



(RESEARCH ARTICLE)



## Determination of the prevalence of the HBs antigen and evaluation of the vaccination status against Hepatitis B among the staff of the Dschang district hospital in West Cameroon

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### Abstract

Hepatitis B infection is a major global health problem. Sub-saharan Africa is particularly affected. The aim of this study was to determine the prevalence of HBs antigen (HBs Ag) and to assess the hepatitis B vaccine status among medical and paramedical staff at Dschang District Hospital. A descriptive cross-sectional study was conducted at Dschang District Hospital from November 2018 to June 2019. All medical and paramedical staff of the Dschang District Hospital were included, regardless of sex or age, vaccinated and unvaccinated. We assessed the level of knowledge of hepatitis B, investigated hepatitis B markers like HBs antigen (HBs Ag), HBc antibody (HBc Ab), HBs antibody (HBs Ab); we performed HBs Ab assay, investigated hepatitis B risk factors, and low hepatitis B immunization factors, among an average of 171 health personnel aged  $36.48 \pm 9.58$ . Of these, 94.7 % said they knew hepatitis B. The prevalence of hepatitis B was 7%. Nursing and paramedical professions were the main concerned by the HBs Ag positivity. The risk factors found in HBs Ag carriers were unprotected sex, scarification and blood exposure accident. There was an association between HBs antigen portage and unprotected sex ( $P=0.021$ ), blood exposure accident ( $P=0.021$ ) and piercing ( $P=0.004$ ). However, there was no association between HBs Ag carrying and age group ( $P=0.779$ ), sex ( $P=0.248$ ) and marital status ( $P=0.779$ ). On the basis of the statements, without a certificate, 57% of the staff said they had already been vaccinated against hepatitis B; of these, 89% had received at least 3 doses of vaccine, of which 53.3% had acquired immunity from HBV. Advanced age (over 40 years) and overweight were associated with a low response to hepatitis B vaccine. In addition, sex and smoking were not associated with low hepatitis B seroprotection. In conclusion, this study found that the prevalence of HBs Ag is still high in our context and low hepatitis B seroprotection in the study population. Hence the need for awareness-raising, systematic screening and vaccination of health personnel, training of vaccinators and monitoring of the vaccination chain.

**Keywords:** Hepatitis B; Seroprevalence; Vaccination; Healthcare workers

### 1. Introduction

Viral hepatitis is an infectious and inflammatory damage to the liver by hepatotropic viruses. Among these viruses, hepatitis B virus is frequently encountered worldwide and is a major public health problem because of its great contagiousness, the insidious nature of its evolution and the possibility of an evolution towards cirrhosis and hepatocellular carcinoma [1]. The World Health Organization (WHO) estimates that 2 billion people are infected with HBV and around 248 million are chronic carriers of the hepatitis virus. With a prevalence above 8%, sub-Saharan Africa

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and Southeast Asia are areas of high endemicity [2]. Bigna's study in Cameroon between January 2000 and September 2016 announced a prevalence of hepatitis B of 11.2% [3].

The occupational origin of this pathology is on the way to being mastered in developed countries thanks to the introduction of compulsory vaccination for health personnel, with a prevalence of HBs antigen carrier <0.5% [4]. In addition, prevention with the vaccine would prevent at least 80 to 90% of deaths linked to this viral infection.

In Cameroon, although vaccination is not systematic for health personnel; some hospitals have undertaken the systematic vaccination of their personnel, which could justify the high vaccination coverage rate of 66.1% found by Vanta in 2012 in Douala General Hospital [5]. Regarding the Dschang District Hospital, neither vaccination nor screening of health personnel is systematic. In the present study we wanted to determine the prevalence of HBs Ag and the hepatitis B vaccination status of medical and paramedical staff at Dschang District Hospital.

### *Equipment*

We carried out a cross-sectional and descriptive study at the Dschang District Hospital (HDD) over a period of 08 months from November 2018 to June 2019. As material, this study required, among others individual survey sheets and consent, laboratory handling procedures, data entry and analysis software (SPSS version 20.0, Microsoft Excel version 2016 software), computer, scientific calculator, collection equipment, rapid diagnostic test strips HBs Ag and a spectrophotometer.

