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Investigation on the awareness of hepatitis B virus among health care workers in Nigeria

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Abstract

Hepatitis B is a disease caused by the hepatitis B virus (HBV), which is transmitted through percutaneous or mucosal exposure to infective blood or body fluids. It is a major problem because it can cause chronic infection, resulting in cirrhosis of the liver, liver cancer, liver failure, and even death. The main aim of the study was to investigate the Awareness of hepatitis B virus among health care workers at the Federal Medical Centre Asaba, Nigeria; to assess the attitude of health care workers' vaccination against HBV; and to assess the barrier to predictors for effective hepatitis B virus among health care workers. Two-hundred and fifteen copies of questionnaire were distributed and 161 copies were retrieved, which shown overall response rate of 74.9%. The data was analyzed using SPSS and cross-tabulation, percentage and chi-square utilized. The results revealed that health care workers have poor knowledge of hepatitis B virus; the use of protective material appeared to be influenced by the perceived risk of transmission and majority indicating that overall practices towards hepatitis B virus (HBV) prevention was good. Based on the finding, the study recommends that; there is a need to inform health care workers (HCN) of the availability of an effective, safe vaccine that prevent HBV. All health care facilities should have programs designed to minimize risk, including infection control programs; hepatitis B vaccine protocol should be available at each health care facility; and programs need to be implemented to identify HBV positive HCNs and transfer them for appropriate medical management for vaccination.

Introduction

Hepatitis B virus (HBV) infection is a major global health problem [1,2], especially in Asia, Africa, Southern Europe and Latin America [3]. About 2 billion people are infected with HBV worldwide [3], and 400 million among them are suffering from chronic HBV infection [4]. The reason may be the lack of proper health facilities; poor economic status and less public awareness about the transmission of major communicable awareness diseases. The major route of HBV transmission in sub-Saharan Africa is horizontal (that is transmission unrelated to recognize-sexual, perinatal, parenteral exposure) [5] in children under 5 years of age; however, percutaneous/parenteral transmission is also an important mode of spread [6].

Health Care Workers (HCWS) may be exposed to the risk of infection with blood-borne viruses (BBVS) such as HBV, hepatitis C virus (HCV) and human immunodeficiency virus (HIV) via contact with blood (and other body fluids) in the course of their work [7]. The form of exposure most likely to result in occupational BBV infection is needle stick injury (NSI). A safe and effective vaccine against HBV is available throughout world, yet many health care workers in resource-poor countries remain at risk because they are not vaccinated against hepatitis B virus [8].

The main aims of this study is to investigate the effect of HBV among health care workers in five (5) Asaba metropolis. The specific objectives are to assess the level of knowledge of health care workers about vaccination against HBV; to assess the attitude of health care workers' vaccination against HBV and to assess the barriers to predictors for effective hepatitis B virus vaccination among health care workers at Federal Medical Centre (FMC) Asaba.

The following research questions were addressed in this study. Firstly, does the level of Knowledge about hepatitis B influence health care workers to vaccinate against HBV? Secondly, what attitudes do health care workers in Asaba have towards hepatitis B vaccination? Thirdly, to what extent is the proportion of health care workers in Asaba vaccinated against HBV? And lastly, what are the barriers to predictors for effective HBV vaccination among health care workers at FMC Asaba?

Methodology

In pursuance of the objective of the study, attentions were focused on a survey on public awareness of Hepatitis B among health care workers in Federal Medical Centre, Asaba. Descriptive study conducted in Federal Medical Centre in Asaba metropolis. Randomly sampling was used for this study. The study followed a quantitative approach, and participants completed a self-administered questionnaire to access their knowledge, attitude and practice (KAP) regarding HBV.

Population and sample size

The population of this study included all qualified doctors and nurses working at Federal Medical Centre, Asaba who consented to

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take part in this study were included.

The sample size for the study was calculated at 80% power and a 95% confidence level at 146. This was based on the following assumption (a) at least 21% of HCWs will be vaccinated, (b) 40% of those who have good knowledge about HBV vaccination are vaccinated against HBV, and (c) 70% of those who have poor knowledge of HBV vaccination are vaccinated against HBV [9]. One hundred and sixty-one (161) randomly selected nurses and doctors from Federal Medical Centre, Asaba who consented to participate were given questionnaires.

Data collection tool

Data was collected through a questionnaire which was formulated by the researchers and divided into 4 sections.

1. Demographics: Comprised of respondents' age, gender, job category, duration as health care worker (years) and health care site.

