



# Hepatitis B Vaccination Coverage and Its Predictors among Health Workers in Fako Division, South West Region of Cameroon

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## Abstract

**Introduction:** The occupational risk of hepatitis B among health care workers (HCWs) has been long known. Despite a WHO recommendation for hepatitis B vaccine for all HCWs, coverage in Cameroon remains very low. This study investigates the hepatitis B vaccination coverage and its predictors among HCWs in Cameroon and evaluates their perceptions concerning the disease.

**Methods:** A cross-sectional study was carried out where structured questionnaires were used to obtain data from HCWs in 24 different health institutions within the Fako Division from February to May 2019. Categorical variables were compared using Chi-square test and a  $p$ -value less than 0.05 was considered significant. **Results:** A total of 643 participants were recruited with a male to female ratio of 0.33. Of the participants, 52.41% had a high risk perception of hepatitis B as a disease. The overall  $\geq 1$  and  $\geq 3$  dose vaccination coverage was 27.37% and 12.91%, respectively. Hospital vaccination policy [aOR = 4.25 (95% CI 2.43 - 7.46),  $p < 0.0001$ ], history of free hepatitis B screening [aOR = 29.73 (95% CI 6.96 - 120.92),  $p < 0.0001$ ], working in the private sector [aOR = 1.74 (95% CI, 1.02 - 2.99),  $p = 0.04$ ] and longer working experience [aOR = 2.33 (95% CI, 1.1 - 4.92),  $p = 0.03$ ] were independent predictors of  $\geq 3$  dose vaccination coverage. **Conclusion:** The risk perception of hepatitis B among HCWs in Fako Division is low but however not associated with a low vaccination coverage among these HCWs. Strategies to improve vaccination coverage among HCWs should target the above-identified predictors.

## Subject Areas

Emergency & Critical Care, Epidemiology

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## Keywords

Vaccination Coverage, Health Care Workers, Predictors

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### 1. Introduction

Hepatitis B is an endemic disease in nearly all regions of the world with 60% of people on earth said to be living in endemic hepatitis B zones [1]. The disease is transmittable from person to person principally when there is mucosal or cutaneous exposure to blood and other body fluids containing the hepatitis B virus (HBV) [2]. This percutaneous transmission mode places health care workers at particularly high risk of contracting hepatitis B from various exposures in the line of duty [3]. Unlike HIV, HBV remains stable in the environment for a minimum of 7 days being in high titers on infected surfaces and thus people infected will probably not know when exposure occurred [4]. In some past studies, the majority of hepatitis B positive HCWs were not able to recollect any obvious injury or having worked on an HBV-infected patient [2]. The disease exists in both acute and chronic forms, with the chronic form most frequently leading to potentially fatal conditions like liver failure, cirrhosis or cancer [5].

The occupational risk of HBV infection among HCWs has been long elucidated [6]. The best prevention against HBV infection is reportedly vaccination [7] and since 1982 a vaccine has been available against HBV [8]. Just after the introduction of the first hepatitis B vaccine in 1982, the vaccine was immediately recommended for HCWs in the USA by the Advisory Committee on Immunization Practices (ACIP) [8]. The World Health Organization has subsequently recommended Hepatitis B vaccination for all health care workers [9]. Despite the fact that the vaccine is safe, effective and recommended for health care workers, coverage rates among HCWs in developing countries still remain very low [10]. According to WHO among HCWs, HBV vaccination coverage in low and middle income countries is only 18% - 39% against 67% - 79% in high income countries [11]. The rate of sharps injuries has been estimated in the past to be about 839 injuries per 1000 HCW in the healthcare setting [12] and with unvaccinated individuals having a 6% to 30% chance of getting infected once exposed to HBV-infected blood and body secretions [13]. HCWs especially in developing countries are at continuing high risk of HBV infection from occupational causes. In Cameroon, not many studies have investigated the epidemiology of HBV in HCWs. Previous studies have shown coverage of only 24.5% among surgical residents [14], 18% among medical students in clinical years [15] and 19% in general HCWs [16]. This low uptake of HBV vaccine among HCWs in Cameroon is highly contrasted to good knowledge about the risks and vaccine availability as reported by some of these studies [14] [16]. Our study was thus aimed at investigating the vaccination coverage and its determinants among healthcare workers in hospitals within Fako Division, Southwest Region, Cameroon.

