Hepatitis B vaccine knowledge and vaccination status among health care workers of Bahir Dar City Administration, Northwest Ethiopia: a cross sectional study

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Abstract

Background: Hepatitis B infection is a major public health problem in Ethiopia. Health care workers are at increased risk of acquiring hepatitis B infection due to occupational exposure. There is effective and safe vaccine against hepatitis B infection. But many health care workers in developing countries are not vaccinated. There is no study in Ethiopia that describes hepatitis B vaccine knowledge and vaccination status of health care workers. Therefore, this study was done to assess hepatitis B vaccination status and knowledge among health care workers of Bahir Dar city administration, Northwest Ethiopia.

Methods: Institution based cross sectional study design was employed from April 1 to 30, 2012. All healthcare workers who were working in Health care facilities of Bahir Dar city administration were the study populations. A total of 374 health care workers were included in the study. Simple random sampling technique was used to select eligible study participants from the list of health care workers. Self administered questionnaire was used to collect data. The completeness of questionnaires was checked every day by facilitators and principal investigators. Data were entered and analyzed with statistical package for social sciences version 16.0 software.

Result: In this study, 64.7% of respondents perceived their risk of acquiring hepatitis B infection very high or high. Only 52% of the respondents were knowledgeable about hepatitis B infection. In this study, only 62% of health care workers were knowledgeable about hepatitis B vaccine. From the total of 370 respondents, only 20 (5.4%) reported that they took three or more doses of hepatitis B vaccine.

Conclusion: Hepatitis B vaccination status of health care workers in the study area was low. Health care workers’ knowledge about hepatitis B infection and hepatitis B vaccine was also low as all health care workers should be knowledgeable.

Keywords: Hepatitis B vaccine, Bahir Dar City Administration, Health care workers

Background

Hepatitis B is a disease caused by hepatitis B virus (HBV), which is transmitted through percutaneous or per mucosal exposure to infectious blood or body fluids, mainly semen and vaginal fluid [1]. It is one of the most serious of the 20 blood borne pathogens which are the major threat to health care workers (HCWs) [2,3]. It is a major problem because it can cause chronic infection, resulting in cirrhosis of the liver, liver cancer, liver failure and death. Moreover, extra hepatic lesions occur in other organs of the body particularly kidney by deposition of immune complexes as result of this infection [4]. Persons with chronic infection also remain a carrier for HBV transmission [1].

HBV accounts for an estimated 360 million chronic infections with about a million who die each year from chronic liver diseases [5,6]. Most persons who become chronic carriers of the virus live in Asia and Africa [7].

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Studies conducted among different segments of the population in Ethiopia showed that hepatitis B virus is a major public health problem in the country. A study conducted in Addis Ababa to investigate sero-epidemiology of hepatitis B virus estimated that the prevalence of hepatitis B virus infection was 7% [8].

The prevalence of hepatitis B virus infection was estimated 2.1% in a study done among voluntary blood donors of Jimma University specialized teaching hospital [9]. Studies among voluntary testing and counselling clients in Shashemene General Hospital and Addis Ababa showed that 5.7% of voluntary testing and counselling clients had hepatitis B virus [10,11].

HCWs are at risk of acquiring blood borne disease including HBV due to occupational exposure to blood and body fluids [12-14]. The World Health Organization (WHO) estimated that, of the 35 million HCWs worldwide, 3 million experience percutaneous exposures to blood pathogens each year, of these 2 million are exposed to hepatitis B virus [13-16].

A study conducted among medical waste handlers in Gondar town governmental health institutions revealed that 6% of medical waste handlers had hepatitis B virus in their blood [17].

A study done among HCWs and non HCWs in Ethiopia showed that of the 110 HCWs and 110 non HCWs, hepatitis B virus was detected in 8 (7.3%) and 1 (0.9%) of health care and non health care workers, respectively [18].