2. Knowledge test: Since the study population was HCWs, respondents were expected to know that one can get hepatitis B through a needle stick injury; there is an effective vaccine for hepatitis B; after vaccination for hepatitis B, a blood test is needed to confirm immunity against hepatitis B; the hepatitis B vaccine provide 100% protection for 90% of adults and children; the hepatitis B vaccine protects against HBV for at least 15 years; patients who are vaccinated against hepatitis B can still be considered as a possible source of hepatitis B; a person who has been vaccinated or recovered from a previous hepatitis B infection, can still infect others. Statements were phrased either correctly or incorrectly, and respondents had to choose one option between "true", "false", "don't know".

3. Practice test: This was concerned with exposure to and or protection against hepatitis B virus. Information concerning vaccination, such as have you been vaccinated against hepatitis B virus?, if vaccinated, how many doses?, was your immunity against hepatitis B checked after vaccination?, how many times during your working lifetime have you experienced a needle stick or sharp injury involving a needle or sharp instrument that had been used on a patient?, how many times in the last year have you experienced blood or body fluids splashing in your eyes or mouth?, and do you wear protective clothing when handling blood or body fluids?

The analysis identified the level of practice of HCWs about vaccination against HBV. Respondents had to choose one of the options, namely, for vaccination: 1 dose, 2 doses or 3 doses; for immunity; checked and not checked; protected and not protected; for universal precautions: always, sometimes, never and don't know.

4. Attitude test: Questions consisted of: hepatitis B vaccination should be compulsory for HCWs; hepatitis B vaccination is too expensive; I am scared of being vaccinated because it hurts; I am not at risk for hepatitis B because I am always careful when examining patients and taking specimens; careful when examining patients and taking specimens; I am not at risk for HBV because I am a healthy person; I don't trust vaccinations; and vaccination is against my religion, or traditional beliefs. From these questions respondents had to choose one of the options: strongly agree, agree, don't know, disagree and strongly disagree.

Reliability and validity of the study

The questionnaire was pretested to 10 Health care workers from an institution which was not randomly selected. This was done to check on the validity if the question that is to see if the questions were

clear and gave valid information. The questionnaires were formulated in such a way that the measure accounts for all the elements of the variables, which are knowledge, attitudes and practices. This ensured content validity. Threats to external validity were prevented as random selection of health care workers was done during sampling. Health care workers were sampled from difficult health care settings. Simple random selection also allowed one to draw externally valid conclusions about the entire population based on the sample.

Bias

Errors introduced by bias were minimized by making the study sample statistically powerful (that is at 80% and 95% confidence), and then increasing the sample size further. Also the sample was randomly selected, to make the sample as representatives of the population as possible. The steps minimized errors due to the following:

1. Recall Bias: This could have resulted when those who had previously been occupationally exposed to HBV (for example through a NSI) recalled facts about HBV and HBV vaccination better than those who had never been exposed.

2. Volunteer Bias: A poor response rate results in volunteer bias, since volunteers may have different health behaviours than people who refuse to participate. Volunteer bias is unavoidable, since people cannot be forced to take part in a study. However, it was minimized by increasing the sample size to allow for non-response, and a statistically powerful sample size was reached.

Data analysis techniques

Analytical tools such as percentage and mean were employed in this study. Statistical Package for Social Sciences (SPSS) was utilized in the analysis of the data.

Results

Two hundred and fifteen questionnaires are distributed as described, and one hundred and sixty-one were returned, giving an overall responses rate of 74.9%. All the respondents were from public hospital.

Background characteristic

The background profile of the respondents (Table 1) indicated that majority of the respondents were female, (70.8% [114/161]) and Nurse predominated (56.5% [91/161]). It also indicated that the majority of the respondents (57.1% [92/161]) had been employed as Health Care Workers for more than ten years.

Knowledge about vaccination against hepatitis B

The first research objective in this study was to identify the level of

Table 1. Background profile of respondents.

S/N	Item Statement	Respondent	Frequency	Percentage
1	Gender	Male	46	70.8
		Female	114	
2	Job Category	Doctor	69	
		Nurse	91	
3	Duration as Health Care worker	5 years or less	44	
		6-10 years	24	
		11-15 years	23	
		16-20 years	25	
		More than 20 years	44	
		No answer	1	

knowledge of Health Care Workers about vaccination against HBV. Nine items measured the number of correct responses on general knowledge questions regarding vaccination against HBV. The potential range of scores was 0-9. Poor knowledge was defined as scores of 3 or less, moderate knowledge as 4 to 6, and good knowledge as 7 to 9. The actual scores ranged from 0 to 8 with a mean score of 3.13 (SD=1.47). Overall, 66.46% (107/161) had poor knowledge, 31.68% (51/161) had moderate knowledge and 1.86% (3/161) had good knowledge (Tables 2-4).