## 2. Material and Methods

### 2.1. Study Area and Sampling

This was a cross-sectional study carried out in 24 healthcare institutions in the four health areas, Buea, Limbe, Tiko and Muyuka which make up the Fako division From February to May 2019. There were both public (10) and private (14) health institutions and the public health institutions included two regional hospitals, three district hospitals, 3 sub-divisional hospitals and two health centres while the private facilities included 2 hospitals, 8 clinics, 2 health centres and 2 medical cabinets. In total 643 participants who were either fulltime or part time workers at the selected health facilities at the time of the research were enrolled. Participants were recruited using a non-randomized and successive sampling of HCWs met at their station of work and who consented to the study.

### 2.2. Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee for Research on Human Health of the University of Douala. Administrative clearance for the study was gotten from the South West regional delegation for public health and from the directors of all health facilities included in the study. Only HCWs who gave their informed consent were recruited into the study. For confidentiality purposes, no name was required from research participants and only unique identification codes were used to identify participants.

### 2.3. Data Collection

A pretested self-administered structured questionnaire was used to abstract data from participants. The questionnaire had 6 different sections which were: demographic data, knowledge of Hepatitis B, History of sharps injury, History of participation in free HBV screening, HBV vaccination history and general perceptions about HBV.

### 2.4. Statistical Analysis

All data collected were keyed into a Microsoft excel spreadsheet and analyzed using the Epi Info software (version 7) (Centers for Disease Control and Prevention, USA). Point estimates were calculated for both  $\geq 1$  dose and  $\geq 3$  dose vaccination coverage. Chi-square tests were used for the analysis of predictors of vaccination coverage and odds ratios (OR) with their 95% confidence intervals (CI) were calculated. Multivariable logistic regression analysis was used to determine independent predictors of  $\geq 1$  dose and  $\geq 3$  dose vaccination coverage. For this reason, we categorized some variables into two groups. The age was grouped into two classes:  $< 30$  and  $\geq 30$  years. Profession was categorized as Paramedical for “Laboratory worker, cleaners and general workers” and Medical for “Doctor and Nurse”. Hospitals which recommended or provided Hepatitis B vaccination for their workers were said to have vaccination policy while those that didn’t had no vaccination policy. Also hospitals were categorized as public (government owned)

or Private (for both confessional and profit based hospitals). Household income was dichotomized into two groups: <100,000 XAF and  $\geq$ 100,000 XAF. To assess the effect of HCWs risk perceptions on vaccination coverage, respondents were dichotomized as having high risk perception (above the mean score) or having low risk perception (below the mean score). Similarly, respondents' perception about Hepatitis B vaccine was dichotomized as good (above the mean score) or bad (below the mean score.) For all tests, *P* values of < 0.05 were considered to be statistically significant.

### 3. Results

#### 3.1. Socio-Demographic Characteristics of Study Participants

In all 643 HCWs were included in the study, more than half of whom 356 (55.45%) were in the age group 18 - 29. There were 482 (74.96%) females and 161 (25.04%) males in the study sample. Nurses 397 (61.74%) constituted the highest professional category. This sample size was representative of the abundance of these various professions within the selected hospitals. Most participants 420 (65.32%) had working experience of less than 10 years and a majority (70.56%) also had a household income less than 100,000 XAF (~\$200) a month. Only 221 (34.37%) participants worked in a hospital that had a hepatitis B vaccination policy of any sort. More than half 352 (54.74%) of the participants had a history of sharps injury in the course of their career. Only about half of the participants 351 (54.59%) had good knowledge of hepatitis B and 381 (59.25%) had participated in a free HBV screening program before. **Table 1** shows the descriptive statistics of the study participants.

#### 3.2. Participants' Perceptions about Hepatitis B

HCWs were asked 9 questions to assess their level of risk perception about Hepatitis B and the mean risk perception score was 7.16 with a standard deviation of 1.74. About half of the participants (52.41%) scored above the mean risk perception score. Almost all participants 604 (93.93%) agreed that hepatitis B was a very serious disease and 396 (61.59%) thought that the disease could have fatal consequences (**Table 2**).

