



Perspectives on Hepatitis B Vaccination among Health Care Workers in Nigeria

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/IJTDH/2016/27450

Editor(s):

(1) Paul M. Southern, Department of Pathology and Internal Medicine, University of Texas Southwestern Medical Center at Dallas, USA.

Reviewers:

(1) Sonali Kar, Kalinga Institute of Medical Sciences, KIIT University, India.

(2) Anam Yousaf, University of the Punjab, Lahore, Pakistan.

Complete Peer review History: <http://www.sciencedomain.org/review-history/15672>

Review Article

Received 1st June 2016
Accepted 5th July 2016
Published 5th August 2016

ABSTRACT

Nigeria has been declared among the group of countries endemic for hepatitis B infection with about 20 million people infected with HBV and about five million deaths resulting from the consequences of hepatitis B infection. Hepatitis B virus (HBV) infection is a serious global health problem, with 2 billion people infected worldwide, and 350 million suffering from chronic HBV infection. It is a major occupational hazard for Health care worker (HCWs). Approximately one health care worker dies each day from hepatitis B. Thus, Hepatitis B infection remains a major occupational hazard among health care workers in Nigeria. HBV being a vaccine preventable virus, about three-quarters of health workers in developed nations are vaccinated against HBV unlike the critically low percentage obtainable in developing countries. Despite the understanding of HCWs in Nigeria of their high risk of exposure to this deadly but vaccine preventable-virus, there is Poor compliance of Health workers to hepatitis B vaccination which calls for serious attention and thus, the heart of this review.

Keywords: Hepatitis B virus; health care workers; vaccine preventable-virus; hepatitis B vaccine.

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1. INTRODUCTION AND BACKGROUND

Hepatitis B virus (HBV) is a major cause of morbidity and mortality worldwide causing 620,000 deaths per year [1]. More than 780 000, people die every year due to complications of hepatitis B, including cirrhosis and liver cancer [2]. Prevalence of hepatitis B surface antigen (HBsAg) in the general population varies geographically, with the highest rates (8%) measured in West Africa [3].

In the United States, 804,000-1.4 million persons are estimated to be infected with the HBV, with majority being unaware of their status [4]. HBV infection is highest in sub Africa and hyper endemic in Nigeria with 14% of the population in Nigeria being exposed to HBV [5].

2–5% of the general population in the Middle East and the Indian subcontinent have been found to be chronically infected. This proportion is larger compared to less than 1% of the population in Western Europe and North America that are chronically infected [6]. The World Health Organization has classified Ireland as a country of low prevalence for HBV, i.e. prevalence of HBsAg <2%. In Europe, the total percentage of people infected with HBV varies between different countries, with higher rates in the southern part of Europe. The country with the highest prevalence (>4%) is Romania followed by medium prevalence countries (>1-2%), Spain, (parts of) Italy, and Greece. Belgium, Finland, Germany, Ireland, Sweden and Slovak have been identified as countries with a low prevalence of HBV (<1%) [7] Fig. 1 shows the geographical distribution of hepatitis B virus in the world.

Approximately one health care worker dies each day from hepatitis B [8]. Hence, HBV accounts for a major occupational hazard for health care workers due to their regular exposure to blood, blood products and body fluids [9], although, the concentration of hepatitis B virus in different body fluids varies. It is high in blood, serum, wound exudates; moderate in semen, vaginal fluid, saliva, and low/not detectable in urine, faeces, sweat, breast milk, tears [10] which are all the working medium of health care workers especially doctors, nurses, medical laboratory scientists.

More so, the risk of HBV infection in an unvaccinated person from a single HBV-infected needle stick injury ranges from 6-30% [11]. According to Rampal [12], the risk exposure varies among the HCWs but exposure rate is higher among the nurses due to a number of activities they are involved in more than others. This is also in line with Ndakoda [13] who reveals that the prevalence of HBV tends to be high among personnel with high proximity to blood and body fluids. Elmulkasfi et al. [14] has also established the fact that there is association between occupation and type of department and the rate of getting HBV.

In the industrialised world, occupational surveillance assess and monitor the health hazards related to blood borne pathogens and preventive measures to reduce the risk of transmission but this is in contrast to what we have in the developing countries where exposure and health impacts are rarely monitored and much remains to be done to protect health workers from such risk that causes infection [15]. According to Okwara et al. [16], there's is poor adherence to safety practices among health



Fig. 1. A map showing global distribution of hepatitis B infection Source: Centers for Disease Control and Prevention. CDC Health Information for International Travel 2012. New York: Oxford University Press; 2012 [17]

care personnel in Nigeria which contribute to the risk of Needle Prick Injuries and majority of health care workers who have had needle prick injuries never take post exposure prophylaxis (PEP) despite the fact that they are aware of this PEP. It is also pertinent to note that In Nigeria, majority of HCWs have a good knowledge about hepatitis B infection but quite a number of healthcare workers in Nigeria are yet to be vaccinated while some were incompletely vaccinated this corroborates with the findings of [18,19]. This is indeed a call for action!

