

Hepatitis B Vaccination Coverage and Knowledge among Healthcare Workers at a Tertiary Hospital in Jeddah, Saudi Arabia

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ABSTRACT

Background: Healthcare workers in tertiary hospital are at the risk of exposure and possible transmission of hepatitis B virus (HBV) infection. This infection is a major and important occupational hazard among health care workers (HCWs), it is may be 2–10 times higher than in the general population.

Objectives: To detect the hepatitis B vaccination coverage and the level of knowledge among HCWs.

Methods: A cross-sectional study was performed on a representative sample of health care workers randomly selected from a tertiary hospital, Jeddah, Saudi Arabia through stratified cluster sampling.

Results: vaccination coverage among study group was 63.3%. Complete HBV vaccination was significantly associated with age, duration of work and profession ($p=0.002$, 0.038 and 0.049 , respectively). Our predictors of complete vaccination coverage were age above 30 years (OR= 2.164; 95% CI: 0.678 -3.907), profession [dentists (OR= 2.89; 95% CI: 0.96 -6.71) and lab technicians (OR= 3.09; 95% CI: 0.95-8.00)] and those who had positive perception towards HBV vaccine (OR= 2.52; 95% CI: 1.57- 4.05) and good knowledge about HBV vaccine (OR= 1.84; 95% CI: 1.14- 2.95).

Conclusion: HBV vaccination coverage among HCWs was low and they had lack of knowledge although they had good awareness about the vaccine. So we recommend to increasing the vaccine coverage through training and the educational program must be given to HCWs about HBV vaccine and the necessity of following the HBV vaccine course. Enforcement makes a valid certificate that the HCW can keep for employment. Furthermore a policy of mandatory hepatitis B surface antigen screening is important. Different communication and discussion about beliefs and fear is effective.

Keywords: Healthcare worker; Hepatitis B vaccine; knowledge; perception; HBV.

1. INTRODUCTION

Hepatitis B virus (HBV) infection is a major and important occupational hazard among health care workers (HCWs), it is may be 2–10 times higher than in the general population [1]. HCWs are always at the risk of acquiring infection from

their patients. Accidental needle stick and sharps injuries (NSSIs), which are common among HCWs, are high-risk conditions for blood-borne pathogens transmission [2]

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Many studies among HCWs the average risk of transmission after percutaneous exposure to infected blood has been estimated approximately 0.3% for human immunodeficiency virus (HIV), 1.8% for Hepatitis C virus (HCV) and 6–30% for HBV [3]. Injuries with contaminated injection devices are frequent in developing countries due to the lack of knowledge about control practices, the lack of resources for sterilization and buying disposables and cultural issues [4].

After infection with HBV, 10% of the patients develop chronic hepatitis and about 15%-25% develop cirrhosis. Half of these individuals later develop hepato-cellular carcinoma [5].

Although the incidence of HBV infection has drastically reduced after the introduction of effective vaccination, modification of high-risk practices and possibly a decrease in the number of susceptible persons, yet about 400 million people worldwide are carriers of HBV. The acute and chronic consequences of HBV infection are major problems both in developed as well as developing world [6].

In developing countries needle-stick injuries (NSIs) cause a high infection rate of 40% to 60% among HCWs; however, vaccination has reduced the HBV infection rate to less than 10% in developed countries [7].

According to current CDC recommendations all HCWs and students should receive hepatitis B vaccine. Vaccination (3-dose series) should be followed by assessment of hepatitis B surface antibody to determine vaccination immunogenicity and, if necessary, revaccination. HCWs who do not have protective concentration of anti-HBs (HBsAb) (>10 mIU/ml) after revaccination (i.e. after receiving a total of 6 doses) should be tested for HBsAg and anti-HBc to determine their infection status [8].

Pre-vaccination serologic testing is not indicated for most persons being vaccinated, except for those persons and students at increased risk for HBV infection, such as those born to mothers in or from endemic countries [9].