Six other questions assessed participants' perceptions about the Hepatitis B vaccine and in a scale where a positive response to vaccine was 1 and a negative response 0, the mean perception score was 3.94 with a standard deviation of 1.45. Of the 643 respondents, 411 (63.92%) scored above the mean perception score. Most respondents 564 (87.71%) thought that vaccination could protect them from hepatitis B but 112 (17.41%) participants also said they feared instead becoming infected with the virus by the vaccine (**Table 2**).

#### 3.3. Vaccination Coverage

The  $\geq$ 1 dose vaccination coverage (all persons who had received at least one dose of the hepatitis B vaccine) was 27.37% (176 on 643) while the  $\geq$ 3 dose coverage

**Table 1.** Socio-demographic characteristics of participants.

| Characteristic     | Categories            | Number | Percentage |
|--------------------|-----------------------|--------|------------|
| Age                | 18 - 29 years         | 356    | 55.45      |
|                    | 30 - 50 years         | 256    | 39.72      |
|                    | 51 - 65 years         | 31     | 4.83       |
| Gender             | Female                | 482    | 74.96      |
|                    | Male                  | 161    | 25.04      |
| Work experience    | <10                   | 420    | 65.32      |
|                    | ≥10                   | 223    | 34.68      |
| Profession         | Doctor                | 45     | 7.00       |
|                    | Nurse                 | 397    | 61.74      |
|                    | Laboratory worker     | 143    | 22.24      |
|                    | Cleaners              | 42     | 6.53       |
|                    | Others                | 16     | 2.49       |
| Household income   | <100,000 XAF          | 454    | 70.56      |
|                    | 100,000 - 200,000 XAF | 138    | 21.50      |
|                    | >200,000 XAF          | 51     | 7.94       |
| Sector             | Public                | 385    | 59.88      |
|                    | Private               | 258    | 40.12      |
| Vaccination Policy | No                    | 422    | 65.63      |
|                    | Yes                   | 221    | 34.37      |
| Free HBV screening | No                    | 262    | 40.75      |
|                    | Yes                   | 381    | 59.25      |
| Sharps injury      | No                    | 291    | 45.26      |
|                    | Yes                   | 352    | 54.74      |
| HBV Knowledge      | Poor                  | 292    | 45.41      |
|                    | Good                  | 351    | 54.59      |

**Abbreviations:** HBV: Hepatitis B Virus; XAF: Central African CFA Franc.

**Table 2.** HCWs' perception about hepatitis B and the vaccine.

| Perceived risk  | Agree (%)   |
|---|-------------|
| I think hepatitis B is a serious disease                                  | 604 (93.93) |
| I think hepatitis B is common in Cameroon                                 | 154 (23.95) |
| I think hepatitis B can lead to dead from liver disease                   | 578 (89.89) |
| I think hepatitis B is a lifelong disease                                 | 469 (72.94) |
| I think hepatitis B can cause liver cancer                                | 553 (86.00) |
| I think I can die if I become infected with Hepatitis B                   | 396 (61.59) |
| As a health care worker I think I have a high risk of getting Hepatitis B | 548 (85.23) |

**Continued**

|  |             |
|--|-------------|
| I worry about getting Hepatitis B  | 514 (79.94) |
| I think patients being treated for different illness could as well transmit hepatitis B to me if they are positive | 477 (74.18) |
| <b>Perceived benefits/barriers</b>   |             |
| I think vaccination can protect me from Hepatitis B infection  | 564 (87.71) |
| I think vaccination is the safest prevention method for Hepatitis B  | 551 (85.69) |
| I think the vaccines are not usually available in the hospital   | 389 (60.50) |
| I think vaccination can infect me instead with Hepatitis B   | 112 (17.41) |
| I think Hepatitis B vaccine is too expensive   | 233 (36.24) |
| I think the vaccine doses are too many   | 310 (48.21) |

was only 12.91% (83 on 643). Of the 643 participants, 467 (72.63%) had not been vaccinated, 93 (14.46%) had received one or two doses of the vaccine only, 83 (12.91%) had completed 3 or more doses.

