky, represent the only possible response within a failing system.

A more unexpected finding was that harmful practices were concentrated not among the least qualified staff but among general practitioners (40.0%) and nursing aides (33.3%), the two extremes of the district's professional hierarchy, while nurses and midwives, who together deliver most routine antenatal and immunization care, reported the highest rates of adequate practice. This pattern suggests that formal qualification alone does not protect against harmful PMTCT practice, and that physicians - who see fewer PMTCT cases individually and may rely more on general clinical judgement than on protocol-driven routine - may benefit as much from targeted retraining as the auxiliary staff more traditionally viewed as a priority for supervision.

Multivariable analysis identified recent in-service training as the only factor significantly associated with adequate practices (aOR = 3.03). This finding is of major importance. It indicates that staff who received specific training on HBV PMTCT within the previous three years were three times more likely to adopt adequate practices than their untrained colleagues. This association confirms the central role of competency reinforcement in improving quality of care. This finding is consistent with work conducted in other African settings. A study in Uganda showed that positive attitudes and a good level of knowledge predicted better preventive practices⁹. In Nigeria, the results of an assessment¹⁰ showed that although 73.8% of facilities had adopted a birth-dose vaccination policy, only 61.3% actually administered it; a complementary qualitative analysis by the same authors¹¹, exploring the perspectives of health workers and pregnant women, identified the lack of trained staff and unavailability of doses outside scheduled vaccination days as the main perceived barriers, underscoring, as in Obala, the central role of training and continuous input availability in closing this gap. More recently, a multicenter study among obstetric care providers in Central Ethiopia similarly found that in-service training was independently associated with both good knowledge and good practice of intrapartum HBV prevention¹⁴, while a cross-sectional survey of midwives and physicians in Ghana identified inadequate training as a major predictor of poor PMTCT practice despite only moderate overall practice scores¹³, closely mirroring the pattern observed in Obala. In-service training acts as a vehicle for knowledge updating but also, according to Bandura¹⁶, as a lever for strengthening self-efficacy: trained staff feel more competent and confident in performing technical procedures, even under conditions of constraint.

These findings align with a documented trend across the African Region. Birth-dose coverage in the African Region reached only 17% in 2021⁴. The 43.2% rate of systematic administration reported in Obala, although insufficient in absolute terms, compares favorably with this regional average. This relative performance reflects genuine progress that should be acknowledged, even as efforts must be intensified; it should, however, be interpreted cautiously, since Cameroon's own national birth-dose policy remains selective and recorded coverage close to 0% as recently as 2024⁶, so facility-level gains such as those observed in Obala have not yet translated into a measurable national uptick. In Cameroon, earlier studies have documented similar findings. In Yaoundé, a study found that only 21% of staff had good knowledge, 64.4% had favorable attitudes, and practices were inadequate among 57.1% of participants⁸. Our study, documenting higher knowledge levels (36.4% with a good level of knowledge) but equally insufficient practices, suggests a positive evolution in knowledge alongside persistent

structural barriers. This evolution may be attributable in part to the effect of recent national policy attention to hepatitis B, notably the February 2025 birth-dose communiqué, even though its selective scope and reported coverage suggest that its practical impact on the ground remains, for now, limited^{5,6}.

Limitations

This study has several limitations. Its cross-sectional design does not allow causal inference and provides only a single point-in-time assessment. Self-reported assessment of practices, rather than direct observation, may have introduced social desirability bias, with participants tending to overestimate their good practices. This bias, inherent to any self-reported survey, was mitigated by strict anonymity, which reduces pressure toward social conformity. Nonetheless, the reported rate of good practices (19.5%), and the substantial share of practices graded as frankly harmful (21.2%), are so low and so concerning, respectively, that they cannot be attributed to reporting bias alone; they reflect a concerning reality. The attitude domain's limited internal consistency ($\alpha = 0.343$), addressed by item-by-item analysis rather than a global score, is a further methodological limitation inherent to the multidimensional nature of this construct.

Generalizability

The findings of this study are likely generalizable to other semi-rural districts in Cameroon and sub-Saharan Africa sharing similar characteristics: high HBV prevalence, decentralized health systems with rural integrated health centers, multitasking staff, and uneven access to in-service training. However, contextual differences (input availability, national free-of-charge policies, staff density) may modulate the magnitude of the phenomena observed.