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## **2. Method**

### **2.1. Target population**

It was made up of medical staff (general practitioners and specialists, dental surgeons, pharmacists) and paramedical staff: State-certified nurses, midwives, physiotherapists, dieticians, laboratory and radiology technicians, and dentists, surface technicians, nursing assistants, vaccinated and unvaccinated. Administrative staff and security guards, as well as pupils and students on internship at HDD during the study period were excluded.

### **2.2. Ethical considerations**

The ethical clearance N°2019/074 obtained from the institutional ethics committee of the Université des Montagnes was a prerequisite for the study. Authorization from the Director of HDD had been obtained. Medical and paramedical staff were informed of the value of the study, the objectives and the methodology used. Agreement to answer the questions required to complete the survey form was obtained. Only those staff who freely consented to participate were included in the study. The data collected has been stored and processed in strict compliance with medical confidentiality. To maintain confidentiality, an anonymity number was assigned to each participant and noted on their technical sheet.

### **2.3. Procedure**

After obtaining the various administrative authorizations and ethical clearance, the study took place in the following chronological order : Meeting with medical and paramedical staff, Presentation of the study and its interest to each staff, Distribution of the information and consent form, Signature of the consent form and completion of a survey form by each participant, Establishment of a schedule for each service to take samples, Registration of each participant with attribution of an anonymous code number, Drawing of 5 ml of venous blood taken under suitable aseptic and safe conditions with collection in the labeled sterile tube, were put to rest for 30 minutes before centrifuging at 2500 rpm for 5 minutes for the "obtaining serum, Rapid immunochromatographic test for the detection of HBs Ag, anti-HBc Ab and anti-HBs Ab, Assay of anti-HBs Ab" for people who have regularly received at least 3 doses of vaccine.

For each staff, we recorded: identity, history, knowledge of hepatitis B, knowledge of viral B serological status, vaccination status, and current viral B serological status.

### **2.4. Variables and data analysis**

The independent variables studied were age, sex, occupation, service, nationality, marital status, history (jaundice, blood transfusion, unsafe sex, scarification, tattooing, piercing, drug addiction, sexually transmitted infection, blood exposure accident), current viral B serological status, current vaccination status, number of doses received, adherence

to the vaccination schedule, circumstance of vaccination, reason for non-vaccination, consumption of tobacco, BMI, chronic medical problems.

The dependent variables were: HBs Ag, anti-HBc Ab and anti-HBs Ab (as tested by rapid chromatographic immunity test) and anti-HBs Ab level.

The data collected was entered and analyzed using Statistical Package for Social Sciences (SPSS) software version 20.0.0. Microsoft Office Excel was used to make the figures. Data were presented as counts, percentages, mean +/- standard deviation. Frequency comparison was performed using cross tabulation with chi-square test,  $P < 0.05$  was considered statistically significant.

## 2.5. Prevalence of HBs Ag

To determine the prevalence of HBs Ag, we used a qualitative test based on the HBV One Step Hepatitis B Virus Combo Test Device reagent which allowed the detection of the HBs antigen (HBs Ag), of the anti HBc antibody. (Anti-HBc Ab) and anti HBs antibody (Anti-HBs Ab) in the serum of each participant.

### 2.5.1. Factors associated with carrying HBs Ag

The search for Factors associated with the carriage of HBs Ag was done for each participant, by analyzing the data concerning sex, marital status, history of blood transfusion, history of unsafe sex, history of scarification, history of tattooing, history of piercing, history of IV drug addiction, history of sex-transmitted infections, history of Blood Exposure Accident (BEA).

### 2.5.2. Immunization status

To determine vaccination status, we performed a quantitative assay for anti-HBs antibody with the BIOELISA anti-HBs test kit following the manufacturer's instructions.