Providers who are performing exposure-prone procedures also should receive pre-vaccination testing for chronic HBV infection [10]. Exposure of a patient to the blood of HBV-infected HCWs should be handled with post-exposure prophylaxis and testing of the patient in a manner similar to the reverse situation (i.e., prophylaxis for providers exposed to the blood of an HBV-infected patient) [11].

Before 1990, Kingdom of Saudi Arabia (KSA) was considered one of the hyper-endemic countries for HBV infection. At that time, crude prevalence of HBV infection in different provinces of the Kingdom ranged between 5% -12%. The overall prevalence was estimated to be 8.3% [12]. In 1990, a National Vaccination Program against HBV was introduced. A Committee for the prevention of HBV infection was constituted and an immunization apparently resulted in significant reduction of HBV infection among Saudi children with reported that the prevalence has dropped to 0.05% [13]. In the current study we detect the hepatitis B vaccination coverage among HCWs at a tertiary hospital, Jeddah, Saudi Arabia and to determine the level of knowledge about the Hepatitis B vaccine, risk of exposure to HBV infection and perception towards HBV vaccine among HCWs

2. METHODS

A cross-sectional study was performed on a representative sample of HCWs randomly selected from a tertiary hospital, Jeddah, Saudi Arabia through stratified random sample. It is a referral hospital for training undergraduate and postgraduate students and for research.

The sample size was calculated using WHO manual for sample size determination in health studies considering an anticipated HCWs proportion of vaccination coverage of 50% and an absolute precision of 5% at a 95% confidence, the minimal sample size required for the study was estimated to be 384 HCWs. To overcome for possible non-responses or any missing data, we distributed of 450 questionnaires and returned 400 where two questionnaires excluded due to incomplete data. An informed consent was obtained from each one participated. All HCWs were eligible for the study.

Participating HCWs completed a self-administered questionnaire which was based mainly on the knowledge of hepatitis B virus vaccination, knowledge of risk of exposure, and perception towards HBV vaccine.

The following information was requested: demographic characteristics (age, gender, marital status, nationality, duration of work); professional group [physicians, dentists, lab technicians, nurses and others (dietitian, radiologist and managers)] and self reported status of immunization (HBsAb),

The participants were classified into two groups, who complete the vaccination course (full vaccine coverage of three doses) and those

who had not vaccinated at all or incomplete the course (one dose or two doses) of vaccination (unvaccinated group). Ethical committee approval for the study was obtained from the Ethical Review Board and also from the hospital committee.

2.1 Statistical Analysis

The data from all the returned questionnaires were coded and entered into SPSS, version 16, and analysis done. Descriptive statistic in the form of mean and standard deviation for quantitative data and number and percent for qualitative data were done. Chi-square and Fisher's Exact Test were used to detect the association and logistic regression was used to detect the predictors of complete vaccination coverage. The level of significance was set at $P < 0.05$.

3. RESULTS

Out of 450 distributed questionnaires, 400 were returned and 398 were included in this study with a response rate of 88.9 %. As demonstrated in Table 1, the mean age of participants was 31.51 ± 9.11 years and mean duration of work was 5.92 ± 6.38 years. Most of study group (72.9%) were females, 61.3% were Saudi, 51.2% were married, and professional group was 35.7%, 6.0%, 5.8%, 30.7% and 21.8% (physicians, dentists, lab technicians, nurses and others, respectively), (other includes dietitian, radiologist and managers).

As displayed in Table 1, vaccination coverage among study group was 63.3% completely vaccinated (full vaccine coverage of three doses) while 36.7% were not vaccinated. Moreover self reported immunity status (HBsAb) of completely vaccinated group was 27.4% positive, 44.0% negative and 28.6% don't know their immune status.

Association between completely vaccinated and unvaccinated group regarding personal characteristics demonstrated in Table 2. Complete HBV vaccination was significantly associated with age, duration of work and profession group ($p=0.002$, 0.038 and 0.049 , respectively). Moreover, physicians were had higher percentage of unvaccinated (41.5%) than dentists (20.8%), lab technicians (17.4%) and nurses (33.6%). Whereas there was no association observed with gender, nationality and marital status ($p > 0.05$).