2. METHODS

A number of documents were reviewed. Six documents from CDC on hepatitis B [4,7,8,20-23], two documents of the WHO on hepatitis B virus [1,6]. Twenty two published documents on different researches carried out on the state of HBV vaccine among health care workers outside Nigeria [2,3,9-12,14,15,24-37]. Twenty one published documents from Nigeria on the prevalence of hepatitis B vaccination, barriers to vaccination among health care workers in Nigeria and the state of HBV vaccine among the HCWs in Nigeria [5,8,13,16,18,19,38,39-51,37]. All these fifty- one documents were selected from an internet search. They all provided a basis for the perspectives on hepatitis B vaccination among health care workers in Nigeria and the need for prompt action to reduce the prevalence of hepatitis B virus among HCWs in Nigeria.

3. FINDINGS

3.1 Global Overview of Prevalence of Hepatitis B Virus among Health Care Workers

The worldwide annual proportion of HCWs exposed to HBV infection were reported to be about 5.9% and the risk of contracting hepatitis B by HCWs being fourfold higher as compared to general adult population, thus, reaffirming HBV as a major occupational hazard for HCWs [24]. The World Health Organization (WHO) also reported that about two million health care workers (HCWs) in sub-Saharan Africa face occupational exposure to HBV each year [25]. Singhal [26] identified the prevalence of HBV infection among HCWs with frequent blood contact or those who frequently report Needle Prick injuries is about two folds higher than other HCWs. This report is based on the

seroprevalence study carried out among health care workers in India where 2% of HCWs were also found to be HBsAg positive [27]. This is smaller to the result of the sero-frequency of HBV among HCWs in Khartoum where 4.4% were positive to HBsAg [28]. In Turkey the prevalence rate of HBV positive HCWs is as low as 0.7% [29].

In Uganda 8.1% of health care workers were seropositive to HBV with 67.8% prevalence of needle stick injuries and 41.0% prevalence of exposures to mucous membranes such as the eyes [30]. In Tanzania, 7% of HCWs tested positive to HBV this shows the high burden of HBV among HCWs in Tanzania [9]. Nigeria being among the group of countries endemic for HBV infection with about 18 million of its residents being infected with HBV [38], 17% of HCWs in Nigeria were said to be positive to HBsAg based on a screening for hepatitis B surface antigen (HBsAg) carried out among HCWs in an urban community south –south Nigeria [13]. In Egypt, prevalence of HBV was also seen to be high among HCWs (7.3%) compared to the non HCWs (0.9%). This is in line with the high number of needle stick injury which was reported among the HCWS [31]. All these prevalence studies of hepatitis B virus among HCWs shows that HBV still pose a great threat to the health of many health workers.

Fig. 2 shows the prevalence of HBV among HCWs with nurses and technicians having highest frequency among other HCWs who tested positive for HBV.

3.2 Overview of Hepatitis B Vaccination among Health Care Workers

The CDC has recommended Hepatitis B vaccine as on the vaccines that are to be taken by HCWs due to their exposure blood and body fluids of patients or handling of materials that could spread infection. Hence, all Healthcare workers including physicians, nurses, emergency medical personnel, dental professionals and students, medical and nursing students, laboratory technicians, pharmacists, hospital volunteers, and administrative staff have been mandated to have a document showing evidence of a complete HBV vaccine series otherwise they should get the 3 doses of hepatitis B vaccine and have an anti- HBs serologic test within 1-2 months after the third dose [20].

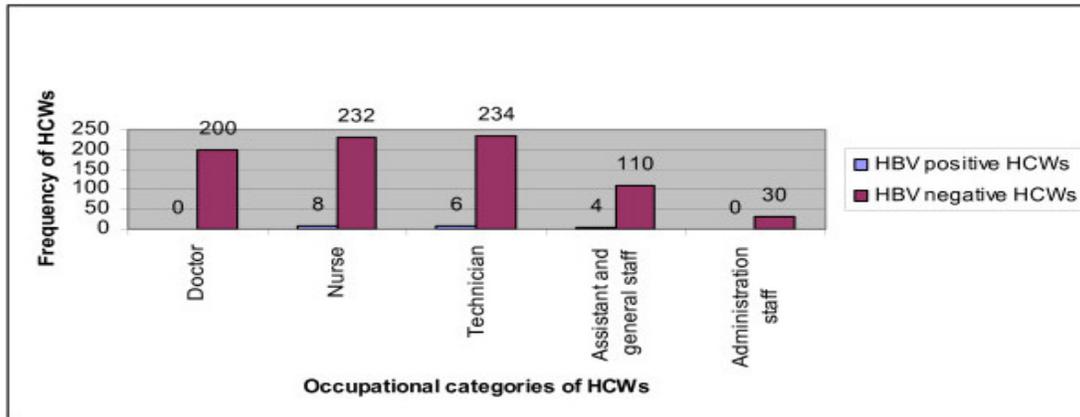


Fig. 2. Distribution of HBV positives and HBV negative among health care workers

Adapted from: Attaullah et al. [11]

