Introduction

Recent estimates show that Hepatitis accounts for approximately 1.3 million deaths annually, making it the seventh leading cause of death globally [1]. Hepatitis B and C are responsible for a large proportion of hepatitis mortality and morbidity, with over 90% of persons infected unaware of their condition, and as such they don't seek treatment [2].

The World Health Organisation (WHO) estimates that about 60 million persons in the African region are currently infected with the Hepatitis B virus (HBV), accounting for 23% of the global Hepatitis B disease burden [3]. The burden of Hepatitis B is on the increase even though effective vaccines to prevent the disease have existed since the 1980s [3]. This continued increase in burden is due to ineffective or nonexistent hepatitis management programs in the sub-Saharan African region. The high mortality and morbidity that results is due in part to the fact that persons can live asymptptomatically with the virus for up to 30 years; as such, testing is mostly conducted when disease becomes chronic and liver cirrhosis is already severe. Furthermore, there is a general lack of awareness with studies showing average to poor knowledge of hepatitis B virus infection and hepatitis vaccine among persons residing in regions of high risk [4–6]. To curtail this problem, in 2015 the WHO launched an ambitious goal to reduce HBV infections by 90% and increase global vaccine coverage to 90% [3]. Achieving this goal would require proper interventions targeted at behaviour change in regions of high prevalence.

This study sought to assess the knowledge of hepatitis B and associated factors among three different groups across three states in Nigeria.

Methods

Study Settings and Participants

We conducted a descriptive cross-sectional study from March to July 2016 across three major states in Nigeria: Lagos, Ogun and Abia States. The participants included were University Students from Covenant University, Bells University of Technology, Crawford University, Gateway Polytechnic Ibeja and the general public in Lagos and Abia State. Convenience sampling method was used.
**Study Instrument and Measures**

The study instrument was a self-administered questionnaire designed after consulting previously published studies. The questionnaire consisted of the following two sections.

**Demographic Information.** Participants were asked to indicate their age group, marital status and the highest level of education attained.

**HBV Knowledge and Perception.** This section contained 29 questions assessing the knowledge and beliefs of participants toward HBV infection and vaccination. This section included nine questions used to access how much the respondent knew about HBV. One mark was given for each correct response, and zero marks were given for an incorrect or no response. Knowledge scores ranged from one to nine and were normalized by taking the percentage of correct responses. Respondents were divided into three categories based on their normalized knowledge scores; those scoring greater than 30 but less than or equal to 60 were classified as having average knowledge, whereas those scoring above 60 were classified as having good knowledge. Study respondents were also asked to provide vaccination information.

**Data Analysis**

For better granularity, we created three strata based on the location and characteristics of the study respondent. Respondents from Covenant University, Bells University of Technology and Crawford University were grouped as Private Institution; respondents from Gateway Polytechnic Igbesa were grouped as Public Institution; and respondents who didn’t belong to a university, were in the working class and were from Abia and Lagos were grouped as Working Class.

Descriptive statistics were used to describe distributions. A chi-square test was used to assess the difference in proportion of independent variables with previous vaccination. Our continuous dependent variable was checked for normality using the Shapiro-Wilk and Kolmogorov-Smirnov tests alongside a histogram. To examine the relationships between our dependent (knowledge score) and independent variables, we performed either a Mann-Whitney test for independent variables with two categories or a Kruskal-Wallis test for independent variables with more than two categories. Pair-wise tests were performed for post hoc Kruskal-Wallis comparisons. Multivariate analysis using a multilinear regression were used to assess whether significant ($p < 0.05$) variables from the bivariate analysis predicted knowledge. Dummies of categorical variables were created prior to including them in the model. Multicolinearity of independent variables was assessed using a spearman correlation in a correlation matrix and variance inflation factors (VIF). Variables with VIF exceeding 5.0 were removed. All analysis was performed using SPSS 20 for windows, and $p < 0.05$ was considered statistically significant for all tests.

**Results**

**Summary of Study Participants**

A total of 805 responses were obtained, and 758 were included in the analysis based on completeness of demographic information. Table 1 shows the characteristic of respondents included in this survey. Of the 758 respondents, 347 (45.8%) were from a private institution, 233 (30.7%) were from a public institution and 178 (23.5%) didn’t belong to either group. Most respondents had never been married (80.3%), possessed higher education (92.3%) and were within the age range of 16–39 (88.7%).

**Knowledge of HBV**

The respondents in this study had average knowledge about HBV, with a mean knowledge score of $4.85 \pm 2.69$.