Concerning knowledge of hepatitis B virus vaccine, 91.7% of participants were aware of the

presence of the vaccine. The majority (95.0%) answered that the vaccine should be given as part of work place safety measure. while 38.7% thought that hepatitis B vaccine can be administered simultaneously with hepatitis B immunoglobulin (HBIG) when indicated and only 24.4% of participants rightly answered that complete vaccination does not consist of just 2 doses of the vaccine (Table 3).

As regards knowledge of the risk factors for HBV infection, 90.5%, 78.4%, 73.4% and 62.8% believed that hepatitis B virus infection can be transmitted through percutaneous injury, mucous membrane contact with blood, and contact of abraded skin with potentially infected tissue, contact of skin afflicted with dermatitis with potentially infected body fluid, respectively. Eighty seven percent (87%) of participants thought that they were at a greater risk of becoming infected with HBV than the general population (Table 3). Furthermore completely vaccinated group had significantly higher rates of knowledge than unvaccinated group regarding their awareness of the existence of hepatitis B vaccine (93.9% versus 70.3%, $P=0.000$) and rightly indicated that fully vaccination dose not consist of just 2 doses of the vaccine (70.0% versus 30.0%, $P = 0.002$). While no significant difference was observed regarding other questions about knowledge of HBV vaccine ($P > 0.05$). On the other hand regarding knowledge related to the risk factors for HBV infection, the only significant difference between the two groups was Percutaneous injury with blood is considered risk factor for HBV infection ($P=0.035$). Other than there was no significant difference between them ($P > 0.05$) regarding the rest of the questions.

The majority of study group had positive perception of the hepatitis B vaccine, 91.7 % of the respondents agreed that the vaccine is safe, 90.7% of respondents would recommend the vaccine to another colleagues and 50.0% of respondents did not know how many of their colleagues that had received hepatitis B vaccine (Table 3). Moreover, There was statistical significant difference between completely vaccinated and unvaccinated group regarding their agreement that HB vaccine is safe (66.0% versus 34.0%, $P=0.000$), recommendation of HB vaccine to another colleague (66.8% versus 33.2%, $P=0.000$) and about how many of their colleagues had received HBV vaccine (71.4% versus 28.6%, $P=0.001$).

The result of the logistic regression model demonstrated in Table 4, it indicated that our

predictors of complete vaccination coverage among the participants were **those** who had age above 30 years (OR= 2.85; 95% CI: 1.40 -5.82), profession group [dentists OR= 2.89; 95% CI: 0.96 -6.71) and lab technicians (OR= 3.09; 95% CI: 0.95-8.00)]; moreover those who had **positive** perception towards HBV vaccine (OR= 2.52; 95% CI: 1.57- 4.05) and **good knowledge about HBV vaccine** (OR= 1.84; 95% CI: 1.14- 2.95).

Table 1. Demographic characteristics and Vaccine coverage among study group

	Study group (N=398) N (%)
Age/ year:	
mean ± SD	31.51 ±9.114
Duration of work / year:	
mean ± SD	5.92 ±6.384
Gender	
Male	108 (27.1)
Female	290 (72.9)
Nationality	
Saudi	244 (61.3)
Non- Saudi	154 (38.7)
Marital status	
Single	179 (45)
Married	204 (51.2)
Divorced	15 (3.8)
Occupations :	
Physicians	142 (35.7)
Dentists	24 (6.0)
Lab technicians	23 (5.8)
Nurses	122 (30.7)
Others	87 (21.8)
Vaccination coverage:	
Completely Vaccinated	252 (63.3)
un vaccinated	146 (36.7)
Immune status (HBsAb) (n=252) :	
Positive	69 (27.4)
Negative	111 (44.0)
I don't know	72 (28.6)

4. DISCUSSION

At the time of study, the hospital has policies requiring staff to be vaccinated against HBV, free HBV vaccination was routinely accessible to staff in this hospital. This study surveyed the hepatitis B vaccination coverage among HCWs at a tertiary hospital. Our results show that 63.3% of studied HCWs completely vaccinated with three doses of the HB vaccine while 36.7% had not received the vaccine.