It is worthy to note that despite this recommendation, the global history of vaccination among health care workers is generally low as many HCWs have never been vaccinated, and majority have been incompletely vaccinated. Those who have had the three doses of the HBV vaccines are yet to go for serologic test to ensure they are completely immunized against this infectious disease. In the United States, 72% of HCWs had received the primary vaccination and 68% had completed the course of vaccination [32]. In India, 50% have been fully vaccinated, 6% are partially vaccinated and 1.8% were not vaccinated at all [27]. In a study carried out in Netherlands it was discovered by Askariah [33] that 35% of HCWs and 47% of nursing staff were not vaccinated against HBV. Among HCWs in Tanzania 48.8% received three doses of the vaccine in the last 10 years, while 10% had received two vaccinations, and 4.5% only had one vaccination [9]. The prevalence of complete hepatitis B vaccination among primary HCWs in rural areas of North West Pakistan was 40.2%. This is lower than the prevalence among primary HCWs reported from rural Sindh Pakistan where 50.2% had complete vaccination [34]. In a cross sectional study by Abeje and Asage, [35] a very poor history of hepatitis B vaccination was reported among HCWs in Ethiopia where only 5.4% reported that they took three or more doses of hepatitis B vaccine. In a tertiary health care centre in North India, the prevalence of hepatitis B vaccination acceptance was 60% out of which only 38.8% of the health workers had received the full three dose vaccination schedule while 21.4% had received one or two doses, and 40% were unvaccinated. This implies that Coverage of complete immunization was low among health

care workers in India. A low coverage was also recorded in Pakistan where only 49% health care workers and 42.20% medical students were vaccinated [39]. Vaccination coverage rates vary greatly across countries and these dissimilarities might be justified by economic status or other characteristics of these countries.

3.3 Prevalence of Hepatitis B Vaccination among Health Care Workers in Nigeria

Despite the availability of Hepatitis B vaccination since 1981, a large proportion of Health Care Workers are still unvaccinated and the condition is same in most of the countries. Musa et al. [5] reveals that Vaccination against the hepatitis B virus (HBV) in the West African nation of Nigeria is lower than many Sub-Saharan African countries thus making health workers in Nigeria to be at risk of contracting hepatitis B virus while discharging their duties Health care workers (HCWs) in Nigeria have an extra risk of getting infected from their workplace and yet they are not routinely vaccinated against HBV infection.

In a study carried out among health care workers in a teaching hospital in Ile-Ife south west Nigeria, it was revealed that only 65% of the health workers have been vaccinated against hepatitis B infection while majority of nurses and pharmacist have never been screened of hepatitis B infection [19]. In Sokoto 56.0% HCWs have had the recommended three doses of HBV vaccine as reported by Hassan et al. [40]. This is high compare to only 32.6% of HCWs who have had HBV in a cross sectional study on prevalence of hepatitis B vaccination among health care workers in a teaching hospital in Jos

and Bayelsa in Nigeria [18]. Also, in a study carried out among health care workers in a secondary health care facility in Lagos state revealed that 11.9%, 17.2% and 48.5% of the HCWs had received 1 dose, 2 doses and complete 3 doses of HBV vaccine respectively [41]. Mohammed et al. [42], reported that only 65% of nurses in a public hospital in Niger claimed that they had HBV screening before while 35% have never been screened for HBV. Majority of public health workers in Jos have good knowledge about the immunization but only 10.8% of them had ever attended any training or workshop on standard safety precautions and blood borne infections. Also the vaccination history among them is also poor [43]. Among dental surgeons in Benin, only 20.0% had received three doses of the hepatitis-B vaccine, 48.6% either two doses or a single dose, and 31.4% were not vaccinated [44]. HBV vaccination rate among Warri, laboratory worker was as low as 16.4% [45].

Among the operating room personnel (ORP) teaching Hospitals in the Northern, Eastern, Western, and Southern Nigeria, only 26.8% were vaccinated against HBV [46]. [47] Also identified 50.6% Hepatitis B vaccination uptake among doctors in Benin City, Edo state Nigeria. All these reports shows that healthcare workers in Nigeria, who are expected to have high knowledge of and exposure to hepatitis-B infection, showed the greatest apathy to the vaccination program.

At this juncture it is pertinent to ask for the major reasons or barriers to having complete hepatitis B immunization among Nigeria health workers so as to be fully protected from this global occupational hazard.

