

Low coverage of hepatitis B vaccine and determinants among health professionals working in Amhara regional state hospitals, Ethiopia

Berhanu Elfu Feleke

Department of Epidemiology and Biostatistics, University of Bahir Dar, Ethiopia

Abstract

More than two billion people have been infected with hepatitis B virus (HBV), 360 million have chronic infection and 600,000 die each year from HBV-related liver disease or hepatocellular carcinoma. Each year more than 66,000 health professionals are infected by hepatitis B virus and vaccination against hepatitis B saves the life's of these health professionals. The aim of this study was to determine the prevalence and associated factors of hepatitis B vaccine coverage in a resource limited settings. A cross sectional study design was conducted. The study was conducted on 1184 health professionals at Amhara national regional state, Ethiopia. Simple random sampling technique was used. Structured questionnaire was used to collect the data. Descriptive statistics were used to identify the prevalence while Binary logistic regression was used to assess the determinants of hepatitis B vaccine coverage. The coverage of hepatitis B vaccine was 4%. Vaccination were affected by work load (AOR=0.19, 95%CI= 0.08-0.46; P<0.01), negligence (AOR=0.04, 95%CI=0.01-0.11; P<0.01), universal precaution training (AOR=14.75, 95%CI=5.66-38.44; P<0.01), perception that they are not at risk of infection (AOR=0.34, 95%CI=0.15-0.79; P=0.01), unaffordable cost (AOR=0.12, 95%CI=0.05-0.28; P<0.01), awareness about the vaccine (AOR=4.55, 95%CI=1.53-13.49; P<0.01), peer pressure (AOR=3.8, 95%CI=1.34-10.74; P=0.01), knowledge about where to get the vaccine (AOR=5.13, 95%CI=1.87-14.11; P=0.02), unavailability of the vaccine (AOR=0.25, 95%CI=0.1-0.63; P=0.03), year of experience (AOR=7.27, 95%CI=2.23-23.72; P<0.01). Low hepatitis B vaccine coverage was observed. The ministry of health should avail the vaccine to all those health professionals, develop awareness on HBV and improve the affordability of the vaccine.

Introduction

Hepatitis B is a contagious liver disease that

results from infection with the hepatitis B virus (HBV). At initial infection, a person can develop an acute infection, which can range in severity from a very mild illness with few or no symptoms to a serious condition requiring hospitalization.¹ Patients in the first 6 months manifest with the symptoms of acute viral hepatitis. Some patients fight the infection and clear the virus without any intervention. For others, the infection remains and leads to a chronic or lifelong illness. Chronic HBV refers to the illness that occurs if the HBV remains in a person's body. HBV infection can result in devastating health problems;¹ approximately 15-25% of patients develop serious health problems including liver damage, cirrhosis, liver failure, and hepatocellular carcinoma (HCC).^{1,2}

Approximately 2 billion people have been infected with HBV, more than 360 million people have chronic viral hepatitis, and 600,000 annual mortalities have been registered due to HBV infection.²⁻⁶

Each year, more than 3 million health professionals suffer from percutaneous exposure to blood borne pathogens. More than 66,000 health professionals are infected by HBV, 500-600 health professionals are hospitalized, and more than 200 health professionals develop chronic hepatitis as a result of their occupation.⁷⁻⁹ Each year, more than 400,000 health professionals suffer from percutaneous injuries in the United State of America (USA).¹⁰ The prevalence of HBV infection in Brazilian health professionals is 0.8%.¹¹

Sub-Saharan Africa (SSA) has a burden of 7-26% of chronic HBV infections.¹² Approximately one-quarter (25.7%) of Nigerian surgeons are infected by HBV.¹³ The prevalence of HBV infection in Ugandan medical students ranges from 45-79%.¹⁴

The probability of HBV infection in an unvaccinated person with single sharp injury ranges from 6-30% ,with higher risk. among health professionals.^{6,15-17}