The HBV vaccination coverage rate reported in the current study (63.3%) is higher than the rates

of 40% reported among selected HCWs in Sweden (fully vaccinated) [14], 48.2% had full coverage in dental workers in Japan [15] and only 19.9% had full coverage of vaccination among HCWs in South Africa [16]. Additionally, the HBV vaccination rates among HCWs in the Middle East and other countries with low socioeconomic status have been reported to be unsatisfactory [14]. Studies from India [17], Pakistan [18], Egypt [19], Brazil [20] and Nigeria [21] indicate that only 16—60% of HCWs have received complete HBV immunization. In these countries, paramedics were more often unaware of HBV transmission and received HBV vaccination less often than doctors. However, our rate is less than rates reported among HCWs in other countries such as USA (75%) [22], France (93%) [23], Libya (72%) [24].

The current study observed that completely HBV vaccination was significantly associated with age, duration of work, profession **group**, and **positive** perception of the hepatitis B vaccine. Moreover, logistic regression indicated that our predictors of complete vaccination **coverage** among the participants were those who had age above 30 years, profession group [dentists and lab technicians **more predictor for full vaccination than physicians**], **those who had good knowledge about HBV vaccine** and **positive** perception towards HB vaccine. Our results are in agreement with the findings of a study done in Nigeria [25] and Egypt [26] where vaccination coverage among HCWs was linked with longer years of working duration. In the same study at Egypt because routine HBV vaccine was not offered to HCWs in study sites, it is probable that younger HCWs had poorer vaccine uptake probably due to their lower access to HBV vaccine or poorer knowledge about their need for HBV vaccination as they are high risk group.

On the contrary, a different finding was reported in Greece [27] where younger HCWs were shown to be more likely to complete HBV vaccination. This difference may be due to different methods used or study tools or sample size.

Our results revealed most of participants had good knowledge of the risk factors for hepatitis B virus infection and good perception towards the hepatitis B vaccine. We think that the reason may be due to receiving educational **programs** on hepatitis or from the media. This is in agreement with studies by Kesieme et al. [28] reported the most of study group were aware of the modes of transmission of HBV infection but the vaccination coverage among HCWs in Nigeria was low (65%). They noticed

Table 2. Association between completely vaccinated and unvaccinated group regarding personal characteristics
Please check this table

	Vaccine coverage (N=398)		X ²	P-value
	Completely vaccinated (n=252) N (%)	Unvaccinated (n=146) N (%)		
Gender				
Male	70 (64.8%)	38 (35.2%)	0.143	0.727
Female	182 (62.8%)	108 (37.2%)		
Age/ year				
≤ 30	141 (57.3%)	105 (42.7%)	9.98	0.002*
> 30	111 (73.0%)	41 (27.0%)		
Nationality				
Saudi	100 (64.9%)	54 (35.1%)	0.283	0.669
Non-Saudi	152 (62.3%)	92 (37.7%)		
Work duration /year				
≤ 5	154 (59.5%)	105 (40.5%)	4.750	0.038*
> 5	98 (70.5%)	41 (29.5%)		
Marital status				
Single	107 (59.8%)	72 (40.2%)	1.755	0.210
Married	145 (66.2%)	74 (33.8%)		
Profession :				
Physicians	83 (58.5%)	59 (41.5%)	9.474 ^a	0.049*
Dentists	19 (79.2%)	5 (20.8%)		
Lab technicians	19 (82.6%)	4 (17.4%)		
Nurses	81 (66.4%)	41 (33.6%)		
Others	50 (57.5%)	37 (42.5%)		

* Significant $P < 0.05$

^a Fisher's Exact Test

Table 3. Knowledge of hepatitis BV vaccine, risk factors for HBV infection and perception towards HBV vaccine among study group
Please check this table