The search for Factors associated with the decrease in the immune response was carried out for each participant in whom the anti-HBs Ab assay was performed, by analyzing the data concerning: age, gender, tobacco consumption, body mass index, chronic medical problems.

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## 3. Results

### 3.1. Sociodemographic characteristics of the study population

The medical and paramedical staff at Dschang District Hospital numbered 187 people, but only 171 persons (or 91.4%) agreed to participate in the study. Sixteen healthcare workers were not included in this study. Of the participants, 97 (or 56.7%) claimed to be vaccinated against the hepatitis B virus while the remaining 74 (or 43.3%) had not received any vaccine.

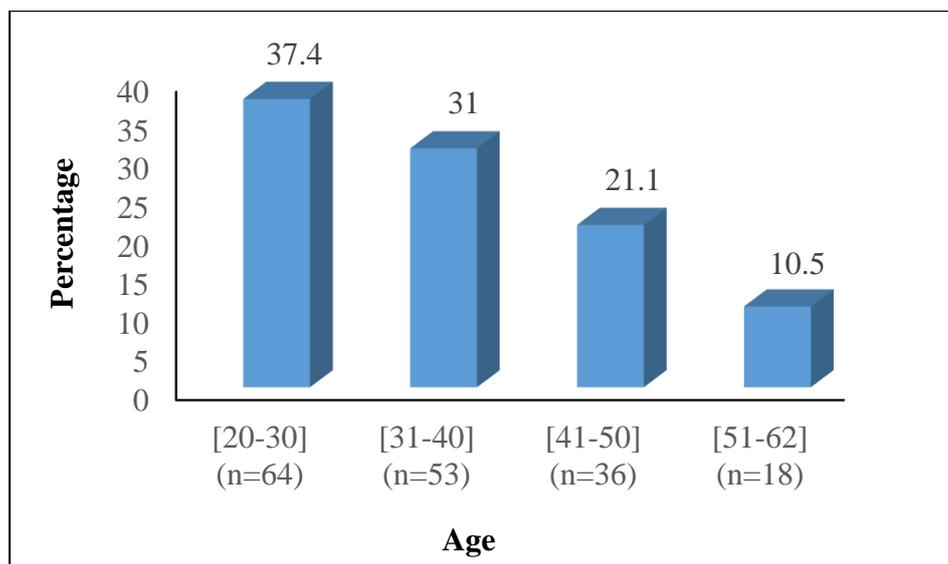
#### 3.1.1. Sex

The distribution of the population by sex was in favor of women 76% (130) against 24% (41).

#### 3.1.2. Age

Figure 1 shows the distribution of the population according to age groups.

The population was predominantly young (age under 30 years). The most represented age group was between 20 and 30 years, followed by 31 to 40 years; the extremes were 20 years and 62 years. The mean age was  $36.48 \pm 9.58$  years.



**Figure 1** Distribution of the population according to age groups

### 3.1.3. Profession and marital status

Table 1 shows the distribution of our study population according to occupation and marital status.

**Table 1** Distribution of the study population by occupation and marital status

Characteristics	Methods	Staff	Percentages (%)
Nationality (n = 171)	Cameroonians	171	100
Marital Status (n = 171)	Married	112	65.5
	Single	58	34.0
	Divorced	1	0.5
Profession (n = 171)	Nurses	82	48.0
	Lab technicians	23	13.5
	Nursing assistants	20	12.0
	Surface technicians	10	5.8
	Midwives	8	4.5
	Doctors	6	3.5
	Dental technicians	6	3.5
	APS for PV VIH	4	2.3
	Physiotherapists	4	2.3
	Pharmacists	3	1.7
	Dietitians	2	1.2
	Dentists	2	1.2
Imaging technicians	1	0.5	

Married people were twice as numerous as single people; nurses represent almost half of our study population.