### 3.4. Predictors of $\geq 1$ Dose Vaccination Coverage

HCWs who were aged  $\geq 30$  years, who had working experience  $\geq 10$  years, who worked in a hospital having a vaccination policy, who had benefitted of free HBV screening before, who had a history of sharps injury, who had good knowledge of Hepatitis B and who had good perception of the HBV vaccine had a higher  $\geq 1$  dose vaccination coverage than those who did not fall into these categories in binary logistic regression analysis (all  $p$  values  $< 0.05$ ). After carrying out multivariate logistic regression including all factors with  $p < 0.2$ , only those HCWs who worked at a hospital with a vaccination policy ( $p < 0.001$ ) and those who had benefitted from free HBV screening ( $p < 0.0001$ ) had significant higher  $\geq 1$  dose vaccination coverage than those who were not in these groups (**Table 3**).

### 3.5. Predictors of $\geq 3$ Dose Vaccination Coverage

For vaccination series completion ( $\geq 3$  doses) factors significantly associated to it were similar to those for  $\geq 1$  dose coverage except for age that was not significant. After carrying out multivariate logistic regression, working experience  $\geq 10$  years ( $p = 0.03$ ), working in the private health sector ( $p = 0.04$ ), working in a hospital with a hepatitis B vaccination policy ( $p < 0.0001$ ) and having prior benefitted from free hepatitis B screening ( $p < 0.0001$ ) were all independent predictors of higher  $\geq 3$  dose vaccination coverage (**Table 4**).

## 4. Discussion

To the best of our knowledge this is the largest study on hepatitis B vaccination in HCWs done in Cameroon. According to the health believe model [17], perceived risk (perceived severity plus perceived susceptibility) of a health condition

**Table 3.** Unadjusted and adjusted predictors of  $\geq 1$  dose hepatitis B vaccination coverage among HCWs in Fako.

| Characteristic            | Categories         | n   | $\geq 1$ dose (%) | Unadjusted OR (95% CI) | p value             | Adjusted OR (95% CI) | p value             |
|---------------------------|--------------------|-----|-------------------|------------------------|---------------------|----------------------|---------------------|
| <b>Age</b>                | 30 years           | 356 | 84 (23.60)        | 1                      | <b>*0.02</b>        | 1                    | 0.86                |
|                           | $\geq 30$ years    | 287 | 92 (32.06)        | 1.53 (1.08 - 2.16)     |                     | 1.05 (0.62 - 1.77)   |                     |
| <b>Gender</b>             | Female             | 482 | 125 (25.93)       | 1                      | 0.16                | 1                    | 0.88                |
|                           | Male               | 161 | 51 (31.68)        | 1.32 (0.90 - 1.95)     |                     | 1.03 (0.67 - 1.59)   |                     |
| <b>Work experience</b>    | 10 years           | 420 | 102 (24.29)       | 1                      | <b>*0.02</b>        | 1                    | 0.24                |
|                           | $\geq 10$ years    | 223 | 74 (33.18)        | 1.55 (1.08 - 2.21)     |                     | 1.39 (0.53 - 1.30)   |                     |
| <b>Profession</b>         | Medical            | 442 | 126 (28.51)       | 1                      | 0.34                | NA                   | NA                  |
|                           | Paramedical        | 201 | 50 (24.88)        | 0.83 (0.57 - 1.22)     |                     | NA                   |                     |
| <b>Household income</b>   | 100,000 XAF        | 454 | 117 (25.83)       | 1                      | 0.16                | 1                    | 0.41                |
|                           | $\geq 100,000$ XAF | 189 | 59 (31.22)        | 1.30 (0.90 - 1.90)     |                     | 0.83 (0.53 - 1.30)   |                     |
| <b>Sector</b>             | Public             | 385 | 99 (25.71)        | 1                      | 0.25                | NA                   | NA                  |
|                           | Private            | 258 | 77 (29.84)        | 1.23 (0.87 - 1.75)     |                     | NA                   |                     |
| <b>Vaccination policy</b> | No                 | 422 | 96 (22.75)        | 1                      | <b>***&lt;0.001</b> | 1                    | <b>***&lt;0.001</b> |
|                           | Yes                | 221 | 80 (36.20)        | 1.93 (1.35 - 2.75)     |                     | 2.24 (1.48 - 3.38)   |                     |
| <b>HBV free screening</b> | No                 | 262 | 15 (5.73)         | 1                      | <b>***&lt;0.001</b> | 1                    | <b>***&lt;0.001</b> |
|                           | Yes                | 381 | 161 (42.26)       | 12.05 (6.89 - 21.09)   |                     | 11.88 (6.65 - 21.23) |                     |
| <b>Sharps injury</b>      | No                 | 291 | 67 (23.02)        | 1                      | <b>*0.02</b>        | 1                    | 0.06                |
|                           | Yes                | 352 | 109 (30.97)       | 1.50 (1.05 - 2.14)     |                     | 1.48 (0.99 - 2.20)   |                     |
| <b>HBV knowledge</b>      | Poor               | 292 | 67 (22.95)        | 1                      | <b>*0.02</b>        | 1                    | 0.58                |
|                           | Good               | 351 | 109 (31.05)       | 1.51 (1.06 - 2.16)     |                     | 1.12 (0.74 - 1.68)   |                     |
| <b>Risk perception</b>    | Low                | 306 | 75 (24.51)        | 1                      | 0.12                | 1                    | 0.27                |
|                           | High               | 337 | 101 (29.97)       | 1.32 (0.93 - 1.87)     |                     | 1.25 (0.84 - 1.86)   |                     |
| <b>Vaccine perception</b> | Bad                | 232 | 51 (21.98)        | 1                      | <b>*0.02</b>        | 1                    | 0.65                |
|                           | Good               | 411 | 125 (30.41)       | 1.55 (1.07 - 2.26)     |                     | 1.10 (0.72 - 1.69)   |                     |