4. BARRIERS TO HBV VACCINATION AMONG HEALTH CARE WORKERS IN NIGERIA

The prevalence of hepatitis B infection in Nigeria should reinforce the importance of administering Hepatitis B vaccination for all HCWs. It should also serve as a key for evaluating hepatitis B protection among previously vaccinated HCWs particularly those who have been vaccinated more than ten years ago and clarifies recommendations for post exposure management of HCWs exposed to blood or body fluid. But despite their understanding of their high risk of exposure to this deadly but vaccine preventable-virus, there is Poor compliance of Health workers in Nigeria to hepatitis B

vaccination which calls for serious attention [48]. The following are some of the barriers identified by HCWs in Nigeria to HBV vaccination.

4.1 Lack of Opportunity

This is one of the most common reasons given by health care workers in Nigeria for non compliance with the HBV vaccine. This was identified by Ibekwe, [49] and [45]. In Nigeria majority of the health facilities are understaffed and health workers usually have a great deal of work to carry out on daily basis. Fatusi [50] also reasoned that the heavy work load of doctors and nurses may hinder them from getting vaccinated. This corroborates with Obi and Ofii [47] where it was identified that pressure from work coupled with the long vaccination schedule for Hepatitis B may further hinder HCWs from been completely vaccinated.

4.2 Negligence

Many health workers in Nigeria had never given it a thought to be immunized against HBV infection [51]. They focussed more on other people's health neglecting their own health. This is in line with the findings of [30,36], where negligence was the highest reason for unvaccination of most HCWs.

4.3 Long Vacation Schedule of the Vaccine

The long vaccination schedule of HBV vaccine may contribute to the tendency for forgetfulness among health care workers resulting in missed vaccine administration and the immunity that should have been acquired through vaccination thus, further increasing HCWs being exposed to Hepatitis B infection [47].

4.4 Fear of Side Effects of the Vaccine

Perception of vaccine safety was identified as the most important predictor for acceptance of HBV vaccine [15], logistics of vaccine administration and fear of side effects was identified among doctors, nurses and laboratory staffs. This might have reduced the compliance for HBV vaccine. Although, HBV vaccine(particularly Recombivax) have some common side effects like irritability, pain or redness at the injection site, fever, headache, tiredness, sore throat ,nausea, loss of appetite. If all these persist, it is pertinent to inform your doctor or care giver. Occasionally it

has temporary symptoms such as fainting, dizziness or seizure-like movement which require immediate attention of the care provider. However, the benefit one gets from the vaccine outweighs the side effects [37]. On the other hand the fear of disease and the high hope placed on HB vaccine promoted its acceptance by the other [44].

4.5 Fear of Being Recognized as a Hepatitis-B Carrier

This always hinder the confidence level of health workers in going for hepatitis B vaccine knowing well that the result of their hepatitis status will be required from them before they will commence hepatitis B vaccination. Thus, fear of “what if i tested positive” is always a major concern and many will chose not to be aware of their hepatitis B status.

4.6 Non-Availability

Unavailability of vaccine through government channels have also been identified by some healthcare worker. This may depend largely on the economic state of the country [44,47] Other barriers reported in other countries apart from Nigeria are high cost of the vaccine [39].

5. FACTORS THAT CAN ENHANCE VACCINE COMPLETION AMONG HEALTH CARE WORKERS IN NIGERIA

5.1 Level of Education

Education as it is generally said is power. The level of education that each health worker has can be of great advantage to completion of hepatitis B vaccine. Knowing the consequences of not completing the HBV will encourage each health worker to go for the vaccine and ensure they had a complete dose. This is congruent with the study carried out among theatre and laboratory workers in Imo state, Nigeria; where it was discovered that only 48% of the participants had completed the three doses of HBV majority having tertiary education [16].

5.2 Good Knowledge about the HBV Infection

Knowledge about the modes of transmission of HBV being through percutaneous mean, via sexual contacts and via body fluids as well as knowledge of people who are at risk of getting

the virus will help HCWs in Nigeria to get vaccinated. Also, knowing that hepatitis B is 50 to 100 times more infectious than HIV will also aid the vaccination of health workers in Nigeria [6].

Ndako [13] identified that the risk of HBV infection in HCWs depends on the prevalence of HBV infected patients that the HCWs are exposed to, and the frequency of exposure to infected blood and body fluids. This understanding will enhance HCWs who have regular contact with the blood and body fluid of patients to ensure they have complete hepatitis B vaccine.

5.3 Good Knowledge of the Safety and Efficacy of HBV Vaccine

Hepatitis B immunisation has been described as a vaccine that is safe and effective for children and adult population at risk such HCWs against hepatitis B infection [21]. It has been demonstrated to be safe among persons in all age groups. It is not contraindicated in persons with history of multiple sclerosis, Guillain- Barre syndrome, autoimmune diseases and other chronic diseases [22]. CDC weekly report in [23] identified that Hepatitis B vaccine is not contraindicated for pregnant women as vaccines contain non-infectious HBsAg and this causes no risk of infection to the fetus. It is also not contraindicated for lactating mothers but it is contraindicated for persons with history of sensitivity to yeast components. Knowledge of this fact will help HCWs in Nigeria to embrace HBV vaccine.