The transmission of HBV is possible if a person is in contact with infected body fluids.² HBV is more infectious than HIV (50-100 times), and humans are the primary reservoirs.¹⁸ Importantly, the virus can remain alive for 7 days outside the human being and can infect others.² Vaccination is a primary way to prevent HBV infection.¹ In USA, occupational exposure to HBV infection historically accounts for 4.5% of acute HBV cases.¹⁹

We have no medication that can cure HBV, which underscores the importance of hepatitis B vaccination. The hepatitis B vaccine is safe and effective if appropriate doses are given during a period of 6 months. With more than 90% effective protection after all doses.^{2,3,20-24}

After the implementation of universal Hepatitis B vaccination in the 1990s by many countries, especially in the western world HBV

Correspondence: Berhanu Elfu Feleke, Department of Epidemiology and Biostatistics, University of Bahir Dar, 1160 Bahir dar, Ethiopia. Tel.: +25.1918312095. E-mail: elfufeleke@gmail.com; berhanue@bdu.edu.et.

Key words: Prevalence; Hepatitis B; Vaccination; Health Professionals; Hospitals.

Acknowledgements: the author would heartfelt thank the University of Bahir Dar for financially granting this work. He would like to acknowledge Amhara National Regional State Health Bureau for giving the necessary information. He would also like to acknowledge the data collectors, field supervisors and all the hospital staffs for their cooperation during the data collection stage.

Conflict of interest: the author declares no potential conflict of interest.

Received for publication: 26 April 2016.

Revision received: 14 September 2016.

Accepted for publication: 30 November 2016.

This work is licensed under a Creative Commons Attribution NonCommercial 4.0 License (CC BY-NC 4.0).

©Copyright B. Elfu Feleke, 2016

Licensee PAGEPress, Italy

Journal of Public Health in Africa 2016; 7:553

doi:10.4081/jphia.2016.553

mortality and morbidity reduced significantly.³

The hepatitis B vaccine averts new infection, which in turn leads to prevention of HCC.^{3,25,26}

A 1998 study from Pakistan revealed that the coverage of hepatitis B vaccine among health professionals was 49%. Hepatitis B vaccination was affected by the high cost of the vaccine and the belief that they are not at risk of hepatitis B virus infection.²⁷

A 2003 study in the USA showed that the coverage of hepatitis B vaccine among health professionals was 75% and was highest among nurses and white health professionals.²⁸

Studies from Pakistan indicated that the coverage of hepatitis B vaccine among health professional ranges from 49% to 86%.²⁹⁻³²

A 2009 survey from Pakistan identified that the most common reasons cited by health care worker (HCWs) for not getting vaccinated were forgetting dosage schedule, lack of awareness and negligence.³³

Another study from Georgia in 2010 identified that the coverage of Hepatitis B vaccine among health care personnel was 12% for physicians and 54% for nurses. The uptake of the vaccine was affected by perception of the vaccine's safety and perception of the risk of infection.³⁴

A 2011 finding from Pakistan predicted that work pressure, negligence, unaffordability and unavailability were the barriers for taking the hepatitis B vaccine.³⁵

A 2013 finding from Lao PDR identified that the coverage of hepatitis B vaccine among health professionals was 21%, and the uptake of the vaccine was affected by sex, age, marital status, educational status, and poor knowledge about the vaccine.³⁶

A 2013 finding from Iraq revealed that hepatitis B immunization coverage was 45 % and was affected by knowledge and years of experience.³⁷

A survey from SSA revealed that 39% of surgeons reported that they are fully vaccinated against hepatitis B.³⁸ In Cameroon, the coverage of the Hepatitis B vaccine was 5.5%, and being a doctor increased the probability of vaccination.³⁹ In Uganda, only 6.2% of health care workers in tertiary hospitals were vaccinated against HBV.⁴⁰

The World Health Organization, the center for disease control and prevention, and the federal democratic republic of Ethiopia ministry of health infection-prevention guidelines recommend that all health professionals should be vaccinated against HBV vaccine before they start the clinical attachments during their stay in the medical school.⁴¹⁻⁴³ Thus, evaluating the coverage of HBV vaccine among health professionals might help in designing specific intervention in this HBV high risk population.