**Notes: Abbreviations:** CI, Confidence interval; HBV, Hepatitis B Virus; OR, Odds Ratio; XAF, Central African CFA Franc. Bold face indicates statistical significance (\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ).

**Table 4.** Unadjusted and adjusted predictors of  $\geq 3$  dose hepatitis B vaccination coverage among HCWs in Fako.

| Characteristic         | Categories      | n   | $\geq 3$ dose (%) | Unadjusted OR (95% CI) | p value        | Adjusted OR (95% CI) | p value      |
|------------------------|-----------------|-----|-------------------|------------------------|----------------|----------------------|--------------|
| <b>Age</b>             | 30 years        | 356 | 38 (10.67)        | 1                      | 0.06           | 1                    | 0.61         |
|                        | $\geq 30$ years | 287 | 45 (15.68)        | 1.56 (0.98 - 2.47)     |                | 0.83 (0.40 - 1.71)   |              |
| <b>Gender</b>          | Female          | 482 | 59 (12.24)        | 1                      | 0.38           | NA                   | NA           |
|                        | Male            | 161 | 24 (14.91)        | 1.05 (0.59 - 2.10)     |                | NA                   |              |
| <b>Work experience</b> | 10 years        | 420 | 42 (10.00)        | 1                      | <b>**0.003</b> | 1                    | <b>*0.03</b> |
|                        | $\geq 10$ years | 223 | 41 (18.39)        | 2.03 (1.27 - 3.23)     |                | 2.33 (1.10 - 4.92)   |              |

## Continued

|                           |              |     |            |                       |                     |                       |                     |
|---------------------------|--------------|-----|------------|-----------------------|---------------------|-----------------------|---------------------|
| <b>profession</b>         | Medical      | 442 | 57 (12.90) | 1                     | 0.99                | NA                    | NA                  |
|                           | Paramedical  | 201 | 26 (12.94) | 1.00 (0.61 - 1.65)    |                     | NA                    |                     |
| <b>Household income</b>   | 100,000 XAF  | 454 | 51 (11.26) | 1                     | 0.05                | 1                     | 0.74                |
|                           | ≥100,000 XAF | 189 | 32 (16.93) | 1.61 (1.00 - 2.60)    |                     | 1.10 (0.62 - 1.96)    |                     |
| <b>Sector</b>             | Public       | 385 | 42 (10.91) | 1                     | 0.06                | 1                     | <b>*0.04</b>        |
|                           | Private      | 258 | 41 (15.89) | 1.54 (0.97 - 2.45)    |                     | 1.74 (1.02 - 2.99)    |                     |
| <b>Vaccination policy</b> | No           | 422 | 36 (8.53)  | 1                     | <b>***&lt;0.001</b> | 1                     | <b>***&lt;0.001</b> |
|                           | Yes          | 221 | 47 (21.27) | 2.90 (1.81 - 4.63)    |                     | 4.25 (2.43 - 7.46)    |                     |
| <b>HBV free screening</b> | No           | 262 | 2 (0.76)   | 1                     | <b>***&lt;0.001</b> | 1                     | <b>***&lt;0.001</b> |
|                           | Yes          | 381 | 81 (21.26) | 35.10 (8.55 - 144.16) |                     | 29.00 (6.96 - 120.92) |                     |
| <b>Sharps injury</b>      | No           | 291 | 33 (11.34) | 1                     | 0.28                | NA                    | NA                  |
|                           | Yes          | 352 | 50 (14.20) | 1.29 (0.81 - 2.07)    |                     | NA                    |                     |
| <b>HBV knowledge</b>      | Poor         | 292 | 28 (9.59)  | 1                     | <b>*0.02</b>        | 1                     | 0.23                |
|                           | Good         | 351 | 55 (15.67) | 1.75 (1.08 - 2.84)    |                     | 1.39 (0.81 - 2.39)    |                     |
| <b>Risk perception</b>    | Low          | 306 | 43 (14.05) | 1                     | 0.41                | NA                    | NA                  |
|                           | High         | 337 | 40 (11.87) | 0.82 (0.52 - 1.31)    |                     | NA                    |                     |
| <b>Vaccine perception</b> | Bad          | 232 | 23 (9.91)  | 1                     | 0.09                | 1                     | 0.72                |
|                           | Good         | 411 | 60 (14.60) | 1.55 (0.93 - 2.59)    |                     | 1.11 (0.63 - 1.96)    |                     |