5.4 A Reminder System

Owing to the busy schedule of majority of health care worker, a reminder system should be developed to ensure the complete uptake of the vaccine.

This can be done by sending a text message to remind them of their next immunization appointment so as to enhance their compliance and also reduce incomplete immunization due to lack of opportunity and forgetfulness.

5.5 Pre-employment Screening for Hepatitis B Virus

Just like HIV test is being done as a pre employment screening in the same vein, hepatitis B screening should be done for every

health worker before they are fully employed. Those who are negative should immediately go for the vaccination and ensure completion while those who tested positive should go for treatment as soon as possible. This claim is supported by [16] who also identified that screening for Hepatitis B virus should be done as a pre employment screening for all health care workers.

6. RECOMMENDATIONS

In order to reduce the global burden of hepatitis B among Nigeria population and also among HCWs in Nigeria the following recommendations are made:

- Nationwide vaccination campaign against hepatitis B in high risk groups especially HCWs. Nigeria government has greatly improved in vaccination of children against HBV, the next step could be to consider adults at risk, such as HCWs, hairdressers, motorist, etc and targeted vaccination should be done for such group.
- Free HBsAg screening for newly employed staff before vaccination. This is needed to make vaccination of health care workers against HBV infection a firm policy and ensure complete and consistent adherence to work standard safety measures.
- To increase the vaccination rate among HCWs in Nigeria is to make the vaccine available at no cost to all HCWs.
- Nigeria government should further ensure that there should be a written policy on hepatitis control in all hospitals; hence, they should be encouraged to adopt standard precautions, to use safety devices and other personal protective equipments there is need for health workers to take standard precaution against this deadly virus.
- Apart from the annual world hepatitis day marked in the hospital, training and seminar should be done for all HCWs on the merits of vaccination and using the evidence of vaccination as a requirement for annual practicing license renewal.
- Government should ensure that Post-exposure management be put in place in hospital settings so that it can be centrally initiated, promptly, as and when required. Similar to HIV prophylaxis there must be a centralized counselling, testing, vaccination, and treatment facility that is

widely advertised, and the location and contact numbers must be displayed at most visible sites of the hospital premises and made available round the clock.

7. CONCLUSION

In conclusion, a large number of residents in Nigeria have been identified to be chronically infected with HBV and being a major occupational health hazard it poses HCWs in Nigeria to be at greater risk of contacting this deadly disease while discharging their duties. It is therefore pertinent for the health care providers who are at high risk to proclaim that hepatitis affects everyone, everywhere and to get themselves protected via vaccine against the deadly virus.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. World Health Organization. Hepatitis B and C, Immunization, Vaccines and Biologicals; 2013. Available:<http://www.who.int/immunization/topics/hepatitis/en/> (Accessed: 27th April, 2016)
2. Smith L. World hepatitis day: Facts, statistics and differences between types of the condition July 28, 2015 00:00 BST. Available:<http://www.ibtimes.co.uk/world-hepatitis-day-facts-statistics-differences-between-types-condition-1512838> (Accessed: 22 February, 2016)
3. Stockdale AJ, Geretti AN. Chronic hepatitis B infection in Sub-Saharan Africa: A grave challenge and a great hope. *Trans R Soc Trop Med Hyg.* 2015;109:421–422. Available:<http://trstmh.oxfordjournals.org/> (Accesses 13th April, 2016)
4. Centers for Disease Surveillance- United States. Global statistics on hepatitis B; 2011.