### Table 1: Summary of Study Participants.

|                | Private Institution | Public Institution | Working Class | Total |
|----------------|---------------------|--------------------|---------------|-------|
|                | N       | %     | N       | %     | N       | %     | N       | %     |
| **Age Group**  |         |       |         |       |         |       |         |       |
| <16            | 2       | 0.6%  | 0       | 0.0%  | 0       | 0.0%  | 2       | 0.3%  |
| 16–36          | 291     | 83.9% | 233     | 100.0%| 148     | 83.1% | 672     | 88.7% |
| 37–47          | 35      | 10.1% | 0       | 0.0%  | 0       | 0.0%  | 55      | 7.3%  |
| 48–58          | 10      | 2.9%  | 0       | 0.0%  | 7       | 3.9%  | 17      | 2.2%  |
| 59–69          | 0       | 0.0%  | 0       | 0.0%  | 3       | 1.7%  | 3       | 0.4%  |
| ≥70            | 9       | 2.6%  | 0       | 0.0%  | 0       | 0.0%  | 9       | 1.2%  |
| **Marital Status** |         |       |         |       |         |       |         |       |
| Single         | 261     | 75.2% | 223     | 95.7% | 125     | 70.2% | 609     | 80.3% |
| Married        | 77      | 22.2% | 8       | 3.4%  | 50      | 28.1% | 135     | 17.8% |
| Separated      | 9       | 2.6%  | 2       | 0.9%  | 3       | 1.7%  | 14      | 1.8%  |
| **Education**  |         |       |         |       |         |       |         |       |
| Tertiary       | 311     | 89.6% | 226     | 97.0% | 163     | 91.6% | 700     | 92.3% |
| Secondary      | 30      | 8.6%  | 7       | 3.0%  | 14      | 7.9%  | 51      | 6.7%  |
| Primary        | 2       | 0.6%  | 0       | 0.0%  | 1       | 0.6%  | 3       | 0.4%  |
| None           | 4       | 1.2%  | 0       | 0.0%  | 0       | 0.0%  | 4       | 0.5%  |
| **Total**      | 347     | 45.8% | 233     | 30.7% | 178     | 23.5% | 758     | 100   |
Knowledge scores across the three major groups differed significantly, with the working class (5.59 ± 2.340) having significantly (H = 24.617, p < 0.001) higher scores than respondents in private (4.91 ± 2.6) and public (4.19 ± 2.9) institutions. Post hoc tests showed that respondents from the Gateway Polytechnic Igbesa had significantly (p < 0.001) poorer knowledge than respondents from Covenant University, Abia State and Lagos State.

There was no significant difference observed for knowledge across the age groups (H = 6.823, p = 0.234) and levels of education (H = 2.986, p = 0.394). Persons who had heard about HBV (p < 0.001), had been previously tested (p < 0.001) or knew someone who had HBV (p < 0.001) were more likely to have better knowledge than those who did not. In addition, respondents who had been previously vaccinated (p = 0.01) or were aware of the HBV vaccine (p < 0.001) also had significantly better knowledge than those who had not received vaccination or heard about the vaccine (Table 2).

The highest proportion of correct responses was for questions regarding the aetiology of Hepatitis B (73.7%) and its ability to cause death (74%). See Table 3. Knowledge regarding the transmission routes was generally poor, with 56.5%, 35.4% and 31.4% knowing that bodily fluids, sexual intercourse and personal items, respectively, are routes of Hepatitis B transmission.

**Vaccine Coverage**

Only 242 (31.9%) of the respondents were aware of the presence of a vaccine against hepatitis B virus, and 161 (21.2%) had been previously vaccinated (Table 4). Persons who had good knowledge of HB (p = 0.003), had been previously tested (p < 0.001) and/or knew someone who was infected (p < 0.001) were more likely to have received a vaccine against Hepatitis B. As such, 182 (24%) and 181 (23.9%) of the study participants had more than one sexual partner and engaged in unprotected sex, respectively. Persons from a public institution had the highest proportion of respondents who engaged in unprotected sex (31.6%) or had more than one sexual partner (28.1%). Having more than one sexual partner (p = 0.663) and engaging in unprotected sex (p = 0.305) were not significantly associated with HBV vaccination.

**Multivariate Analysis**

School of study was correlated with type of institution (VIF = 9.866) and as such was removed from the analysis. All other variables passed the test for multicollinearity at the VIF threshold of 5.