Knowledge of HBV vaccine		N	%
Are you aware of vaccination for hepatitis B	Yes	365	(91.7)
	No	33	(8.3)
Hepatitis B vaccine should be given as part of work place safety	Yes	378	(95.0)
	No	10	(2.5)
	DNK	10	(2.5)
Hepatitis B vaccine can be administered simultaneously with HBIG (the immunoglobulin) when indicated	Yes	154	(38.7)
	No	43	(10.8)
	DNK	201	(50.5)
When indicated as part of post-exposure prophylaxis, it should be administered within 24 hrs of exposure	Yes	182	(45.7)
	No	29	(7.3)
	DNK	187	(47.0)
For complete protection, it consists of two doses at 0 and 6 months	Yes	175	(44.0)
	No	97	(24.4)
	DNK	126	(31.6)
Knowledge of risk factors of HBV infection?		N	%
Per-cutaneous injury with blood	Yes	360	(90.5)
	No	38	(9.5)
Mucous membrane contact with blood	Yes	312	(78.4)

	No	86 (21.6)
Contact of abraded skin with potentially infected tissue	Yes	292 (73.4)
	No	106 (26.6)
Contact of skin afflicted with dermatitis with potentially infected body fluid	Yes	250 (62.8)
	No	148 (37.2)
Do you agree you are at risk more than the general population?	Yes	346 (87)
	No	28 (7.0)
	DNK	24 (6.0)
Perception of the HBV vaccine		N %
You agree that HBV vaccine is safe	Yes	365 (91.7)
	No	7 (1.8)
	DNK	26 (6.5)
I will recommend HBV vaccine to another colleague staff	Yes	361 (90.7)
	No	13 (3.3)
	DNK	26 (6.0)
Do you think your colleagues have received HBV vaccination?	KN	199 (50.0)
	DKN	199 (50.0)
<i>DNK= Do not know KN= Know</i>		

78.9% of respondents assumed that Hepatitis B vaccine is safe and 81.1% would recommend it to another staff. On the opposite, other studies confirmed a very low knowledge of hepatitis B infection [29-32]. Kamolratanakul reported that lack of knowledge and negative attitudes were the major reasons for unvaccination against hepatitis B virus. These were found to improve significantly after distribution of information about HBV infection with rates increasing from 56.9% to 77.7% [33].

On the other hand, regarding knowledge of HBV vaccine, although most of study group had good awareness (91.7%) about the vaccine however they had a lack of knowledge of some statements for HBV vaccine as 24.4% of

participants rightly pointed to the right doses of the vaccine. This is similar to other study [28] observed that the majority (86.8%) had the awareness of the existence of Hepatitis B vaccine. 83.8% of respondents believed that the vaccine should be given to the personnel as part of work place safety measures. Other study found 75.5%, were aware of the existence of Hepatitis B vaccine [32]. However Quddus et al. [34] found 31% of HCWs were aware of vaccine, 45% did not consider themselves among high risk group.

The explanation between the high level of awareness and low vaccination coverage may be due to lack of time or forgot to take the vaccine .

Table 4. Predictors of complete vaccination coverage among the participants: logistic regression analysis

Characteristics	OR	95% C.I	P-value
Gender:			
Female	0.69	0.39 -1.20	0.189
Nationality :			
Non-Saudi	1.68	0.89 - 3.14	0.105
Duration of work / y:			
> 5 years	1.24	0.626 -2.47	0.533
Age:			
> 30 year	2.85	1.40 -5.82	0.004
Profession :			
- Dentists	2.89	0.96-6.71	0.059
- Lab technicians	3.09	0.95-8.00	0.059
- Nurses	1.64	0.80- 3.34	0.172
- Others	1.44	0.75- 2.75	0.267
Perception towards HBV vaccine:			
- positive	2.52	1.57- 4.05	0.000
Knowledge about HBV vaccine:			
-Good	1.84	1.14- 2.95	0.011
Knowledge about RF of HBV infection:			
- Good	0.77	0.47-1.26	0.308

OR: odds ratio, **C.I:** confidence interval, *Significant (P <0.05)*
HB= hepatitis B, **RF=** risk factors

The main strength of this study is that it includes all occupational categories of HCWs and randomly selected sample. However, this study may have some limitations as it is a cross-sectional study; therefore, the cause-effect relationship may be difficult to establish. Serological test may be needed to define vaccine status of HCWs, so further studies in this field needed.