The distribution of answers to the knowledge questions are shown in Table 5 which showed that the vast majority of respondents knew that HBV can be contracted from a NSI, and that there is an effective vaccine to protect against HBV. However, it is also clear that the vast majority do not know just how effective the vaccine is or how long they will be protected against HBV after vaccination.

Attitude of HCWS towards vaccination against HBV

The second research objective in this study was to examine the attitudes of HCWs towards vaccination against HBV. There were seven statements to assess participants' attitude towards HBV. All the

Table 2. Distribution of knowledge of HCWs.

Knowledge	Frequency	Percent
Poor knowledge	107	66.46
Moderate knowledge	51	31.68
Good knowledge	3	1.86
Total	161	100

Table 3. Cross tabulation knowledge and being vaccinated.

Knowledge	Vaccination	Against HBV	Total
	No	Yes	
Poor Knowledge's	30	77	107
Moderate Knowledge's	15	36	51
Good knowledge	0	3	3
Total	45	116	161

Table 4. Frequency distribution of knowledge scores.

Knowledge	Frequency	Percent
0	1	.6
1	17	10.6
2	160	24.8
3	49	30.4
4	27	16.8
5	14	8.7
6	10	6.2
7	2	1.2
8	1	.6

Table 5. Distribution of answers to knowledge.

S/N	Item statement	True	False	Don't know
		No (%)	No (%)	No (%)
1.	Can get hepatitis B through a needle stick injury.	147 (91.3%)	5 (3.1%)	9 (5.6%)
2.	There is no effective vaccine for hepatitis B	13 (8.1%)	141 (87.6%)	7 (4.3%)
3.	There is no need for a blood test	21 (13%)	117 (72.7%)	23 (14.3%)
4.	Hepatitis B vaccine provides 100% protection for 90% adults.	84 (52.2%)	37 (23.0%)	40 (24.8%)
5.	Hepatitis B vaccine protects against HBV for at least 15 years	49 (30.4%)	46 (28.6%)	66 (41.0%)
6.	Vaccinated patients should not be considered as a possible source of HBV	54 (33.5%)	82 (50.9%)	25 (15.5%)
7.	A person vaccinated or recovered from hepatitis B infect others	67 (41.6%)	65 (40.4%)	29 (18.0%)
8.	HIV is more infections than hepatitis B virus.	32 (19.9%)	109 (67.7%)	20 (12.4%)
9.	For protection against hepatitis B, one needs a liter of at least 10ml/U/ml	37 (23.0%)	23 (14.3%)	101 (62.7%)

statements had 5-point scale answers ranging from +2 (strongly agree) to -2 (strongly disagree) for positive statements, and from +2 (strongly agree) for negative statements. The distribution of answers to attitude question is shown in Table 6. Table 7 shows that the majority had a positive attitude among those who vaccinated, the majority (82.8%), [176/116]) had a positive attitude towards vaccination as shown in Table 8.

Practices of HCWS regarding prevention of HBV

The third research objective in this study was to investigate the practice of HCWs regarding HBV prevention. The results for vaccination uptake and testing for immunity are presented in Table 9, while Table 10 shows the distribution of vaccination uptake according profession, and Figure 1 illustrates the proportions of the vaccinated who had received between 1 and 3 doses of vaccine.

Occupational exposures

The majority of the HCWs (67.7%, [109/161]) experienced needle stick injury. Among them, over a third (37.6%, [41/81]) reported always and those who reported among them 40.7% (33/81) took PEP as show in Table 11. The chi-square test of association was used to find associations between vaccination uptake and demographic variables (Tables 12-14). Job category was the only variable that was significantly associated ($X^2=4.563$; $P=-0.049$) with taking vaccination, and it was found that doctors were twice more likely to take the vaccinations as compared to nurses

Discussion

The main aim of the study is to investigate public awareness on hepatitis B virus among health workers. An overall response rate of 74.9% (161/215) was achieved in the study. This means that the results are adequately representative of the target population from which it was where the required 70% response.