- Available:<http://www.cdc.gov/hepatitis/statistics/2010surveillance/commentary.htm>
(Accessed: December 26, 2015)
5. Musa S, Bussell MM, Borodo AA, Samaila OL, Femi. Prevalence of hepatitis B virus infection in Nigeria, 2000-2013: A systemic review and meta-analysis. Available:<http://www.njcponline.com/article.asp?issn=11193077;year=2015;volume=18;issue=2;spage=163;epage=172;aulast=Musa>
(Accessed: 10th March, 2016)
 6. World Health Organization. Hepatitis B; 2015. Available:<http://www.who.int/mediacentre/factsheets/fs204/en/>
(Accessed 27th April, 2016)
 7. European Centre for Disease Prevention and Control. Info Sheet. Hepatitis B and C. Current situation in EU/EEA; 2010. Available:http://ecdc.europa.eu/en/press/news/Documents/1010_HepatitisAandB_info_sheet.pdf. 2014
(Accessed: 27th April, 2016)
 8. Terwase JM, Emeka CK. Prevalence of hepatitis B surface antigen among residents of Julius Berger staff quarters, Kubwa, Abuja. *International Journal of Prevention and Treatment*; 2015. DOI: 10.5923/j.ijpt.20150402.02 Available:<http://article.sapub.org/10.5923.j.ijpt.20150402.02.html>
(Accessed: 5th May 2016)
 9. Mueller A, Stoetter L, Kalluvya S, Stich A, Majinge C, Weissbrich B, Kasang C. Prevalence of hepatitis B virus infection among health care workers in a tertiary hospital in Tanzania. 2015;15:386. DOI: 10.1186/s12879-015-1129 Available:<http://www.ncbi.nlm.nih.gov/pubmed/26399765>
(Accessed 5th May, 2016)
 10. Occupational safety and health administration. Occupational safety and health administration (OSHA) blood borne pathogen standard informational materials. Washington. Publications Office; 2011. Available:http://www.hivatwork.org/tools/pdf_mgrkt/workplace/osha.pdf
(Accessed: 10th March 2016)
 11. Attaullah S, Khan S, Naseemullah, Ayaz S, Khan SN, Ali I, Hoti N, Siraj S. Prevalence of HBV and HBV vaccination coverage in health care workers of tertiary hospitals of Peshawar, Pakistan. *Virology Journal*. 2011;8:275. DOI: 10.1186/1743-422X-8-275
(Accessed: 10th March 2016)
 12. Rampal L, Zakaria R, Sook LW, Zain AM. Needle stick and sharps injuries and factors associated among health care workers in a Malaysian Hospital. *European Journal of Social Sciences*. 2010;13(3): 354–362. Available:http://www.researchgate.net/.../235607171_Needle_Stick_and_Sharps_I
(Accessed 4th March 2016)
 13. Ndako JA, Onwuliri EA, Adelani-Akande T, Olaolu DO, Dahunsi SO, Udo UD. Screening for hepatitis B surface antigen (Hbsag) among health care workers (Hcw) in an Urban Community South –South Nigeria. *IJBPAS*. 2014;3(3):415-425. Available:<http://ijbpas.com/pdf/1394019734MS%20IJBPAS%202014%201722.pdf>
(Accessed: April 29, 2016)
 14. Elmukashfi TA, Ibrahim OA, Elkhidir IM, Bashir AA, Elkarim MAA. Hazards analysis, within departments and occupations, for hepatitis B virus among health care workers in public teaching hospitals in Khartoum State; Sudan. *Glob J Health Sci*. 2012;4(6):51–59. Available:<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4776995/>
(Accessed: 29th April, 2016)
 15. Topuridze M, Butashvili M, Kamkamidze G, Kajaia M, Morse D, McNutt LA. Barriers to hepatitis B vaccine coverage among healthcare workers in the Republic of Georgia: An international perspective. *Infection Control and Hospital Epidemiology*. 2010;31(2):158-164. Available:<http://www.jstor.org/stable/10.1086/649795>
DOI: 10.1086/649795
(Accessed: 29th April, 2016)
 16. Okwara EC, Enwere OZ, Diwe CK, Azike JE, Chukwulebe AE. Theatre and laboratory workers' awareness of and safety practices against hepatitis B and C infection in a suburban university teaching hospital in Nigeria. *The Pan African Medical Journal*; 2012. Available:<http://www.panafrican-med-journal.com/content/article/13/2/full/>
(Accessed: 22nd February, 2016)
 17. Centers for Disease Control and Prevention. CDC health information for international travel. New York: Oxford University Press; 2012. Available:<http://hepbblog.org/2012/10>
(Accessed: 22nd April, 2016)