HBV can be prevented by practicing standard precautions such as regular personal hygiene; use of protective barriers; and by proper disposal of sharps, body fluids, and other clinical wastes in health care institutions [6,13,14,19]. Moreover, after exposure to blood or body fluids, post-exposure prophylaxis can be administered as a combination of passive immunization with hepatitis B immunoglobulin and vaccination with hepatitis B vaccine [6]. However, the most cost-effective method to prevent and control hepatitis B is through pre-exposure vaccination and compliance of standard precautions [6]. The vaccine has been found to be safe and effective and can protect one for a lifetime [6].

However evidences show that there is knowledge gap among HCWs about hepatitis B vaccine. A study done to assess knowledge of HB vaccination and route of transmission among Pakistan medical students revealed that 85% of the students were aware of availability of the vaccine. In this study, 76% of participants did not have any knowledge about post exposure prophylaxis for hepatitis B [20].

In a study done in South Africa, only 1.8% of HCWs scored high level of knowledge for hepatitis B vaccine. In this study, only 74.5% showed positive attitude towards HBV vaccination. Of the total respondents, 72% of HCWs had received one or more doses of hepatitis B vaccine but only 61.2% of those vaccinated had received all 3 doses of the vaccine [21]. A study done in Paris on HCWs revealed that 69% of the respondents knew the presence of HB vaccination [22].

Studies in different countries showed different findings on HB vaccination status. Studies in Sweden, Pakistan, Turkey, Paris and South Africa showed that 39.8%, 37.2%, 55.8%, 93% and 19.9% of HCWs respectively received three doses of hepatitis B vaccine [22-26].

A safe and effective vaccine against HBV is available throughout the world, yet many HCWs in resource poor countries remain at risk because they are not vaccinated against HBV [27]. The reason for not being vaccinated may be lack of knowledge about the vaccine. In Ethiopia, there are no studies conducted on knowledge of hepatitis B vaccine among HCWs. This study was therefore done to assess knowledge and vaccination status of hepatitis B among HCWs’ Bahir Dar city administration, Northwest Ethiopia.

**Methods**

Institutional based cross sectional study design was employed from April 1 to 30, 2012 to assess knowledge of hepatitis B and vaccination status among HCWs of Bahir Dar city administration. Bahir Dar town is the capital city of Amhara National Regional state which is located 565 kms Northwest of Addis Ababa, Ethiopia (Amhara regional Health Bureau. 2011 annual report. unpublished). According to Central Statistics Authority (CSA) report of the 2007 population census, the total population of the town was estimated to be 180,174 (87,160 males and 93,014 females [28]. There were two hospitals (one governmental referral hospital and one private hospital), 8 health centers (4 in urban, 4 in rural), 4 governmental clinics, 2 nongovernmental clinics, 34 private clinics and 10 health posts in the study area during the study period. According to the Bahir Dar city administration Health office report of 2011, there were a total of 464 HCWs in Bahir Dar city administration at the time of study (Bahir Dar City administration health office. 2011 annual report. unpublished).

All HCWs who were working in health care facilities of Bahir Dar city administration were the study populations. Those HCWs (health assistants, all types of nurses, health officers, medical doctors, dentists, and laboratory technologist) who were involved in direct health care service for clients and patients were included in this study. Students who were on practical attachment at healthcare facilities were excluded from the study.

Sample size of this study was determined using single population proportion formula by considering 95% level of confidence, 5% margin of error and proportion of HCWs who were vaccinated with HBV vaccine 61.2% [21]. Adding 10% none response rate, the final sample size was 403.
Simple random sampling technique was used to select eligible study participants from the list of city administration health offices. Self administered questionnaire was used to collect data from HCWs. The questionnaire had three parts; the first part contains socio-demographic characteristics of HCWs, the second part was knowledge of HCWs on hepatitis B vaccine. Level of knowledge of HCWs was categorized based on the mean value; those who scored below the mean were classified less knowledgeable and those who scored above the mean were classified knowledgeable. The third part was about hepatitis B vaccine status of HCWs. The completeness of questionnaires was checked every day by supervisors and principal investigators on each day of data collection. After checking for consistency and completeness, the supervisors submitted the filled questionnaires to the principal investigator. The collected data were double entered by principal investigator to verify whether the data was properly entered or not by data clerk. Data were entered and analyzed with SPSS version 16.0 software.