### 3.2. Risk factors

The relationship between the main risk factors identified in our population and the prevalence of HBs Ag is shown in Table 2

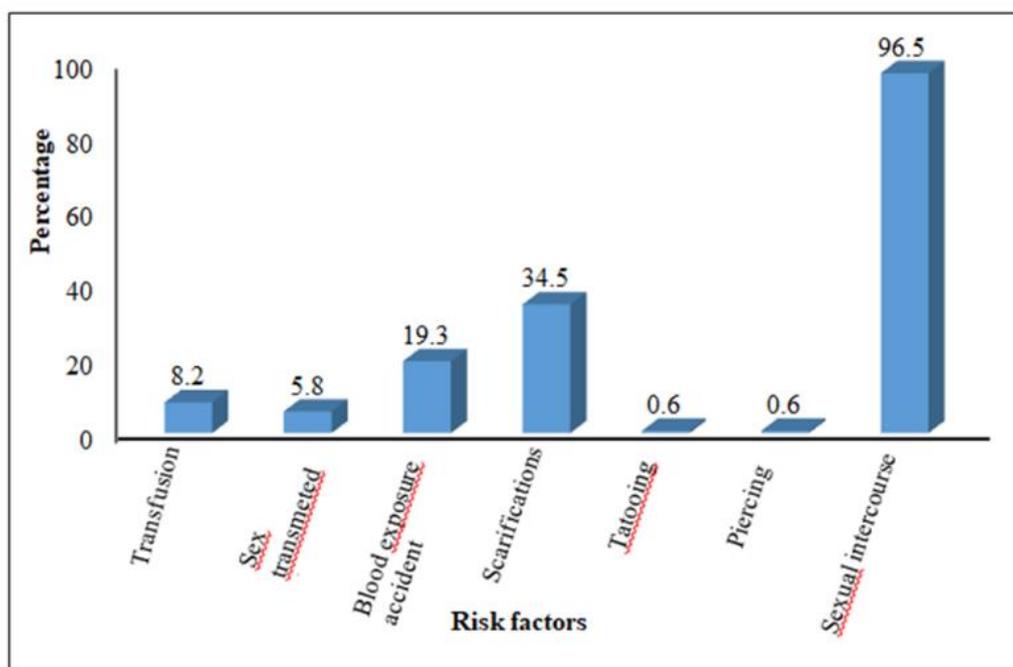
**Table 2** Prevalence of HBsAg according to risk factors

Risk factors	Workforce	Proportions (%)	P
Sexual intercourse (n=12)	9	75.0	0.021
Scarification (n=12)	6	50.0	1.000
BEA* (n=12)	2	16.7	0.021
Piercing (n=12)	1	8.3	0.004
Blood transfusion (n=12)	0	0.0	/
Tattooing (n=12)	0	0.0	/

\* Blood exposure accident

Unprotected sex and scarification are the main risk factors.

The main risk factors for HBV transmission identified among HDD staff are shown in Figure 2.



**Figure 2** Distribution of the study population according to risk factors for transmission of viral hepatitis B

The main risk factors recorded were sexual intercourse, scarification and blood exposure.

### 3.3. Knowledge of hepatitis B.

The level of knowledge of hepatitis by HDD health staff is summarized in Table 3.

**Table 3** Knowledge of hepatitis B

Characteristics	Methods	Staff	Percentages (%)
Knowledge of hepatitis B (n = 171)	No	9	5.3
	Yes	162	94.7
Cause (n = 171)	Virus	159	93.0
	Bacteria	1	0.6
	Don't Know	11	6.4
Transmission Mode	Blood	147	86.0
	Sexual	145	84.8
	Mother-child	127	74.3
	Don't Know	5	3.0
Complications	Cirrhosis	145	84.8
	Liver cancer	133	77.8
	Gastrointestinal bleeding	15	8.8
	Pneumonia	3	1.8
	Influenza	2	1.2
	Don't know	1	0.6

The majority of the study population claimed to have knowledge of hepatitis B and the viral origin of the disease

### 3.4. Serological status

A large part of the staff (73%) affirmed their serological B status. Qualitative tests established that the prevalence of HBs Ag is 7% among HDD staff.