18. Ogoina D, Pondei K, Adetunji B. Prevalence of hepatitis B vaccination among health care workers in Nigeria in 2011–12. *Int J Occup Environ Med.* 2014;5:51-56.
Available:<http://www.theijoem.com/ijoem/index.php/ijoem/article/viewFile/362/439>
(Accessed: 13th April, 2016)
19. Adekanle O, Ndububa DA, Olowookere SA, Ijarotimi O, Ijadunola KT. Knowledge of hepatitis B virus infection, immunization with hepatitis B vaccine, risk perception, and challenges to control hepatitis among hospital workers in a Nigerian Tertiary Hospital. *Hepatitis Research and Treatment.* 2015;6. Article ID 439867.
Available:<http://dx.doi.org/10.1155/2015/439867>
(Accessed: 2nd February, 2016)
20. Centers for Disease Control and Prevention. Recommended vaccines for healthcare workers; 2014.
Available:<http://www.cdc.gov/vaccines/adults/rec-vac/hcw>
(Accessed: 24th may, 2016)
21. Njemanze C, Erhabor O. Hepatitis B immunity status of healthcare workers in Lagos, Nigeria. *Int. J. Biol. Chem. Sci.* 2009;3(6):1509-1514.
Available:<http://ajol.info/index.php/ijbcs>
(Accessed: 27th May, 2016)
22. Schillie S, Murphy TV, Murphy V, Sawyer M, et al. CDC Guidance for evaluating health-care personnel for hepatitis B virus protection and for administering post exposure management. *Recommendations and Reports.* 2013;62(RR10):1-19.
Available:<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6210a1.htm>
(Accessed: 22nd April, 2016)
23. CDC MMWR. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States; 2006.
Available:<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5516a1.htm>
(Accessed: 12th May, 2016)
24. Sharma R, Rasania SK, Verma A, Singh S. Study of prevalence and response to needle stick injuries among health care workers in a tertiary hospital in Delhi, India. *India J community Med.* 2010;35:74-7.
Available:<http://www.ijcm.org.in/text.asp?2010/35/1/74/62565>
(Accessed: 28th April, 2016)
25. Reda AA, Fisseha S, Mengistie B, Vanderweerd J. Standard precautions: Occupational exposure and behaviour of health care workers in Ethiopia. *PLoS One.* 2010;5(12):e14420.
Available:<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3009714/>
(Accessed: 29th May, 2016)
26. Singhal V, Bora D, Singh S. Hepatitis B in health care workers: Indian scenario. *J Lab Physicians.* 2009;1(2):41–48.
Available:<http://dx.doi.org/10.4103/0974-2727.59697>
[PMC free article] [PubMed]
(Accessed: 10th March, 2016)
27. Singhal V, Bora D, Singh S. Prevalence of hepatitis B virus infection in healthcare workers of a tertiary care centre in India and their vaccination status. *J Vaccines Vaccine.* 2012;2:118.
Available:<http://dx.doi:10.4172/2157-7560.1000118>
28. Abdalwhab M, Nafi M. Sero-frequency of hepatitis B infection among health care workers in Khartoum. *American Journal of Research Communication.* 2014;2(12): 148-154.
Available:http://www.usa-journals.com/wp-content/uploads/2014/11/Abdalwhab_Vol2_12.pdf
(Accessed: 28th April, 2016)
29. Karaosmanoglu HK, Aydin OA, Rahsan Ince E, Emirhan Isik M, Kok M. HBV serological profiles and vaccination status among healthcare workers in Istanbul, Turkey. *J Anc Dis Prev Rem.* 2015;3:122.
DOI: 10.4172/2329-8731.1000122
Available:<http://www.esciencecentral.org/journals/hbv-serological-profiles-and-vaccination-status-among-healthcare-workers-inistanbul-turkey-2329-8731-1000122.php?aid=58324>
(Accessed 29th April, 2016)
30. Ziraba AK, Bwogi J, Namale A, Wainaina CW, Mayanja-Kizza H. Sero-prevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. *BMC Infectious Diseases.* 2010;10:191.
Available:[PMC free article] [PubMed]
(Accessed: 30th march, 2016)
31. Geberemichael A, Gelaw A, Moges F, Dagnaw M. Seroprevalence of hepatitis B virus infections among health care workers at the Bulle Hora Woreda Governmental Health Institutions, Southern Oromia,