Conclusions

In the Obala Health District, maternity and immunization staff had acceptable knowledge and generally appropriate attitudes toward HBV PMTCT, but adequate clinical practice remained the exception rather than the rule, and a substantial minority of reported practices, concentrated among general practitioners and nursing aides, were frankly harmful. This disruption of the knowledge-attitudes-practices continuum appears to be driven primarily by structural barriers (vaccine and immunoglobulin availability, geographic isolation, the recency and selective scope of national policy) rather than by a lack of staff motivation, and it directly jeopardizes the achievement of the WHO's 2030 viral hepatitis elimination targets. Three actionable levers emerge as priorities for this district and comparable settings: securing the monovalent vaccine and immunoglobulin supply chain, intensifying in-service training and clinical supervision in the district's most isolated health areas (notably Essong and Etoud-Ayos), and extending in-service retraining beyond nurses and midwives to explicitly include general practitioners and nursing aides, among whom harmful practices were most concentrated.

Abbreviations

HBsAg

Hepatitis B surface antigen

KAP

Knowledge, Attitudes, Practices

ANC

Antenatal Care

HBIG

Hepatitis B Immunoglobulin

CI

Confidence Interval

WHO

World Health Organization

aOR

adjusted Odds Ratio

PMTCT

Prevention of Mother-to-Child Transmission

MTCT

Mother-to-Child Transmission

HBV

Hepatitis B Virus

Declarations

Ethics approval and consent to participate: This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Regional Ethics Committee for Human Health Research of the Centre Region, Cameroon (Ethics Clearance N°2991/CRERSHC/2026). Administrative authorizations were obtained from the Chief of the Obala Health District and the heads of all participating health facilities. Written informed consent was obtained from all participants prior to inclusion.

Consent for publication: Not applicable.

Availability of data and materials: The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request. The study questionnaire is provided as Additional File 1.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: GREE and MITT designed the study, collected and analyzed the data, and drafted the manuscript. TM, REAE, MNS, EFT, and GN contributed to data interpretation and critically revised the manuscript. MJE contributed to study supervision and critically revised the manuscript. All authors read and approved the final manuscript.

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Figures

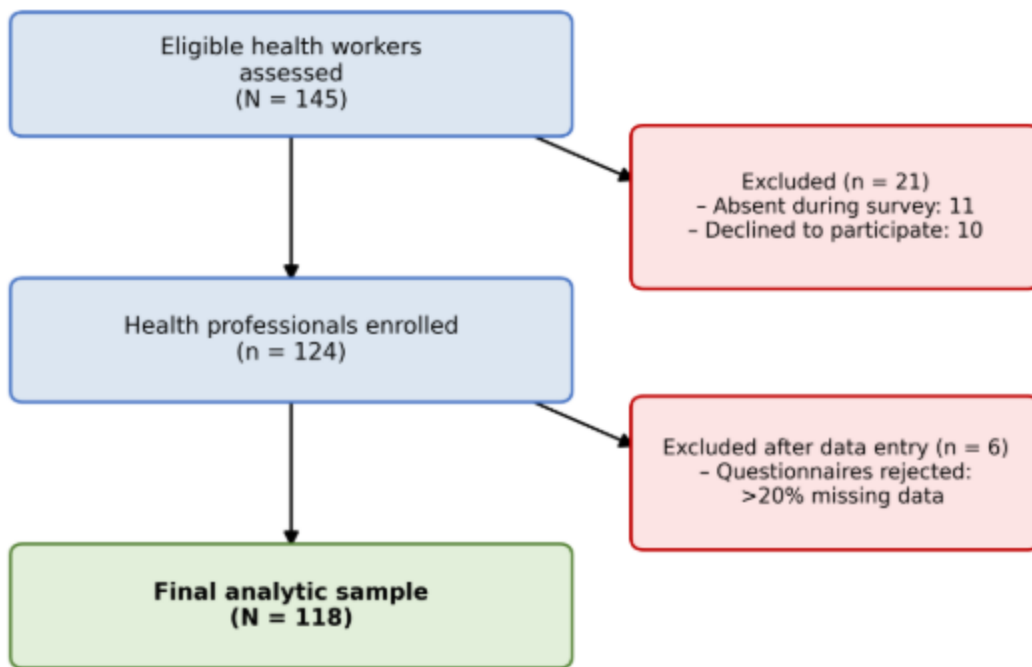


Figure 1

Flow diagram of participant recruitment and inclusion.