The objective of this study was to determine the prevalence and associated factors of Hepatitis B vaccine coverage among health professionals working in Amhara National Regional State Hospitals in Ethiopia.

Materials and Methods

A cross-sectional study design was conducted from January to September 2014 in Amhara National Regional State Hospitals. Located in a Region for 17 hospitals, divided into 11 zones and 3 metropolitan cities with a total population of 17,214,056 and with a total area of 154,708.96 square kilometers based on the 2007 census.⁴⁴ The target population for the study was all health professionals working in Amhara National Regional State Hospitals. Consisting of health professionals working for more than 6 months as inclusion criteria. Health professionals who were sick or absent during the time of data collection were excluded. The sample size was calculated using Epi-info software version 6 assuming 95%CI, 90% power, 50% expected immunization coverage in exposed groups, odds ratio of 1.5, a ratio of exposed to unexposed group of 1 and a 10% non-response rate. The final sample size was

1184. A simple random sampling technique was used to select the study participants using the monthly payroll as a sampling frame. The data were collected in interviews with 34 nurse professionals. The entire data collection process was supervised by 10 first-degree and 4 master's degree trained health professionals. First, the questionnaire was prepared in English and then translated to Amharic (local language) and back to English to keep its consistency. To maintain the quality of the data, a pretest was conducted in 50 health professionals working in private hospitals in the region. Training was given for data collectors and supervisors. The entire data collection process was closely supervised by the principal investigator and supervisors. The collected data were checked for its completeness, quantitative data were checked for outliers, qualitative data were checked for missing and coded using standardized techniques, and all the collected data were cleaned before being entered in the software. The data were entered in the computer using Epi-info software version 7 and transferred to SPSS version 20 for analysis. Descriptive statistics were used to identify the prevalence of Hepatitis B vaccination coverage. Binary logistic regression was used to discover the determinants of the coverage, those variables with p-value of less than 0.05 were declared as determinants of vaccination. A Hosmer and Lemeshow goodness of fit test predicted that the model was good with a P-value of 0.90.

Ethical clearance was granted by Amhara National Regional State Health Bureau ethical review committee and Bahir Dar University College of medicine and health science ethical committee (reference number ANRS/OBR/89/2014). Official permission was granted by the respective authorities. The purpose of the study was explained to each study participant. Each study participant had the right to withdraw from the study at any point without penalty. Names were not written on the questionnaire, and the confidentiality of the data was assured. Written informed consent was obtained from each participant.

Results

A total of 1125 health professionals were interviewed with a response rate of 95.27%. The mean age of the respondents was 31 years (SD 9.38). Among the 1125 study participants, 72.5 % of the respondents had a first degree. Nurse professionals constituted 79.9 % of all study participants. Amhara is the dominant ethnicity (77.6%), and the Orthodox Christian religion constituted 90.4%. More than half of the study participants (53.6%) were married (Table 1).

The prevalence of hepatitis B vaccine coverage was 4% (95% CI=3-5%). Hepatitis B vaccination was not associated with profession, marital status, age, sex or needle stick injury (Table 2). Work load decreased the probability of hepatitis B vaccination by 81% (AOR=0.19, 95%CI= 0.08-0.46; P<0.01). Negligence regarding hepatitis B vaccine decreased the odds of vaccination by 96% (AOR=0.04, 95%CI=0.01-0.11; P<0.01). Universal precaution training increased the odds of hepatitis B vaccination by 14.75-fold (95%CI=5.66-38.44; P<0.01). Approximately 63 % of study participants perceived that they are not at risk for hepatitis B. This belief decreased the odds of vaccination by 66% (AOR=0.34, 95%CI=0.15-0.79; P=0.01). The cost of the Hepatitis B vaccine was unaffordable to 79.9% of the study participants. This factor decreased the odds of vaccination by 88% (AOR=0.12 95%CI=0.05-0.28; P<0.01). Awareness of hepatitis B vaccine increased the probability of vaccination by 4.55-fold (95% CI=1.53-13.49; P<0.01). Only 47.9% of health professionals know where to receive the hepatitis B vaccine. The odds of

Table 1. Socio-demographic characteristics of the study participants (n=1125).