- Ethiopia. *J Environ Occup Sci*. 2013;2(1): 9-14.
DOI: 10.5455/JEOS.20130220105759
(Accessed April 30, 2016)
32. Hashemi SH, Mamani M, Torabian S. Hepatitis B vaccination coverage and sharp injuries among healthcare workers in Hamadan, Iran. *Avicenna J Clin Microb Infec*; 2014.
Available:ajcmicrob.com/33787
(Accessed: 5th May 2016)
33. Askarian M, Yadollahi M, Kouchak F, Danaei M, Vakili V, Momeni M. Precautions for health care workers to avoid hepatitis B and C virus infection; 2014.
Available:<http://www.theijoem.com/ijoem/index.php/ijoem>
(Accessed: 5th May, 2016)
34. Yousafzai MT, Qasim R, Khalil R, Kakahel MF, Rehman S. Hepatitis B vaccination among primary health care workers in Northwest Pakistan. *Int J Health Sci (Qassim)*. 2014;8(1):67-76.
Available:<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4039586/>
(Accessed: 5th May, 2016)
35. Abeje G, Azage M. Hepatitis B vaccine knowledge and vaccination status among health care workers of Bahir Dar City Administration, Northwest Ethiopia: A cross sectional study. *BMC Infectious Diseases*; 2015.
Available:<http://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-015-0756-8>
(Accessed: 10th may, 2016)
36. Pathak R, Chaudhary C, Pathania D, Ahluwlia SK, Mishra PK, Kahlon AS. Hepatitis B vaccines: Coverage and factors relating to its acceptance among health care workers of a tertiary care centre in North India. *Int. J Med Public Health*. 2013;3:55-9.
Available:<http://www.ijmedph.org/text.asp?2013/3/1/55/109324>
(Accessed: 22nd April, 2016)
37. Cunha JP. Recombivax side effects centre. *RxList* 8/28/2015.
Available:www.rxlist.com/recombivax-drug/side-effects-interactions.htm
(Accessed 22nd June, 2016)
38. Nasir K, Khan KA, Kadri WM, Salim S, Tufail K, Sheikh HZ, Ali SA. Hepatitis B vaccination among health care workers and students of medical college. *J Pak Med Assoc*. 2000;50970:239-43.
Available:www.ncbi.nlm.nih.gov/pubmed/10992702
(Accessed: 10th may, 2016)
39. Hassan M, Awosan KJ, Nasir S, Tunau K, Burodo A, Yakubu A, Oche MO. Knowledge, risk perception and hepatitis B vaccination status of healthcare workers in Usman Danfodiyo University Teaching hospital, Sokoto, Nigeria. *J. Public Health Epidemiol*. 2016.8(4):53-59.
Available:<http://www.academicjournals.org/journal/JPHE/article-abstract/6539BB057378>
DOI: 10.5897/JPHE2015.0795
(Accessed: 25th May, 2016)
40. Abiola AO, Agunbiade AB, Badmos KB, Lesi AO, Lawal AO, Alli QO. Prevalence of HBsAg, knowledge, and vaccination practice against viral hepatitis B infection among doctors and nurses in a secondary health care facility in Lagos state, South-western Nigeria. *The Pan African Medical Journal*. 2016;23:160.
DOI: 10.11604/pamj.2016.23.160.8710
(Accessed: 22nd February, 2016)
41. Muhammed AA, Ibrahim BC, Ramadan AM. Knowledge, attitude and practice regarding hepatitis B infection among nurses in public hospitals of Niger State, Nigeria. *International Journal of TROPICAL DISEASE & Health*. 2016; 12(3):1-9.
DOI: 10.9734/IJTDH/2016/18663
(Accessed 25th may, 2016)
42. Daboer JC, Chingle MP, Banwat ME. Knowledge, risk perception and vaccination against hepatitis B infection by primary healthcare workers in Jos, North Central Nigeria. *The Nigerian Health Journal*. 2013;10(1-2).
Available:www.tnhjph.com/index.php/tnhj/article/download/31/25
(Accessed: 22nd April 2016)
43. Azodo CC, Ehizele AO, Uche I, Erhabor P. Hepatitis-B vaccination status among dental surgeons in Benin City, Nigeria. *Ann Med health Sci Res*. 2012;2:24-8.
Available:<http://www.amhsr.org/text.asp?2012/2/1/24/96932>
(Accessed: 22nd, February 2016)
44. Osazuwa F, Ugbebor O, Mudiaga PE. Hepatitis B virus vaccination status of laboratory workers in Nigerian hospitals. *Journal Online*. 2013;11(4).
Available:<http://www.ajol.info/index.php/nhp/issue/view/12543>
(Accessed: 5th May 2016)

45. Kesieme EB, Uwakwe K, Irekpita E, Dongo A, Bwala KJ, Alegbeleye BJ. Knowledge of hepatitis B vaccine among operating room personnel in Nigeria and their vaccination status. *Hepatitis Research and Treatment*. 2011;5. Article ID 157089. Available:<http://dx.doi.org/10.1155/2011/157089> (Accessed: 22nd May, 2016)
46. Obi AI, Ofili AN. Hepatitis B vaccination uptake among doctors in Benin City, Edo State, Nigeria. *J Community Med Health Educ*. 2013;3:246. Available:<http://dx.doi.org/10.4172/2161-0711.1000246> (Accessed 22nd May, 2016)
47. Samuel SO, Aderibigbe SA, Salami TAT, Babatunde OA. Health workers' knowledge, attitude and behaviour towards hepatitis B infection in Southern Nigeria. *International Journal of Medicine and Medical Sciences*. 2009;1(10):418-424. Available:<http://www.academicjournals.org/ijmms> (Accessed: 22nd May, 2016)
48. Ibekwe RC, Ibeziako N. Hepatitis B vaccination status among health workers in Enugu, Nigeria. *Niger J Clin Pract*. 2006;9:7–10. Available:[PubMed]<http://www.ncbi.nlm.nih.gov/pubmed/16986281> (Accessed: 12th May, 2016)
49. Fatusi AO, Fatusi OA, Esimai AO, Onayade AA, Ojo OS. Acceptance of Hepatitis B vaccine by workers in a Nigerian teaching hospital. *East African Medical Journal*. 2000;77(11):608-612. Available:www.ncbi.nlm.nih.gov/pubmed/12862107 (Accessed: 25th May, 2016)
50. Okeke EN, Ladep NG, Agaba EI, Malu AO. Hepatitis B vaccination status and needle stick injuries among medical students in a Nigerian university. *Niger J Med*. 2008;17:330–2. Available:[PubMed]<http://www.ncbi.nlm.nih.gov/pubmed/18788262>
51. Mbaawuaga EM, Enenebeaku MNO, Okopi JA, Damen JG. Hepatitis B virus (HBV) infection among pregnant women in Makurdi, Nigeria. *African Journal of Biomedical Research*. 2008;11:155–159. Available:<http://www.ajol.com> (Accessed: 30th March, 2016)

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