The variations in the prevalence of HBs Ag according to sex, age and marital status are presented in Table 4.

**Table 4** Prevalence of HBs Ag according to sex, age and marital status

Characteristics	Methods	Staff	Percentages (%)	p
Gender (n=12)	Female	8	66.7	0.248
	Male	4	33.3	
Marital status (n=12)	Married	7	58.3	0.779
	Single	5	41.7	
Age (n=12)	[20-30]	3	25.0	0.779
	[31-40]	4	33.3	
	[41-50]	5	41.7	

Although the differences are not statistically significant ( $P > 0.05$ ), women, married people and people over 40 years of age would be the most vulnerable.

### 3.5. Prevalence of hepatitis B markers

The results of the search for the different markers of hepatitis are recorded in Table 5.

**Table 5.** Prevalence of hepatitis markers

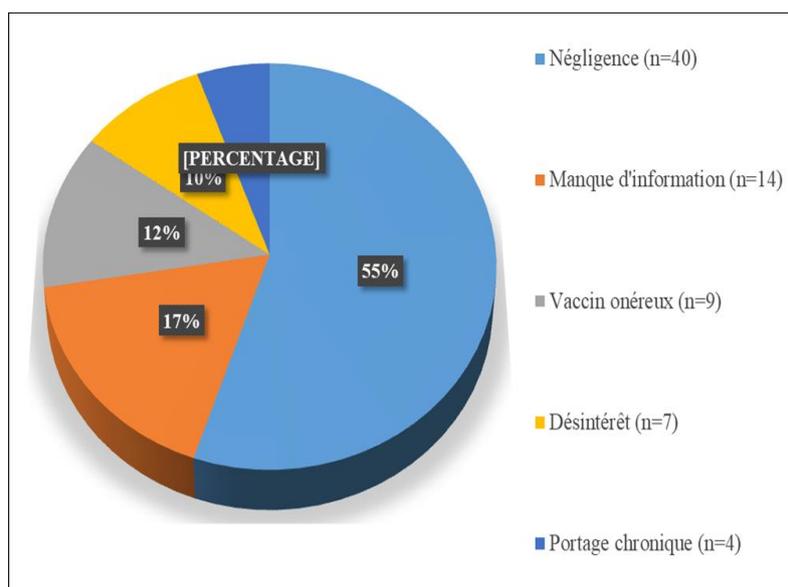
Characteristics	Modalities	Staff	Percentages (%)	p
HBs Ag (n = 171)	Negative	159	93.0	0.000
	Positive	12	7.0	
Anti-HBc Ab (n = 171)	Negative	134	78.4	0.000
	Positive	37	21.6	
Anti-HBs Ab (n = 171)	Negative	110	64.3	0.000
	Positive	61	35.7	

Less than 30% of the population (21.6%) had ever been in contact with HBV (anti-HBc + Ab). Among them, some have acquired passive immunity, evidenced by the presence of anti-HBs Ab and the absence of HBs Ag. Others, on the other hand, were in a situation where it was impossible to identify between a healed or a chronic one.

### 3.6. Vaccination status

Upon simple declaration without presentation of any certificate, 57% of the staff declared themselves vaccinated against hepatitis B.

The reasons for the non-vaccination of others (43%) are grouped together in figure 3.

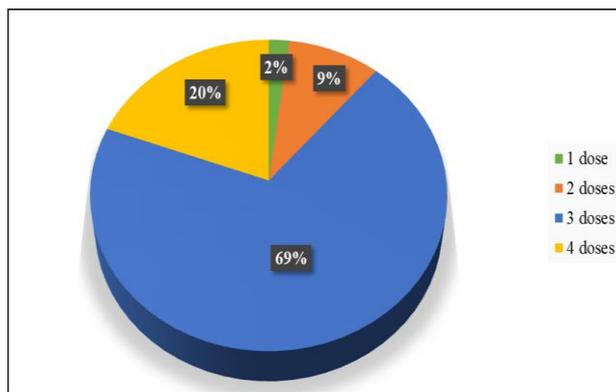


**Figure 3** Distribution of the unvaccinated population according to the reasons for non-vaccination

The main reasons for non-vaccination were neglect and the lack of information about the existence of a vaccine.