Variable	Frequency	Percentage
Ethnicity		
Amhara	873	77.6
Oromo	115	10.2
Agaw	54	4.8
Tigray	37	3.3
Others	46	4.1
Educational status		
Diploma	227	20.2
First degree	816	72.5
Second degree	56	5
Others	26	2.3
Profession		
Nurse	899	79.9
Medical doctor	79	7
Specialist	44	3.9
Laboratory personnel	62	5.5
Pharmacy personnel	26	2.3
Others	15	1.3
Marital status		
Single	499	44.4
Married	603	53.6
Divorced	12	1.1
Widowed	11	1
Religion		
Orthodox	1017	90.4
Muslim	86	7.6
Protestant	21	1.9
Catholic	1	0.1
Sex		
Female	461	41
Male	664	59
Hepatitis B vaccination		
No	1080	96
Yes	45	4

vaccination among health professionals who know where to receive the vaccine were 5.13 times higher (95%CI=1.87-14.11: P=0.02). Peer pressure increased the probability of vaccination by 3.8-fold (95%CI=1.34-10.74: P=0.01). The hepatitis B vaccine was unavailable to 75.6% of health professionals. This factor decreased the odds of vaccination by 75% (AOR=0.25, 95%CI=0.1-0.63: P=0.03). As the years of experience increased, the odds of vaccination increased by 7.27-fold (95%CI=2.23-23.72, P <0.01), (Table 3).

Discussion

The prevalence of Hepatitis B vaccine coverage was 4%, low compared to studies in sub-Saharan Africa,³⁸ may be due to the commitment of the decision makers and health professionals regarding the issues.

Work load decreased the probability of hepatitis B vaccination by 81% (AOR=0.19, 95%CI=0.08-0.46). This finding agrees with findings from Iraq.³⁵ This finding may be because health professionals may not have sufficient time to go where vaccines are administered.

Negligence regarding hepatitis B vaccine decreased the odds of vaccination by 96% (AOR=0.04, 95%CI=0.01-0.11). This result agrees with findings from Pakistan.³³ This finding may be because if they are negligent, they will not give importance to this issue.

Universal precaution training increased the odds of hepatitis B vaccination by 14.75-fold (95%CI=5.66-38.44). Approximately 63% of study participants perceived that they are not at risk for Hepatitis B. This belief decreased the odds of vaccination by 66% (AOR=0.34, 95%CI=0.15-0.79). This finding agrees with

findings from Georgia and Pakistan.^{28,37} This result may be because they will not become ready to avert the infection if they perceive that they are not at risk of the vaccine. The policy maker should understand that in-service training on universal precaution must be considered as one method of preventing HBV infection.

The cost of the Hepatitis B vaccine was unaffordable to 79.9% of the study participants. This factor decreased the odds of vaccination by 88% (AOR=0.12 95%CI=0.05-0.28). This result agrees with findings from Iraq and Pakistan.^{35,37} This finding is because health professionals are underpaid in sub-Saharan Africa, so that they cannot afford the payment for the vaccine because the vaccine is expensive. The health authority should avail the vaccine at affordable cost to every health professionals.