5. CONCLUSION AND RECOMMENDATION

Although the hospital had policies requiring staff to be vaccinated against HBV and free HBV vaccination was routinely accessible to staff in this hospital, hepatitis B vaccination coverage among HCWs in the hospital was low. They have a lack of knowledge of some statements for hepatitis B virus vaccine although they had good awareness about the vaccine. So we recommend to increasing the vaccine coverage especially among the physicians as they had a higher percentage of unvaccination than other profession group, through training and the educational program must be given to HCWs about HBV vaccine (doses, safety,...) and the necessity of following the HBV vaccine course. Moreover detection of the serum level of HBsAb after a complete vaccine by one or two months could be routine before the employment in the hospital for detection of immunity status and an indication of vaccination again if it is negative. Enforcement makes a valid certificate that the HCW can keep for employment. Furthermore different communication and discussion about beliefs and fear is effective. A policy of mandatory hepatitis B surface antigen screening is important.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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REFERENCES

1. Pathoumthong K, Khampanisong P, Quet F, Latthaphasavang V, Souvong V,

- Buisson Y. Vaccination status. Knowledge and awareness towards hepatitis B among students of health professions in Vientiane, Lao PDR. *Vaccine* 2014; 32: 4993–99.
2. Hashemi SH, Mamani M and Torabian S. Hepatitis B Vaccination Coverage and Sharp Injuries Among Healthcare Workers in Hamadan, Iran. *Avicenna J Clin Microb Infec* 2014; 1(2): e19949.
3. Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in health care workers. *Clin Microbiol Rev* 2000; 13(3):385–407.
4. Shepard CW, Simard EP, Finelli L, Fiore AE, Bell BP. Hepatitis B virus infection: epidemiology and vaccination. *Epidemiol Rev* 2006; 28(1):112–25.
5. Jadoon NA, Shehzad MA, Yaqoob R, Ali R and Hussain MI. Hepatitis B vaccination status of health care workers at a tertiary care hospital in Multan. *NMJ* 2009; 1(1): 23-27
6. Nasir K, Khan KA, Kadri WM, Salim S, Tufail K, Sheikh HA and Ali SA. Hepatitis B Vaccination among Health Care Workers and Students of a Medical College. *JPMA* 2000; 50:239.
7. Hutin Y, Hauri A, Chiarello L, Catlin M, Stilwell B, Ghebrehiwet T. Best infection control practices for intradermal, subcutaneous, and intramuscular needle injections. *Bull World Health Organ* 2003; 81(7):491–500.
8. CDC. Immunization of health-care personnel: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2011; 60(No. RR-7).
9. Garner JS. Guideline for isolation precautions in hospitals. The Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1996; 17:53.
10. Mahoney FJ, Stewart K, Hu HX, Coleman P, Alter MJ. Progress toward the elimination of hepatitis B virus transmission among health care workers in the United States. *Arch Intern Med* 1997; 157:2601–5.
11. CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR* 2001; 50(No. RR-11).