Ethical clearance was first obtained from the Ethical Clearance Committee of Bahir Dar University. Permission to conduct the study was taken from Bahir Dar City Administration Health Office and Amhara Regional Health Bureau and written consent was taken from the study participants. Privacy and confidentiality were maintained throughout the study period; each questionnaire was number-coded without any personal identification.

Results

Socio demographic characteristics of HCWs
The mean age of the respondents was 29.59 (±6.74) years. The mean number of work experience among study participants in years was 7.7 with a standard deviation of 7.4 years. Majority of the respondents (55%) were nurses (Table 1).

Perceived risk of acquiring hepatitis B infection among HCWs
Participants were asked to rate their perceived risk of acquiring hepatitis B infection. From the total 354 participants who responded to this question, 166 (46.9%), 63 (17.8%), 72 (20.3%), 25 (7.1%) and 18 (5.1%) respondents rated their risk of acquiring hepatitis B infection very high, high, medium, low and very low respectively. Ten (2.8%) respondents reported that they did not know whether they were at risk or not. From 374 HCWs who answered the question about history of occupational exposure, 335 (89.6%) had positive history (Table 2).

Knowledge of HCWs about hepatitis B infection
Respondents were asked 10 questions about hepatitis B infection. The maximum and minimum scores were 10 and 5 respectively. The mean knowledge score of the respondents about hepatitis B infection was 7.6 with standard deviation of 1.27 and range of 9. About 52% of the respondents scored above the mean knowledge score about hepatitis B infection. About 95% of the respondents correctly responded that hepatitis B is more infectious than HIV. Similarly, about 82% agreed that hepatitis B infection is more common in Sub Saharan Africa (Table 3).

| Table 1 Socio demographic characteristics of health care workers at Bahir Dar city administration health facilities, August 2012 |
|-----------------------------|-----------------------------|-----------------------------|
| Variable                    | Frequency                  | Percent                     |
| Sex (n = 340)               |                             |                             |
| Female                      | 195                         | 57.4                        |
| Male                        | 145                         | 42.6                        |
| Occupation (n = 373)        |                             |                             |
| Physician                   | 13                          | 3.5                         |
| Health office               | 33                          | 8.8                         |
| Nurse                       | 205                         | 55.0                        |
| Midwife                     | 18                          | 4.8                         |
| Lab technician              | 77                          | 20.6                        |
| Other                       | 27                          | 7.2                         |
| Marital status (n = 370)    |                             |                             |
| Single                      | 135                         | 35.7                        |
| Married                     | 223                         | 60.3                        |
| Widowed                     | 5                           | 1.4                         |
| Divorced                    | 10                          | 2.7                         |
| Department of work (n = 343)|                             |                             |
| Emergency room              | 33                          | 9.6                         |
| Outpatient department       | 125                         | 36.4                        |
| Delivery room               | 32                          | 9.3                         |
| Operation room              | 8                           | 2.3                         |
| Ward                        | 32                          | 9.3                         |
| Other                       | 113                         | 32.9                        |

Numbers in () correspond to the number of answers given.

| Table 2 History of occupational exposure among health care workers of Bahir Dar city administration, August 2012 |
|----------------------------------------------------------------------------------------------------------------|
| Question                                                      | Yes Number (%) |
| History of exposure to blood or body fluids on intact skin (n = 369) | 315 (85.4)     |
| History of splash of blood or body fluids to eye or mouth (n = 370) | 256 (69.2)     |
| History of splash of blood on cuts or unprotected skin (n = 368) | 211 (57.3)     |

Numbers in () correspond to the number of answers given.
Knowledge of HCWs about hepatitis B transmission and control

Respondents were asked about hepatitis B prevention and control mechanism. Table 4 below shows the responses of HCWs about hepatitis B infection and control mechanisms.