Awareness of hepatitis B vaccine increased the probability of vaccination by 4.55-fold (95% CI=1.53-13.49). This finding agrees with results from Lao PDR, Iraq, and Pakistan.^{33,36,37} This finding may be because health professionals will not understand the actual situation if they do not know about the vaccine. Only 47.9% of health professionals know where to receive the hepatitis B vaccine. The odds of vaccination among health professionals who know where to receive the vaccine were 5.13 times higher (95% CI=1.87-14.11). This finding is because health professionals will not be able to receive the vaccine if they do not know where the vaccine is available. This suggests conducting sensitization camping among health professionals and implement strategies for wider vaccination.

Peer pressure increased the probability of vaccination by 3.8-fold (95%CI=1.34-10.74). This finding may be because peer pressure increases the awareness of the study participants.

The hepatitis B vaccine was unavailable to 75.6% of health professionals. This factor decreased the odds of vaccination by 75% (AOR=0.25, 95%CI=0.1-0.63). This result agrees with findings from Pakistan.²⁷ This result is because unavailability hinders the accessibility of the vaccine. As the years of experience increased, the odds of vaccination increased by 7.27-fold (95%CI=2.23-23.72). This result agrees with findings from Iraq.³⁷ This result may be because the health professionals' awareness of the vaccine increases as they become more experienced.

Universal precaution training increased the odds of Hepatitis B vaccination by 14.75-fold (95%CI=5.66-38.44). This training will increase awareness of infection prevention among health professionals so they will become ready to become vaccinated² (Table 3).

Conclusions

Low levels of Hepatitis B vaccination were observed. Work load, negligence, training on universal precaution, unaffordability, awareness, knowledge where to get the vaccine, peer pressure, unavailability and years of experiences were the predictors of Hepatitis B vaccination. The availability and affordability of the vaccine was limited to all health professionals working in hospitals. The issue of HBV vaccine was not given due attention by decision makers.

Recommendations

The decision makers should make the vaccine available at an affordable fee to all health professionals working in health institutions. Efforts should be made to increase the awareness of health professionals about hepatitis B.

Table 2. Non-significant variables for hepatitis vaccination (n=1125).

Variables	Cross tabs		COR [95% CI]	AOR [95% CI]	P-value
	Vaccinated	Unvaccinated			
Profession			0.29 [0.15-0.56]	2.09 [0.73-6.0]	0.17
Nurse	25	874			
Others	20	206			
Marital status			0.56 [0.29-1.08]	1.01 [0.42-2.46]	0.98
Married	18	585			
Others	27	495			
Age			3.34 [1.25-9.70]	3.2 [0.55-18.73]	0.19
>=25	40	762			
<25	5	318			
Sex			0.95 [0.5-1.81]	0.99 [0.38-2.56]	0.99
Male	26	638			
Female	19	442			
Needle stick injury			1.44 [0.76-2.74]	0.75 [0.3-1.92]	0.56
Yes	26	527			
No	19	553			

Table 3. Determinants of Hepatitis B vaccination coverage (n=1125).

Variables	Cross tabs		COR [95% CI]	AOR [95% CI]	P-value
	Vaccinated	Unvaccinated			
Work load			0.16 (0.08-0.3)	0.19 (0.08-0.46)	<0.01
Yes	20	901			
No	25	179			
Negligence			0.62 (0.3-1.29)	0.04(0.01-0.11)	<0.01
Yes	12	177			
No	33	303			
Universal precaution training			12.31 (5.43-28.98)	14.75 (5.66-38.44)	<0.01
Yes	37	295			
No	8	785			
Perception that they are not at risk			0.31 (0.16-0.61)	0.34 (0.15-0.79)	0.01
Yes	16	689			
No	29	391			
Unaffordable cost			0.08 (0.04-0.17)	0.12(0.05-0.28)	<0.01
Yes	12	884			
No	33	196			
Awareness			1.27 (0.61 - 2.59)	4.55(1.53-13.49)	<0.01
Yes	12	241			
No	33	839			
Knowledge where to get vaccine			1.51 (0.8 - 2.88)	5.13(1.87-14.11)	0.02
I know	26	513			
I don't know	19	567			
Peer pressure			1.53 (0.7-3.46)	3.8 (1.34-10.74)	0.01
Yes	36	781			
No	9	299			
Unavailability			0.63 (0.32-1.26)	0.25 (0.1-0.63)	0.03
Yes	30	820			
No	15	260			
Years of experience			4.02 (1.62-10.66)	7.27 (2.23-23.72)	<0.01
< 2 years	39	667			
>=2 years	6	413			