Holbrook Allyson identifies response rates as a function of two different aspects of the interaction with respondents, namely contracting respondents and gaining their cooperation. There are different variables that have significance in non-response, namely, Occupation, income, number of hours worked, and knowledge of condition under survey.

Health care workers are at an increased risk of blood borne diseases. The most common form of accidental exposures is due to NSI. Exposures could also result from sharp objects such as scalpels and broken glasses, as well as from mucosal exposures after blood splash or bodily fluids [10]. A few questions on Knowledge were answered correctly by a majority of respondents. A majority of HCWs (91.3% [147/161] knew that one could get HBV through a needle stick injury, and 87.6% (141/161) knew that there is an effective vaccine to protect

Table 6. Distribution of answers to attitudes questions.

Hepatitis B Vaccination	Strongly agree	Agree	Do not know	Disagree	Strongly disagree
Should be compulsory	109 (67.7%)	39 (24.2%)	8 (5%)	4 (2.5%)	1 (0.6%)
Is too expensive	8 (5%)	27 (16.8%)	84 (52.2%)	27 (16.8%)	15 (9.3%)
Scared of vaccination	6 (3.7%)	14 (8.7%)	12 (7.45%)	65 (40.5%)	64 (39.8%)
Always careful therefore don't need it	10 (6.2%)	26 (16.11%)	15 (9.3%)	73 (45.6%)	37 (23.1%)
Not at risk therefore don't need it	3 (1.9%)	11 (6.8%)	19 (11.8%)	75 (46.6%)	53 (32.9%)
Don not trust	4 (25%)	7 (4.3%)	12 (7.5%)	73 (45.3%)	65 (40.4%)
Against my religion/culture	1 (0.6%)	4 (25%)	5 (3.1%)	63 (39.1%)	88 (54.7%)

Source: Research Survey, 2011.

Table 7. Distribution of attitude of HCWs.

Attitude	Frequency	Percent
Negative attitude	1	.62
Neutral	40	24.84
Positive Attitude	120	74.53
Total	161	100

Source: Research Survey, 2011.

Table 8. Cross tabulation between attitude and being vaccinated.

Attitude	Vaccination		Against HBV
	No	Yes	
Negative attitude	0	1	
Neutral	21	19	
Positive attitude	24	96	

Table 9: Distribution of answers to protection against hepatitis B.

Vaccination and protection against hepatitis B		Number (2)
Have you been vaccinated against hepatitis B virus (n=161)		
Yes		116 (72.0)
No		39 (24.2)
Don't know		6 (3.7)
Was your immunity against hepatitis B checked after vaccination? (n=116)		
Checked		32 (27.6)
Not checked		84 (72.4)
If checked, are you protected (n=32)		
Protected		30 (93.75)
Not protected		1 (3.125%)
Don't know		1 (3.125%)

Source: Research Survey, 2011.

Table 10. Cross tabulation of being vaccinated against hepatitis B with job category.

Job category	Vaccination		Against HBV
	No or Do not know (%)	Yes (%)	
Doctor	14 (8.7)	56 (34.8)	
Nurse	31 (19.3)	60 (37.3)	
Total	45 (28)	116 (72)	

against HBV. This is in contrast to studies done in Iran and the UK, where 21.4% and 44% respectively of HCWs knew that HBV can be transmitted by NSI [11,12], and 38% of HCWs in Egypt not knowing how effective the vaccine is [13]. About two thirds (67.7% [109/161]) of HCWs knew that HBV was more infectious than HIV. This was similar to a study done in Dublin, Ireland, where 82% of nurses knew that HBV transmission was 100 times more ineffective than HIV.

Finally, 50.9% (82/161) knew that being vaccinated does not exclude one from being considered a possible source of hepatitis B, and 72.72 (117/161) knew that one has to be tested in order to be sure that one is protected. This finding is similar to a study done in Dublin which showed that nurses had knowledge about the hepatitis B virus infection.

Table 11. Experience of needle stick injury among HCWs (n=161).

No. of time needle stick injury	Frequency	Percent
More than 10 times	5	3.1
6 – 10 times	17	10.6
2 – 5 times	47	29.2
Once	40	24.8
Never	52	32.3
Injury reported (n=109)		
Never		
Sometimes		
Always		
PEP given (n=81)		
Yes	33	40.7
No	48	59.3

Source: Research Survey, 2011.