**Notes: Abbreviations:** CI, Confidence interval; HBV, Hepatitis B Virus; OR, Odds Ratio; XAF, Central African CFA Franc. Bold face indicates statistical significance (\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ).

is the first step towards taking up new behaviors towards ensuring better health. This construct has been corroborated for the uptake of the hepatitis B vaccine among HCWs by different studies [18] [19] [20]. In our study only about half of the participants had a high risk perception of Hepatitis B. This low risk perception is contrary to a high knowledge level about hepatitis B as we have earlier reported [21]. Most of our participants however had a good attitude towards the hepatitis B vaccine, with only less than 20% worrying that the vaccine could instead infect them with the virus. This good perception of the Hepatitis B vaccine among HCWs in Cameroon has previously been reported by two studies done in Yaoundé [14] [15]. This would imply that if all other factors were kept constant, it is expected that most HCWs will uptake the hepatitis B vaccine with limited hesitancy.

Overall vaccination coverage for  $\geq 1$  dose and  $\geq 3$  dose was 27.37% and 12.9% respectively. Many other studies have shown low coverage of hepatitis B vaccination both in Cameroon and other low and middle income countries [14] [15] [16] [19] [22]. Reasons cited for low vaccination coverage from different studies have included, lack of sufficient information, lack of finances, lack of motivation and also vaccine safety concerns like side effects and potential of getting a vac-



cine derived infection [14] [18]. Our findings for  $\geq 1$  dose coverage however, are lower than results from studies in other low and middle income countries like the 83.6% reported in Malaysian HCWs [23], and 67.9% in South Africa [24]. Similarly our  $\geq 3$  dose coverage falls short of other findings like the 49% reported among Pakistani HCWs and 52% among Libyan HCWs [25]. This shows that better coverage could be achieved even within our context with more efforts made towards promoting vaccine uptake.

For the predictors of vaccination coverage, working in a hospital which had a vaccination policy was associated with Higher  $\geq 1$  dose and  $\geq 3$  dose vaccination coverage ( $p < 0.0001$ ). Vaccination policies varied in these hospitals with some having policy only for Laboratory workers while others were having for the entire staff. Also some hospitals simply recommended and made available vaccines while others made it mandatory except for strong contrary reasons. Other studies both in developing countries and developed countries have reported much higher vaccination rates in hospitals with a policy for hepatitis B vaccination [26] [27]. WHO recommends the hepatitis B vaccine for all HCWs, nonetheless almost all public hospitals and most private hospitals in Cameroon still have no policy on vaccination for their employees who are at a continued risk of acquiring the infection in the course of their work.