The independent predictors explained 35.2% of the variation in knowledge scores of study participants. The analysis showed that of the independent predictors, having previously heard about HBV was the most important contributor to knowledge, with persons in the category scoring 2.4 knowledge points (p < 0.0001) more than those who had not previously heard about HBV. Previous knowledge of the HBV vaccine was equally important, accounting for up to 1.171 knowledge points (p < 0.0001). Not being a part of a school, previous testing and knowing someone who was infected accounted for a cumulative 1.6
Table 2: Predictors of Knowledge in Respondents.

| Age Group | Mean | SD  | p-value |
|-----------|------|-----|---------|
| <16       | 4.00 | 4.24 | 0.234   |
| 16–39     | 4.79 | 2.67 |         |
| 37–47     | 5.51 | 2.87 |         |
| 48–58     | 5.12 | 2.80 |         |
| 59–69     | 7.00 | 2.00 |         |
| ≥70       | 4.33 | 2.45 |         |

| Class     | Mean | SD  | p-value |
|-----------|------|-----|---------|
| Private School | 4.91 | 2.60 | <0.001 |
| Public School  | 4.19 | 2.90 |         |
| General Public | 5.59 | 2.34 |         |

| School | Mean | SD  | p-value |
|--------|------|-----|---------|
| Bells  | 4.71 | 2.44 | <0.001 |
| Covenant University | 5.30 | 2.64 |         |
| CRU    | 4.14 | 2.78 |         |
| G. Poly| 4.19 | 2.90 |         |
| Lag    | 5.58 | 2.51 |         |
| Umuahia| 5.60 | 2.17 |         |

| Marital Status | Mean | SD  | p-value |
|----------------|------|-----|---------|
| Single         | 4.69 | 2.68 | 0.001  |
| Married        | 5.59 | 2.58 |         |
| Separated      | 4.57 | 3.03 |         |

| Education | Mean | SD  | p-value |
|----------|------|-----|---------|
| Tertiary | 4.87 | 2.67 | 0.394  |
| Secondary| 4.75 | 2.92 |         |
| Primary  | 3.33 | 2.08 |         |
| None     | 3.00 | 2.94 |         |

| Have you heard about HBV | Mean | SD  | p-value |
|--------------------------|------|-----|---------|
| No                       | 2.68 | 2.51 | <0.001 |
| Yes                      | 5.72 | 2.22 |         |

| Have you been tested for HBV | Mean | SD  | p-value |
|------------------------------|------|-----|---------|
| No                           | 4.49 | 2.69 | <0.001 |
| Yes                          | 6.58 | 1.85 |         |

| Do you know anyone currently infected | Mean | SD  | p-value |
|--------------------------------------|------|-----|---------|
| No                                    | 4.76 | 2.65 | <0.001 |
| Yes                                   | 6.53 | 1.94 |         |

| Are you aware of the vaccine for prevention of HBV | Mean | SD  | p-value |
|--------------------------------------------------|------|-----|---------|
| No                                               | 4.23 | 2.67 | <0.001 |
| Yes                                              | 6.49 | 1.81 |         |

| Have you been previously vaccinated against HBV | Mean | SD  | p-value |
|------------------------------------------------|------|-----|---------|
| No                                               | 4.97 | 2.68 | 0.001  |
| Yes                                              | 5.83 | 2.37 |         |

Discussion
In this study, we show average knowledge as well as poor vaccination coverage among study participants. To the best of our knowledge, there is a paucity of information on HBV knowledge among members of the general population in the study region. Most studies focus on populations for which Hepatitis B is an occupational hazard.

Awareness of HB was high (70%) in this study. This level of awareness, however, did not correlate with knowledge because only 46.4% of the study population had good knowledge of Hepatitis B virus (HBV) infection based on the knowledge assessment. Good knowledge in this study is lower than those in other studies, where they reported above 70% of respondents with good knowledge [7–9]. This asymmetry in awareness levels and knowledge could be indicative of low perceptions of HB risk among the study participants. In addition, our results showed that persons with high-risk behaviour, such as having unprotected sex with multiple sex partners, was not associated with HB knowledge or vaccine uptake. This again indicates a low perception of risk among such individuals.

Overall, our study participants had average knowledge with persons belonging to not belonging to a school having significantly better knowledge than students. The reason for this is not immediately clear based on the information collected, however analysis showed that members of the general public were also more likely to have been tested or vaccinated against HBV and as such could have received informal education about HBV infection. This relationship between vaccination and knowledge has been previously demonstrated [10, 11]. Previous studies [5, 12] have reported age as a predictor of knowledge, however in this study, age was not associated with knowledge. This is a result of the imbalance in our sampling because the age group 16–36 represented over two-thirds of the study population.