### 3.7. Vaccine doses received

Figure 4 shows that the staff vaccinated did not show uniformity in the number of doses of vaccine received.



**Figure 4** Distribution of the vaccinated population according to the number of vaccine doses received

Most of the staff (69%) had received at least 3 doses of the vaccine.

Table 6 shows the proportion of subjects having carried out the pre-vaccination assessment and the post-vaccination assessment.

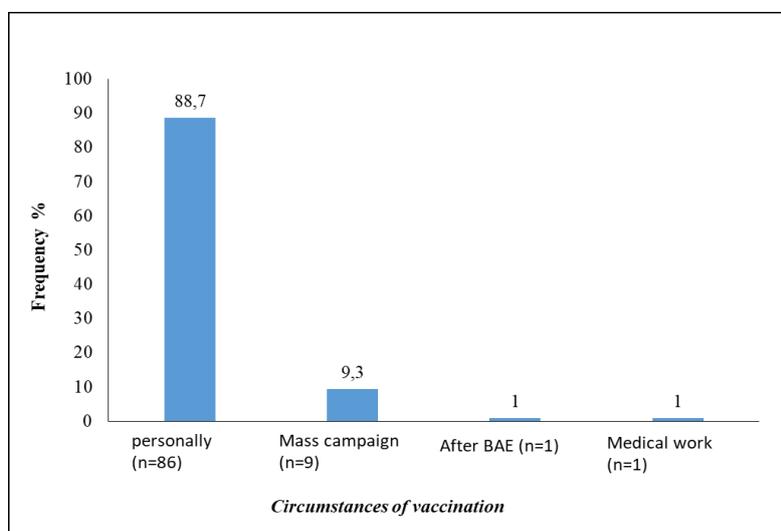
**Table 6.** Distribution of the vaccinated population according to the pre- and post-vaccination assessment

Characteristics	Methods	Workforce	Proportions (%)	P
Prevaccination assessment* (n = 97)	No	5	5.2	0.000
	Yes	92	94.8	
Post vaccination assessment** (n = 97)	No	95	97.9	0.000
	Yes	2	2.1	

\* Research for Ag HBs. \*\* research and/or assay of anti HBs Ab.

The majority of the staff had done a pre-vaccination and post-vaccination workup with a highly significant difference ( $P < 0.05$ ).

But only 38% of the staff adhered to the vaccination schedule. In addition, it is often on a personal basis that employees had been vaccinated (Figure 5).



**Figure 5** Distribution of the population according to the circumstances of vaccination

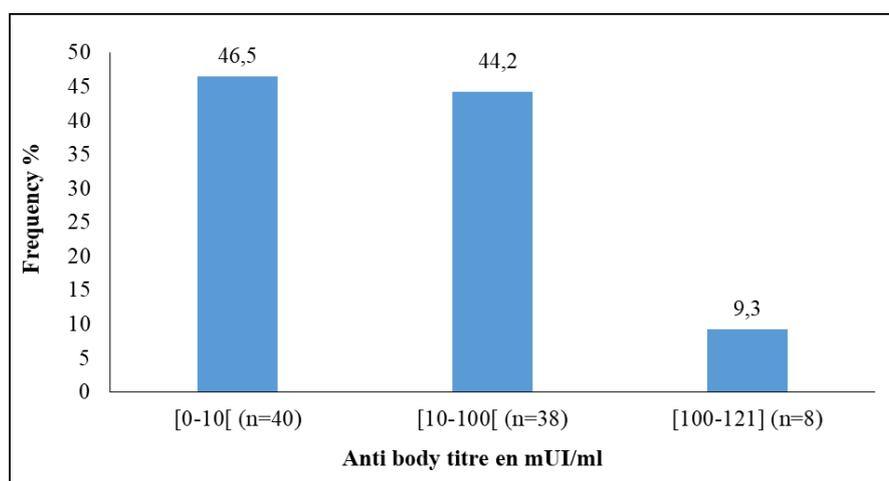
From Table 7, which summarizes the factors likely to influence the immune response, it emerges that advanced age (over 40 years) and obesity (Body Mass Index > 25) are the essential factors associated with the decline in the immune response.