Another independent predictor of both  $\geq 1$  dose and  $\geq 3$  dose vaccination coverage was participation of the HCW in a free screening campaign for hepatitis B ( $p < 0.0001$ ). Despite the high awareness about the disease among HCWs as has been reported [16] [21], our study revealed a low risk perception which probably explains why almost all (161 of 176) of those vaccinated from our study had benefitted from a HBV free screening research or campaign before. Most HCWs still find the cost of the hepatitis B test very costly and given that it is usually required as a prerequisite for receiving the vaccine (which is even more expensive), they don't go for vaccination because they haven't ascertained their status yet. This indicates that more HCWs will probably get vaccinated if at least the HBV test was offered free and the vaccine given at a small fee or even maintained at present cost.

For  $\geq 3$  dose vaccination coverage, working experience was an additional independent predictor ( $p = 0.03$ ) with those who had worked for 10 or more years having a 2.24 more chance of completing their vaccination series than those who had worked for less time after adjusting for working sector, vaccination policy and previous participation in free HBV screening. Reports citing working experience as determinant for Hepatitis B coverage have come from studies in Nigeria [28] and India [29]. Persons who have worked for longer are usually more mature and acquainted with the dangers of their profession and thus are more diligent in completing their vaccination series. This raises the need for more education on the importance of vaccination within health care facilities and training institutions to reach younger and upcoming employees.

Another independent predictor of  $\geq 3$  dose vaccination coverage was the work-

ing sector of the HCW ( $p = 0.04$ ) with those working in private hospitals having a 1.74 more odds of being vaccinated than those working in public hospitals, after adjusting for confounders. This finding is supported by a study from Pakistan [30]. In Cameroon HCWs in public hospitals have a reputation of being negligent not just about the patients but even of their own selves as they may not wear gloves, appropriate uniforms and may not also follow recommendations like those concerning vaccination. This laissez-faire attitude may explain why HCWs of the public sector have lower vaccination coverage than their counterparts in private hospitals.

Although not significant in multivariate analysis ( $p = 0.06$ ), a positive history of sharps injury was significantly associated to  $\geq 1$  dose vaccination coverage in binary analysis ( $p = 0.02$ ) but was not similarly associated to  $\geq 3$  dose coverage even in the binary analysis. HCWs have been reported to be more prone to seek or accept hepatitis B vaccination after exposure to blood and other body fluids in the hospital [26] [27]. Our findings therefore reveal that though HCWs may be motivated to uptake vaccine after an occupational exposure, being exposed is not a sufficient enough motivation for the vaccination series completion.

Similarly to other studies in Cameroon [15] [16], we did not find age as an independent predictor of both  $\geq 1$  dose and  $\geq 3$  dose vaccination coverage. Gender, profession and other socio demographic factors were not independent predictors of vaccination coverage.

There is need for a multifaceted approach towards increasing vaccination coverage among HCWs. Some recommended strategies include reiterating the importance of vaccination to staff, organizing catch up vaccination programs for employees while implementing compulsory vaccination for new recruits [31]. From our study it can also be added that organizing free HBV screening campaigns is a strategy for increasing vaccination coverage.

## 5. Conclusions

There is a low risk perception of hepatitis B among HCWs in Fako Division. Also, despite the availability of a safe and effective vaccine and a high awareness of the vaccine, vaccination coverage among HCWs in Fako Division remains very low. Strategies toward improving vaccination coverage should include instituting vaccination policies in hospitals and also organize free screening programs for HCWs. What's more, strategies to reach health care trainees and workers in public hospitals will be instrumental in improving vaccination coverage.

Since vaccination cards were not required, there may be some recall biases in the self-reported vaccination status. However, the study gives us the closest estimate of the vaccination coverage among HCWs in Fako Division.

## Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Institutional Ethics Committee for Research on Human Health of the University of Douala. N° 1254IEC-UD/02/2018/T.

## Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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All funds for this research were provided by the principal investigator.

## Author's Contributions

This work was carried out in collaboration with all authors. Serge Ngekenge designed the study, performed the statistical analysis, and wrote the protocol and the first draft of the manuscript. Alain Chichom-Mefire and Peter Fon Nde participated in designing the study. Nicholas Tendongfor and Emmanuel Kah Nji managed the analyses of the study. Esembeson Malika managed the literature searches. Simeon P. Choukem participated in the study design and revised the first draft. All authors read and approved the final manuscript.

## Conflicts of Interest

The authors declare no conflicts of interest.

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### List of Abbreviations

HCW—Health Care Workers

aOR—adjusted odds ratio

HBV—Hepatitis B Virus

ACIP—Advisory Committee on Immunization Practices