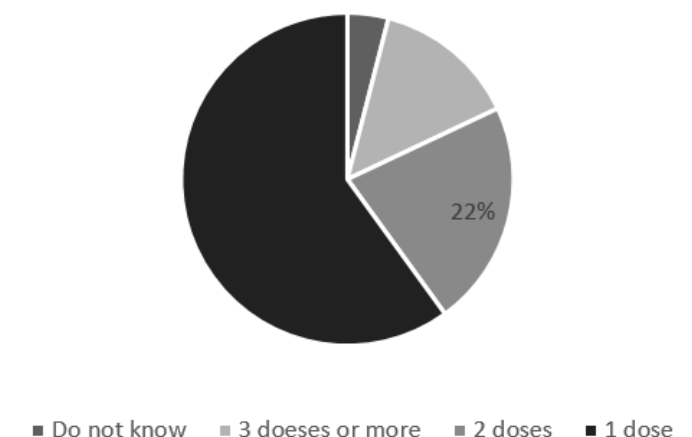


Figure 1. Pie chart showing vaccine doses received.

This is demonstrated by the fact that of the 83% of HCWs who had completed a full course of hepatitis B Immunization, 93% reported a hepatitis B antibody level on completion of the immunization; 14% knew their actual titer and 78% reported immunity. Similarly, a study done in Birmingham, demonstrated that 70% (153/218) HCWs stated that they treat every patient as if he is carrying a BBV.

What was disappointing is that a substantial number 23% (37/161) of HCWs did not know for how long an individual could be protected against HBV after being vaccinated. This finding is similar to a study done in Egyptian HCWs, where it was found that 47% were not sure of how long they would be protected by the vaccine [13]. This study found that 66.5% (107/161) of HCWs had poor knowledge regarding vaccination against HBV, with only 23% (107/161) knowing that one

Table 12. Cross tabulation of gender and vaccination against HBV.

Gender	Vaccination	Against HBV	Chi-square test
	Yes	No	
Male	34	12	0.065 (P=0.847)
Female	84	32	

Table 13. Cross tabulation of job category and vaccination against HBV.

Job category	Vaccination	Against HBV	Chi-square test
	Yes	No	
Doctor	56	13	4.563 (P=0.049)
Nurse	60	31	

Table 14. Cross tabulation of duration as HCW and vaccination against hepatitis B virus.

Duration as HCW	Vaccination	Against HBV	Chi square test
	Yes	No	
5 years or less	34	10	2.998 (P=0.558)
6-10 years	17	7	
11-15 years	17	6	
16-20 years	20	5	
More than 20 years	28	16	

needs a titre of at least 10 M/U/M of antiHBs in order to be protected against HBV. This raises the suspicion that HCWs have not been adequately trained about BBVs. The study done is similar to a study done in Egypt which demonstrated that 47% of HCWs did not exactly know the duration of vaccine validity [13].

This study found that 55.9% (90/161) had a positive attitude towards HBV vaccination, which is similar to a study done in Birmingham where more nurses (86%) than doctors (41%) had the attitude that all patients should be treated as if they have a blood-borne virus. The majority of HCWs (91.3%) knew that one can get HBV through a NSI, and the majority 79.5% (128/161) of HCWs did perceive themselves to be at risk of exposure to HBV since they either disagreed or strongly disagreed that they were “not at-risk for hepatitis because I am always careful when examining patients and taking specimens”. This finding is similar to a study done in Iran which showed that 70% of HCWs were concerned about BBV, but despite this, their use of protective material appeared to be influenced by the perceived risk of transmission [11].

The majority of HCWs 67.7% (109/161) and 24.2% (39/161), either strongly agreed or agreed respectively, that hepatitis vaccination should be made compulsory. In addition, 68.3% (119/161) of HCWs either did not agree or did not strongly agree that “being careful” qualified one for “not being at risk for HBV” when examining patients and taking specimens. This finding is similar to those of a study done in Texas, where only 8% of participating nurses were not willing to be vaccinated against Hepatitis B, since they perceived themselves to be at low risk as they were practicing as nurses and there was lack of concern about getting the illness.

Only 22.4% (36/161) HCWs agreed that they were not at risk for HBV because of always being careful when examining patients and taking specimens. A majority 85.7% (138/161) of HCWs either disagreed or strongly disagreed on a question “I do not trust vaccinations”, and 93.7% (151/161) either disagreed or strongly disagreed on vaccination is against my religion/traditional beliefs.

In contrast to studies done in Sweden [14] and Nigeria [15] where HCWs had a negative attitude towards vaccination because it was expensive, the majority (52.2%) [84/161] of HCWs in this study did not know that it is expensive, and therefore did not have a negative

attitude towards it's expense. This finding may be due to the HCWs not having to pay for the vaccine themselves, but the question about who pays for their vaccination was not posed to the participants.