12. Al-Wayli HM. Prevalence of hepatitis B surface antigen in a Saudi hospital population. *Saudi Med J* 2009; 30: 448-49.
13. Madani TA. Trend in incidence of hepatitis B virus infection in Saudi Arabia. *Trans R Soc Trop Med Hyg* 2007; 101: 278- 83.
14. Dannetun E, Tegnell A, Torner A, Giesecke J. Coverage of hepatitis B vaccination in Swedish healthcare workers. *Journal of Hospital Infection*, 2006; 63,(2): 201–4.
15. Nagao Y, Matsuoka H, Kawaguchi T, Ide T, Sata M. HBV and HCV infection in Japanese dental care workers. *International Journal of Molecular Medicine*, 2008; 21, (6): 791–99.
16. Burnett RJ, François G, Mphahlele MJ. Hepatitis B vaccination coverage in healthcare workers in Gauteng Province, South Africa. *Vaccine* 2011; 29:4293-7.
17. Sukriti, Pati NT, Sethi A, Agrawal K, Kumar GT, Kumar M, et al. Low levels of awareness, vaccine coverage, and the need for boosters among health care workers in tertiary care hospitals in India. *Journal of Gastroenterology & Hepatology* 2008; 23(11):1710—5.
18. Mengal HU, Howteerakul N, Suwannapong N, Rajatanun T. Factors relating to acceptance of hepatitis B virus vaccination by nursing students in a tertiary hospital, Pakistan. *Journal of Health, Population, and Nutrition* 2008; 26 (1):46—53.
19. Talaat M, Kandeel A, El-Shoubary W, Bodenschatz C, Khairy I, Oun S, et al. Occupational exposure to needlestick injuries and hepatitis B vaccination coverage among health care workers in Egypt. *American Journal of Infection Control* 2003; 31(8):469—74.
20. Ciorlia LA, Zanetta DM. Hepatitis B in healthcare workers: prevalence, vaccination and relation to occupational factors. *Brazilian Journal of Infectious Disease* 2005; 9(5):384-9.
21. Sadoh WE, Fawole AO, Sadoh AE, Oladimeji AO, Sotiloye OS. Practice of universal precautions among healthcare workers. *Journal of National Medical Association* 2006; 98 (5):722—6.
22. Simard EP, Miller JT, George PA. Hepatitis B vaccination coverage levels among healthcare workers in the United States, 2002-2003. *Infect Control Hosp Epidemiol* 2007; 28:783-90.
23. Loulergue P, Moulin F, Vidal-Trecan G. Knowledge, attitudes and vaccination coverage of healthcare workers regarding occupational vaccinations. *Vaccine* 2009; 27:4240-3.
24. Ziglama H, El-Hattab M, Shingheera N, Zorganib A, Elahmerd O. Hepatitis B vaccination status among healthcare workers in a tertiary care hospital in Tripoli, Libya. *Journal of Infection and Public Health* 2013; 6, 246—251.
25. Ogoina D, Pondei K, Adetunji B, Chima G, Isichei C, Gidado S. Prevalence of Hepatitis B Vaccination among Health Care Workers in Nigeria in 2011–12. *Int J Occup Environ Med* 2014; 5:51-56.
26. El-Awady MY. Hepatitis B vaccination rates among medical personnel at Ain Shams University Hospital and obstacles to vaccine uptake. *J Egypt Public Health Assoc* 1998; 73:519-37.
27. Sheikh NH, Hasnain S, Majrooh A. Status of Hepatitis B Vaccination Among The Health Care Workers of A Tertiary Hospital , Lahore. *Biomedica* 2007; 23:17-20.
28. Kesieme EB, Uwakwe K, Irekpita E, Dongo A, Kefas John Bwala KJ, Alegbeleye BJ. Knowledge of Hepatitis B Vaccine among Operating Room Personnel in Nigeria and Their Vaccination Status. *Hepatitis Research and Treatment* 2011; Article ID 157089.
29. Abeje G and 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;15:30
30. Adebamowo CA, Odukogbe AA, Ajuwon AJ. "Knowledge, attitude, and practices related to hepatitis B virus infection among Nigerian obstetricians and midwives," *Journal of Obstetrics and Gynecology* 1998; 18, (6), 528– 32.
31. Abdul RM, Munit AS, Salahuddin A, "Hepatitis B.vaccination status and knowledge, attitude, practices of health care workers (HCWS) regarding hepatitis B and C in a tertiary care setting of Karachi," *Infectious Diseases Journal* 2007;16 (4)105–7.
32. 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),418–24.
33. Kamolratanakul P, Ungtavorn P, Israsena S, Sakulramrung R. "The influence of dissemination of information on the changes of knowledge, attitude and acceptance of hepatitis B vaccination

- among hospital personnel in Chulalongkorn hospital," Public Health, 1994; 108 (1), 49–53.
34. Quddus M, Jehan M, Ali NH. Hepatitis–b vaccination status and knowledge, attitude and practice of high risk health care worker body substance isolation. J Ayub Med Coll Abbottabad 2015;27(3):664–8