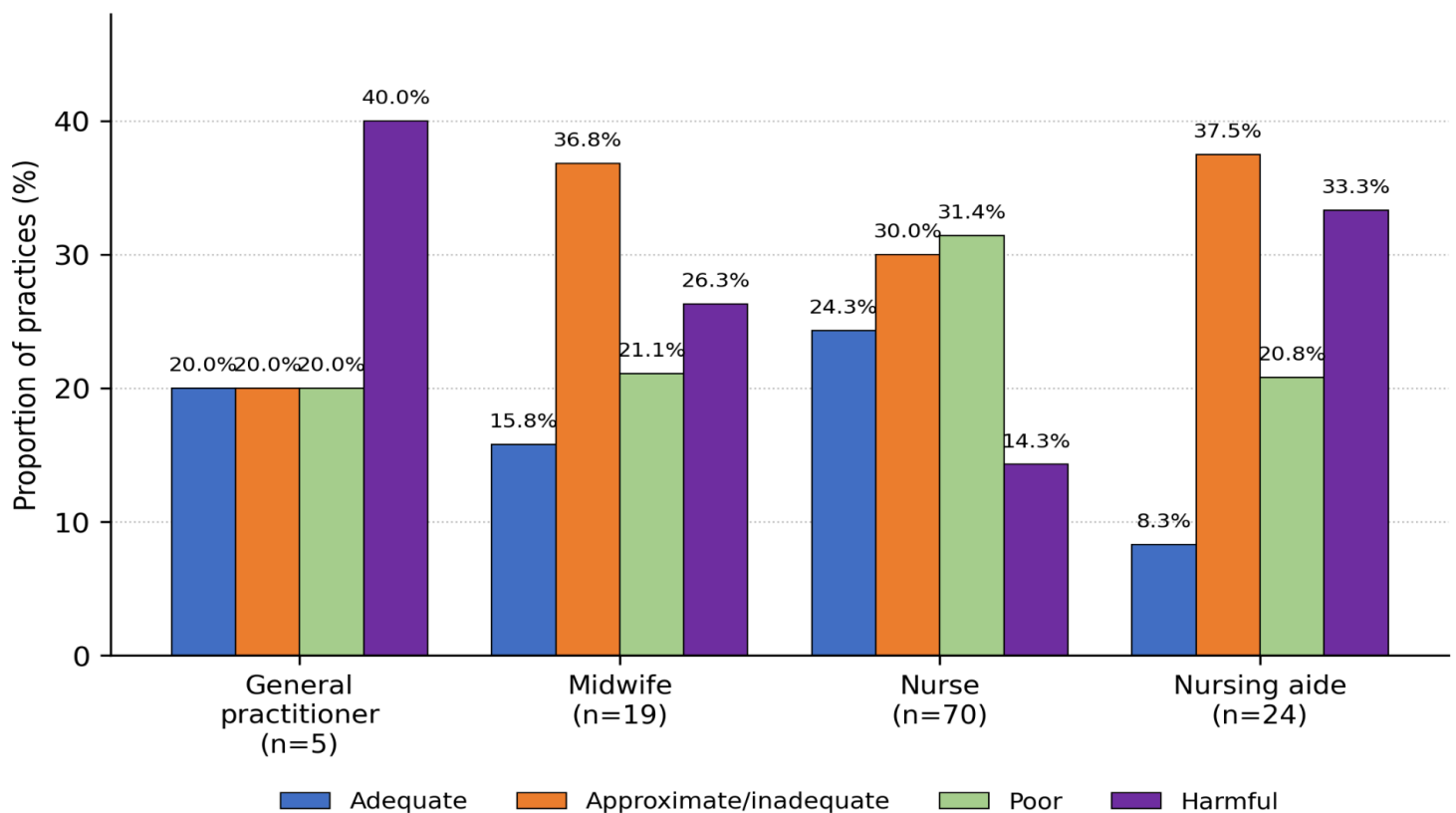


Figure 2

Quality of PMTCT practices by professional category.

Supplementary Files

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- [AdditionalFileQuestionnaireinEnglishlanguagePMTCTHBVKAPStudy.docx](#)