Table 3 Knowledge of hepatitis B infection among health care workers of Bahir Dar City Administration, August 2012

| Question                                                                 | True Number (%) |
|--------------------------------------------------------------------------|-----------------|
| One can get hepatitis B infection through needle stick injury (n = 375)   | 347 (92.5)      |
| Hepatitis B infection can be prevented by vaccination (n = 365)           | 347 (95.1)      |
| Hepatitis B virus can be found in semen or vaginal fluid of infected person (n = 370) | 325 (87.8) |
| Hepatitis B infected person may be asymtomatic for long time (n = 372)    | 323 (86.8)      |
| Every person exposed to hepatitis B virus will develop acute hepatitis immediately (n = 359) | 169 (47.1) |
| Hepatitis B virus is highly infectious (n = 370)                          | 355 (95.9)      |
| Only small proportion of the world population is infected with hepatitis B virus (n = 356) | 97 (27.2) |
| Hepatitis B virus mainly affects liver (n = 372)                          | 359 (96.5)      |

Numbers in () correspond to the number of answers given.

Vaccination status

Of the total respondents, 370 responded to the question whether they were vaccinated or not at the time of interview. Only thirty seven (10%) respondents reported that they received one or more doses of hepatitis B vaccine. From these, only 20 (54%) received three or more doses which was only 5.4% of the total HCWs. Among 333 respondents who were not vaccinated, 201 (60.36%) and 133 (39.93%) reported that the vaccine was not available and costly respectively.

Knowledge about hepatitis B vaccine

Respondents were asked fourteen item questions to assess their knowledge about hepatitis B vaccine. The maximum and minimum score for these knowledge questions were 14 and 5 respectively. The mean knowledge score for hepatitis B vaccine was 8.85 with standard deviation of 2.67. About 62% of HCWs scored above the mean knowledge score. In this study, 93 (27.6%) of the respondents wrongly responded that one or two does of hepatitis B vaccine are sufficient to be fully immunized for an adult (Table 5).

Discussion

Perceived risk of acquiring hepatitis B infection

HCWs are at risk of acquiring blood borne disease including HBV due to occupational exposure to blood and body fluids [12-14]. From 374 HCWs who responded to the question whether they had history of occupational exposure to blood or body fluids or not, 335 (89.6%) reported history of occupational exposure. This indicates high level of occupational exposure to hepatitis B and other blood borne pathogens.

In the presence of this high level of occupational exposure to blood and body fluids, about 12.2% of the respondents reported that they are at low or very low risk for hepatitis B infection. Similarly, 10 (2.8%) respondents reported that they did not know whether they are at risk or not for hepatitis B infection. This proportion is high as all HCWs should know that they are at high risk of acquiring hepatitis B infection. These HCWs are less likely to take hepatitis B infection prevention and control measures as they thought that they are at low or very low risk of hepatitis B infection.

Knowledge of HCWs about hepatitis B infection

Only about 52% of the respondents scored above the mean knowledge score about hepatitis B infection. This is below the expectation that all HCWs should know about hepatitis B infection. This may lead to the conclusion that HCWs were less knowledgeable about hepatitis B infection. About 95% of the respondents correctly responded that hepatitis B is more infectious than HIV. Similarly, about 82% of the respondents agreed that