**Table 7** Factors Associated With Decreased Immune Response to HBV Vaccine

Factors	Modalities	Antibody titre in mIU/ml			P
		[0-10] n (%)	[10-100] n (%)	[100-121] n (%)	
Age	[20-30]	15 (42.9)	16 (45.7)	4 (11.4)	0.030
	[31-40]	15 (46.9)	15 (46.9)	2 (6.2)	
	[41-50]	9 (64.3)	4 (28.6)	1 (7.1)	
	[51-62]	1 (20)	3 (60)	1 (20)	
Sex	Female	32 (45.7)	31 (44.3)	7 (10)	0.068
	Male	8 (50)	7 (43.7)	1 (6.3)	
Smoking	Yes	3 (75)	0.00	1 (25)	0.317
	No	37 (45.2)	38 (46.3)	7 (8.5)	
BMI*	[18.5-24.9]	7 (29.1)	13 (54.2)	4 (16.7)	0.003
	[25-29.9]	17 (53.1)	13 (40.6)	2 (6.3)	
	[30-34.9]	16 (53.3)	12 (40)	2 (6.7)	
Chronic medical problem	Yes	0 (0)	0 (0)	0 (0)	0.006
	No	40 (46.5)	38 (44.2)	8 (9.3)	

\* Body mass index in kilograms per square meter (Kg / m<sup>2</sup>)

As shown in Figure 6, only 9.3% of staff who received at least 3 doses of vaccine had an antibody level conferring definitive immunity.



**Figure 6** Serum anti-HB concentration in participants who received 3 or more doses of vaccine

#### 4. Discussion

Our study focused on determining the prevalence of HBs antigen and assessing hepatitis B vaccination status among medical and paramedical staff at Dschang district hospital (West Cameroon). Nursing staff at Dschang District Hospital showed a clear interest in this study given the high participation rate of 91.44% recorded. It reveals a price for

conscience by these staff with regard to viral hepatitis B infection. In 2016 Tatsilong announced a rate of 61.34% in Yaoundé [6].

The predominance of women (76%) found in Dschang, parallels the results of Noah in 2013(69%) [7] And Tatsilong in 2016 (71%) [6]. It reflects the predominance of women in the nursing profession.

The high proportion of young people (37.4%) and the low average age ( $36.48 \pm 9.58$  years) can be justified by the recruitment of young graduates who took part a year earlier in Cameroon in the framework of Performance Based Financing (PBF).

The high rate of nursing staff (48%) is explained by the fact that in Cameroon the peripheral health structures mainly employ paramedical staff.

The staff of Dschang District Hospital have a good knowledge of HBV (94.7%), with the virus cited as the causative agent of hepatitis B (93%); the same is true of the mode of blood transmission (86%) and the main complications of cirrhosis (84.8%) and hepatocellular carcinoma (77.8%). Lawson in Senegal [8] and Diallo in Mali [8] made similar findings in their study populations. This similarity can be explained by the quality of the training received by health workers during their training as well as in the retraining sessions regularly organized in our health facilities.

The immunochromatographic testing for HBs Ag found a prevalence of 7% for hepatitis B. This rate lower than the national prevalence (11.2%) is similar to those found by Dakou in 1989 in Benin (8.6%) [10]. Chronic HBs Ag carriage was noted in 2.33% of participants. This rate is low compared to that reported in 2015 in Tanzania by Mueller (7.4%) [11].