References

- CDC. General information on hepatitis B virus. Atlanta: CDC Department of Viral Hepatitis; 2010.
- CDC. Hepatitis B Information for the Public. Atlanta: CDC Department of Viral Hepatitis; 2009.
- Colin S, Edgar S, Lyn F, et al. Hepatitis B virus infection: epidemiology and vaccination. *Epidemiol Rev* 2006;28.
- WHO. Hepatitis B. (Factsheet no.204). Geneva: World Health Organization, 2000.
- Perz L, Farrington L, Armstrong G. Hepatocellular carcinoma and cirrhosis: global estimates of fractions attributable to viral hepatitis infection. In: Bethesda, ed. *Hepatocellular Carcinoma: Screening, Diagnosis, Management*: National Institutes of Health, 2004.
- Singhal V, Bora D, Singh S. Hepatitis B in health care workers: Indian scenario. *J Lab Physicians* 2009;1:41-8.
- Ustun A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med* 2005; 48:482-90.
- Pati NT, Sethi A. Low levels of awareness, vaccine coverage and the need for boosters among health care workers in tertiary care hospitals in India. *J GastroHepatol* 2008;23:1710-5.
- CDC. Guidelines for protecting the safety and health of healthcare workers. Joint advisory notice. Atlanta: CDC Department of Viral Hepatitis; 1997.
- Panlilio A, Orelie J, Srivastava P. Estimate of the annual number of percutaneous injuries among hospital-based healthcare workers in the United States, 1997-1998. *Infect Control Hosp Epidemiol* 2004;25:556-62.
- Luiz C, Dirce Z. Hepatitis B in Healthcare workers: prevalence, vaccination and relation to occupational factors. *Braz J Infect Dis* 2005;9:384-89.
- Andre F. Hepatitis B epidemiology in Asia, the Middle East and Africa. *Vaccine*. 2000;18:20-2.
- Belo A. Prevalence of hepatitis B virus markers in surgeons in Lagos Nigeria East Afr Med J 2000;77:283-5.
- Pido B, Kagimu M. Prevalence of hepatitis B virus (HBV) infection among Makerere University medical students. *Afr Health Sci* 2005;5:93-8.
- Sharma R, Rasania S, Verma A. Study of prevalence and response to needle stick injuries among health care workers in a tertiary care hospital in Delhi, India. *Ind J Commun Med* 2010;35:74-7.
- Reis R, Gir E, Canini S. Accidents with biological material among undergraduate nursing students in a public Brazilian university. *Braz J Infect Control Hosp Epidemiol* 2004;8.
- Byrne E. Viral hepatitis: on occupational hazard of medical personnel. Experience of the Yale-New Haven Hospital, 1952-1965. *JAMA* 1966;195:362-4.
- Gregory AP, Robert MJ. Prevention of Hepatitis B with the Hepatitis B Vaccine. *New Engl J Med* 2004;351:2832-8.
- CDC. Hepatitis Surveillance. 1 ed. Atlanta: Centers for Disease Control and Prevention, 2005.
- Duclos P. Safety of immunisation and adverse events following vaccination against hepatitis B. *Expert Opin Drug Saf* 2003;2:225-31.
- Hall A, Kane M, Roure C, Meheus A. Multiple sclerosis and hepatitis B vaccine?