We found that persons who knew someone who had HBV infection were more likely to have been vaccinated and have higher scores. Again, this could be due to the increased perception of risk associated with knowing someone affected. This is in tandem with previous reports

Table 3: Frequency of Correct Responses to Knowledge Assessment Questions.

| Question                                      | Private Institution | Public Institution | Working Class | Total |
|------------------------------------------------|---------------------|---------------------|---------------|-------|
| N     | %      | N     | %      | N     | %      | N     | %      |
| HBV is caused by ..?                         | 264                | 92.3%             | 153           | 87.4% | 142    | 87.7% | 559    | 73.7% |
| Do you know HB can affect liver and causes a chronic disease? | 205                | 62.7%             | 114           | 55.6% | 131    | 74.9% | 450    | 59.4% |
| Can HBV cause yellowing of skin and eyes?    | 196                | 71.5%             | 105           | 61.0% | 129    | 81.6% | 430    | 56.7% |
| Do you know HBV can lead to death?          | 268                | 82.2%             | 137           | 66.8% | 156    | 89.7% | 561    | 74.0% |
| Are you aware HBV is transmitted through blood and other bodily fluids? | 211                | 65.5%             | 116           | 55.8% | 101    | 65.6% | 428    | 56.5% |
| Is HBV a STI?                               | 122                | 37.8%             | 72            | 33.0% | 74     | 43.8% | 268    | 35.4% |
| Can HBV be transmitted from mother to child? | 175                | 55.0%             | 110           | 52.6% | 111    | 68.1% | 396    | 52.2% |
| Are you aware that HB can be transmitted by sharing personal items? | 111                | 33.5%             | 79            | 37.1% | 48     | 28.4% | 238    | 31.4% |
| Is Hepatitis B Curable?                     | 107                | 38.6%             | 63            | 38.2% | 68     | 46.3% | 238    | 31.4% |
among Cambodian women living in the United States where the authors reported strong relationships between knowing someone currently infected, HB knowledge and HB testing [11]. In addition, a study conducted among health workers found higher vaccination rates among those with more knowledge of HBV infection [9].

Vaccination status as reported by the study respondents was lower than the recommended rate of 80% coverage by the WHO [3]. We found a high prevalence of high-risk behaviour such as having multiple sexual partners and having unprotected sex among study participants, however high-risk behaviours were not associated with vaccination status or being aware of the vaccine. This is a pointer to the need for urgent sensitisation of the persons in higher institutions of learning.

This study has a few limitations. We didn’t assess the influence of gender on knowledge and vaccination in our study population. We also did not directly measure the perceived risk of respondents, which may have a role to play in the knowledge of the different groups in this study [11].

**Conclusion**
The results of this study have shown the urgent need for intervention in the areas of HBV awareness and vaccination. It is important to note that the general population consists of many subclusters with varying needs; as such, it would be expedient to tailor interventions to each cluster.

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**Competing Interests**
The authors have no competing interests to declare.

### Table 4: Previous Vaccination and Awareness.

| Private Institution | Public Institution | Working Class |
|---------------------|--------------------|---------------|
|                     | N      | %    | N      | %    | N      | %    |
| Are you aware of the vaccine for prevention of HBV? |
| No                  | 196    | 60.9%| 159    | 77.9%| 98     | 58.0%|
| Yes                 | 126    | 39.1%| 45     | 22.1%| 71     | 42.0%|
| Have you been previously vaccinated against HBV? |
| No                  | 158    | 66.4%| 127    | 79.4%| 88     | 64.7%|
| Yes                 | 80     | 33.6%| 33     | 20.6%| 48     | 35.3%|

### Table 5: Factors Associated with Participant’s Knowledge.

|               | B      | SE B  | Beta   | t      | p-value | 95% CI      | VIF |
|---------------|--------|-------|--------|--------|---------|-------------|-----|
| (Constant)    | 3.184  | 0.317 |        | 10.053 | <0.001  | 2.561 to 3.806 |     |
| Public institution | -0.046 | 0.272 | -0.008 | -0.167 | 0.867   | -0.581 to 0.490 | 1.754 |
| Private Institution | -0.202 | 0.237 | -0.039 | -0.855 | 0.393   | -0.667 to 0.262 | 1.595 |
| Single         | -0.222 | 0.238 | -0.036 | -0.929 | 0.353   | -0.690 to 0.247 | 1.141 |
| Heard about HB | 2.433  | 0.412 | 10.273 | <0.001 | 1.968   | 2.898       | 1.220 |
| Had been vaccinated | -0.337 | 0.227 | -0.855 | -1.485 | 0.138   | -0.782 to 0.109 | 1.239 |
| Tested for HB  | 0.553  | 0.095 | 2.129  | 0.034  | 0.043   | 1.063       | 1.526 |
| Knowing someone who was infected | 0.625  | 0.085 | 2.186  | 0.029  | 0.063   | 1.187       | 1.156 |
| Aware of the HBV Vaccine | 1.171  | 0.223 | 5.223  | <0.001 | 0.730   | 1.611       | 1.381 |

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