Nursing and paramedical professions (nursing assistant, laboratory technician and surface technician) are the most affected by the positivity of HBs Ag. This result is close to that found by Noah in 2013 at the Yaoundé Central Hospital (3.5%) [7]. This similarity can be explained by the fact that in Cameroon, in the exercise of their profession, the latter are in close contact with patients, as well as biological products, and therefore are more at risk of being contaminated by a carrier of HBs Ag or a contaminated product.

There was an association between carrying HBs Ag and having sex without protected, the blood exposure accident and the piercing. Dakou reported that 96% of staff had a history of accidental injection on duty [10], and Kateera in 2015 in Rwanda noted that 4.2% of participants had a history of scarification [12]. This similarity of the results can be explained by the fact of the risky sexual behaviors observed in the general population, the practice of scarification in African traditions and the high risk of blood exposure accident related to their profession.

Although the differences are not statistically significant ( $P > 0.05$ ), women (66.7%), married people (58.3%) and subjects aged over 40 (41.7%) would be the most vulnerable. Dakou in 1989 in Benin [10] and Kateera in Rwanda in 2013 [12] made the same observations. This could be explained by the high representation of women and married couples in those studies.

Only 57% of staff said they had ever been vaccinated against hepatitis B. This result is low compared to Burnett's one in 2009 in South Africa (67.9%) [13] and Ogoina in 2011 in Nigeria (64.5%) [11]. On the other hand, it is superior to those of Meriki in 2018 in South-West Cameroon (39.4%) [15].

More than three quarters of the population declared having received at least one dose of vaccine; of these, 89% had received at least 3 doses of vaccine and 11% less than 3 doses. These values are higher than those of Burnett and Ogoina who found, respectively, that 19.9% and 36.2% of their vaccinated population had received at least 3 doses of vaccine [13, 14].

The main reason for not immunizing was neglect (55%), lack of information (17%) and the high cost of the vaccine (12%). These results are almost similar to those found in South West Cameroon by Meriki in 2018 where neglect was the main reason (58.4%), followed by high cost (24.7%) [15].

Among the 53.5% of the personnel who acquired immunity with 3 doses of vaccine, 44.2% had an anti-HBs Ab titre of between 10 and 100 mIU / ml; the remainder (9.3%) had an anti-HBs Ab titre greater than 100 mIU / ml. These values are very low compared to those of Basireddy in 2013 in India [16] and Chaturanga in 2013 in Sri Lanka [17]. This could raise the problem of the quality of our vaccines in terms of source and especially conservation.

An age over 40 years is a poor response factor to HBV vaccine. Chaturanga had made the same observation in India in 2013 [17]. This confirms the decrease in the proliferative activity of lymphocytes with age [15].

Being overweight (high body mass index) was associated with a decrease in hepatitis B seroprotection; Yang had made the same observation in 2015 in China [18]. However, Meriki, Basireddy, and Muvunyi did not find an association between being overweight and lowered immune response [15, 17, and 19]. Ingardia explain this weak response to hepatitis B vaccination by the main distribution of the vaccine in adipose tissue and not in muscles, which could hinder the absorption and denaturation of the vaccine antigen by enzymatic action [20].

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## 5. Conclusion

At the end of this study, the general objective of which was to determine the prevalence of the HBs antigen (HBs Ag) and to assess the vaccination status against hepatitis B of the medical and paramedical staff of the Dschang District Hospital (HDD), we can retain that:

- The prevalence is lower than the national prevalence in Cameroon ;
- The level of staff knowledge about the virus is good; staff are aware that transmission occurs primarily through blood and sexuality;
- Nursing and paramedical professions are the most exposed because of their permanent contact with patients and blood products ;
- The main risk factors among these staff are: unprotected sex, scarification and blood exposure accident;
- The immune response to the hepatitis B vaccine is weak ;
- Advanced age and obesity are significantly associated with poor response to hepatitis B vaccine.

So, measures should be taken for the screening and adequate vaccination of the staff of this hospital.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

### *Statement of ethical approval*

The ethical clearance N°2019/074 obtained from the institutional ethics committee of the Université des Montagnes was a prerequisite for the study.

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