- Vaccine 1999;17:2473-5.
22. EPI. lack of evidence that hepatitis B vaccine causes multiple sclerosis *Wkly Epidemiol Rec* 1997;72:149-52.
 23. Ascherio A, Zhang S, Hernán M. Hepatitis B vaccination and the risk of multiple sclerosis. *N Engl J Med* 2001;344:327-32.
 24. Stratton K, Almario D, McCormick M. Immunization safety review: hepatitis B vaccine and demyelinating neurological disorders. Washington DC: National Academies Press; 2002.
 25. Beasley R. Hepatitis B immunization strategies: expanded programme of immunization. Geneva: World Health Organization; 1988.
 26. Zuckerman A. Prevention of primary liver cancer by immunization. *N Engl J Med* 1997;336:1906-7.
 27. Khurram N, Khurram Ahmad K, Warneez Mohyuddin K, et al. Hepatitis B Vaccination among Health Care Workers and Students of a Medical College. Allama: Iqbal Medical College, 1998.
 28. Edgar S, Jeremy M, Prethibha G, et al. Hepatitis B Vaccination Coverage Levels Among Healthcare Workers in the United States, 2002-2003. *Infect Control Hosp Epidemiol* 2007;28:783-90.
 29. Hamid S, Faisal W. Hepatitis and the Healthcare worker. A Pakistani Perspective. *JCPSP* 2007;17:240-5.
 30. Ali N, Jamal K, Qureshi R. Hepatitis B vaccination status and Identification of risk factors for hepatitis B in health care workers. *J Coll Physicians Surg Pak* 2005;15:257-60.
 31. Memon M, Ansari S, Nizamani R. Hepatitis B vaccination status in health care workers of two university hospitals. *J Liaquat Uni Med Health Sci* 2007;6:48-51.
 32. Memon A, Sheikh M, Afsar S. 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. *Infect Dis J* 2007;16:105-7.
 33. Nauman J, Muhammad S, Rehan Y, et al. Hepatitis B Vaccination status of health care workers at a tertiary care hospital in Multan. *Nishtar Med J* 2009;1:23-7.
 34. Topuridze M, Butsashvili M, Kamkamidze G, et al. Barriers to hepatitis B vaccine coverage among healthcare workers in the Republic of Georgia. *Infect Control Hospital Epidemiol* 2010;31:158-64.
 35. Sobia A, Sanaullah K, Nasee M, et al. Prevalence of HBV and HBV vaccination coverage in health care workers of tertiary hospitals of Peshawar, Pakistan. *Virology* 2011;8:275.
 36. Pathoumthong K, Khampanisong P, Quet F, et al. Vaccination status, knowledge and awareness towards hepatitis B among students of health professions in Vientiane, Lao PDR. *Vaccine* 2014;32:4993-9.
 37. Samir O, Abubakir S, Nazar S. Knowledge about Hepatitis B Infection among medical students in Erbil City, Iraq. *Eur Sci J* 2013;3:299-305.
 38. Phillips E, Owusu-Ofori A, Jagger J. Blood borne pathogen exposure risk among surgeons in sub-Saharan Africa. *Infect Control Hosp Epidemiol* 2007;28:1334-6.
 39. Fritzsche C, Becker F, Hemmer C, et al. Hepatitis B and C: neglected diseases among health care workers in Cameroon. *Trans R Soc Trop Med Hyg* 2013;107:158-64.
 40. Ziraba A, Bwogi J, Namale A. Sero-prevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. *BMC Infect Dis* 2010;10:191.
 41. CDC. Updated CDC recommendations for the management of hepatitis B virus-infected health-care providers and students. Atlanta: CDC; 2012.
 42. Thomas F, Harold J, Joanne C, Chesley R. CDC guidance for evaluating health-care personnel for hepatitis B virus protection and for administering postexposure management. In: Ronald M, Christine C, Teresa R, et al, eds. Atlanta: CDC; 2013.
 43. FMOH. Infection prevention guidelines for Healthcare Facilities in Ethiopia. infection prevention principles. Addis Ababa: Ethiopian Federal Democratic Republic Ministry of Health; 2004.
 44. CSA. Central statistical agency census report. Addis Ababa: Central Statistical Agency; 2007.