The majority of HCWs (72%) [116/161] has been vaccinated against HBV, however of those vaccinated, only 27.6% (32/116) had their immunity checked and 93.75% (30/31) stated they were protected. This is in contrast to a study done in Kenya where it was found that only 12.82 (71/554) of HCWs had received vaccination previously and none had been screened for immunity or HBsAg [8]. In this study, 91.3% of HCWs knew that HBV was transmitted through a NSI but despite this, only 55.92% of them always wore protective clothing when handling blood or body fluids and 38.5 said occasionally. These findings compare favorably to the practice of HCWs seen in Iran, where only 27% said they wore gloves all the time and 69% said occasionally [11].

Nevertheless, injuries go undocumented in many developing countries as compared to the US, where one out of three needle stick injuries are reported. It has been pointed out that the prevention of an occupational infection with BBVs like HBV is dependent on the integration of exposure avoidance, immunization, and PEP. Overall, it was found that 71.2% had scored 12 or more indicating overall practices towards HBV prevention was good. Nurses had a higher mean score (m=13.09) for practice compared to doctors (m=12.11) and the difference was statistically significant (t=2.14, p=0.17). This finding is similar to a study done in Birmingham where it was found that only 2% of the nurses did not report a NSI as compared to 28% of doctors who did not, which was statistically significant [12].

Although knowledge about vaccination for HBV was found to be generally poor, fortunately poor knowledge was not found to be a statistically significant barrier to vaccination, nor was good knowledge found to be a statistically significant predictor of vaccination uptake. This finding is similar to a study done in Houston, USA where vaccine effectiveness and the belief that they were at risk of exposure were cited as reason for being vaccinated by registered nurses.

However, a study done in Nigeria demonstrated that workers thought to have greater knowledge about HBV infection (doctors and nurses) were the ones who were less interested in receiving the vaccine. Non-clinical workers (medical record personnel (76/3%) and engineering staff (69.5%) demonstrated greater compliance, whilst clinical professional nurses (39.7%) and doctors (40.3%) showed less compliance [9].

Finally, it was found that being a doctor was statistically significantly associated with vaccination uptake, with doctors being 2.23 times more likely to be vaccinated than nurse (P=0.049). This finding stands in contrast to a study done in Saudi Arabia which demonstrated an overall compliance to hepatitis B vaccination of 78.7% (37/47) amongst all categories of Hews in ICU.

Conclusion

It can be concluded from the study that there was overall lack of knowledge amongst the majority of HCWs, despite a positive attitude in the majority of them. This positive attitude was found to be a predictor of vaccination uptake and fortunately poor knowledge was not found to be a barrier. Nevertheless, it is that training in BBVs is suboptimal at the tertiary institutions that train these HCWs.

There is a lack of implementation of policies shown in this study as reflected by the following: inadequate safe injection practices observed as more than fifty percent of HCWs experienced needle stick injuries;

protective clothing was not worn by HCWs such as the HCWs right to protection against BBV is contravened. Not all HCWs were vaccinated, not all those vaccinated were given 3 doses, and not all those vaccinated were tested for immunity. It is thus, clear that there is no consistent vaccination policy at the institutions where these HCWs were employed. There is an existing gap at Nigeria health care facilities in the management of hepatitis B virus amongst HCWs, despite the vaccine being approved by the National Department of Health (NDH).

Recommendations

There is a need to inform the HCWs of the availability of an effective, safe vaccine that prevents HBV. This has been identified as a cost-effective public health intervention for protection against HBV. Although a majority of HCWs demonstrated a positive attitude, education on HBV infection has to be continued to target those who still have a negative attitude and to prevent regression.

All health care facilities should have programs designed to minimize risk, including infection control programs. This demonstrate the fact that it is both the duty of the employee and the employer to curtail the spread of the infection.

It is recommended that hepatitis B vaccine protocol should be available at each health care facility, and a representing body to monitor and evaluate policies that are in place, and to see to it that they are implemented and adhered to.

In addition, programs need to be implemented to identify HBsAg Positive HCWs and to refer them for appropriate medical management, and provide vaccination to their contacts, preferable, this should be done at the beginning of the HCWs profession. Extending these services to HCWs identified as HBsAg positive with help preventing squeal in chronically infected HCWs and enhances vaccination strategies for elimination of HBV transmission.

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