Table 4 Knowledge of hepatitis B infection prevention and control measures among health care workers of Bahir Dar city administration, August 2012

| Questions                                                                 | Yes Number (%) |
|--------------------------------------------------------------------------|----------------|
| Hepatitis virus can be transmitted from one person to the other through** |                |
| Sharps injury                                                             | 340 (91.2)     |
| Blood donation from infected person                                      | 342 (91.7)     |
| Sexual intercourse with infected person                                  | 288 (77.2)     |
| From mother to child during pregnancy                                    | 247 (66.2)     |
| Feaco oral                                                                | 78 (20.9)      |
| Polluted water                                                           | 37 (9.9)       |
| Transmission of hepatitis B infection can be prevented by**              |                |
| Vaccination                                                              | 336 (90.3)     |
| Proper disposal of sharps                                                | 313 (84.1)     |
| Avoiding multiple sexual partner                                         | 212 (57)       |
| Avoiding drinking contaminated water                                     | 36 (9.7)       |
| Avoiding uncooked food                                                   | 27 (7.3)       |
| Using glove                                                              | 270 (72.6)     |

Numbers in () correspond to the number of answers given, **multiple responses were there.
hepatitis B infection is more common in Sub Saharan Africa. About 47% of the respondents wrongly responded that all persons exposed to hepatitis B virus will develop acute hepatitis immediately. This is a big gap that should be bridged as soon as possible. Although they were few (4.9%), some HCWs also wrongly reported that there was no vaccine against hepatitis B infection.

Knowledge of HCWs about hepatitis B transmission and prevention
Most respondents reported that hepatitis B virus may be transmitted from one person to the other through sharps injury (91.2%) and blood transfusion (91.7%). But few HCWs wrongly reported that hepatitis B can be transmitted through faeco-oral rout (20.9%) and through polluted water (9.9%). Similarly, 9.7% and 7.3% of the respondents wrongly reported that hepatitis B infection can be prevented by avoiding drinking contaminated water and eating uncooked food respectively. These facts also show presence of knowledge gap among the respondents about hepatitis B infection transmission and prevention mechanisms.

Vaccination status
From the total respondents included in this study, 370 gave response to the question that asked them whether they were vaccinated or not at the time of interview. Only thirty seven (10%) respondents reported that they received one or more doses of hepatitis B vaccine at the time of interview. From these, only 20 (54%) received three or more times which is only 5.4% of the total health care workers.. This is very low as the level of occupational exposure is high among the study participants. Ethiopia is also one of the countries with high level of hepatitis B. Unavailability of the vaccine was the main reason mentioned for not being vaccinated by respondents although it is available in the private clinics in Bahir Dar town.

Knowledge about hepatitis B vaccine
In this study, about 62% of HCWs scored above the mean knowledge score about hepatitis B vaccine. About 72% of the respondents correctly responded that an adult should take three or more doses of hepatitis B vaccine to be fully immunized. But only about 50% of the respondents knew that hepatitis B vaccine could be given as post exposure prophylaxis. About 25% of the respondents also wrongly responded that hepatitis B vaccine could effectively treat patients with acute hepatitis B infection. Only 59.4% of HCWs knew the necessity of additional booster dose five years after completing the three doses of vaccines. All these figures show presence of knowledge gap about hepatitis B vaccine.

This study tried to assess one of the key areas of public health importance. But because of the cross sectional nature of the study and the small sample size, we were not able to assess factors associated with low knowledge and coverage of hepatitis B vaccine.

Conclusion
In this study, there were HCWs who believed that they were at low or very low risk for hepatitis B infection. Only 5.4% of HCWs also reported that they received three times or more for hepatitis B vaccine. This is a serious public health scenario and challenge for a country with high prevalence of hepatitis B infection.

Knowledge of HCWs about hepatitis B infection, mode of transmission and hepatitis B vaccine was low. There were misunderstandings about these issues among HCWs. Therefore, the Regional Health Bureau and other concerned bodies should give training on hepatitis B infection, prevention and control, and hepatitis B vaccine for HCWs in Bahir Dar City administration.
Abbreviations
CSA: Central statistics authority; HBV: Hepatitis B virus; HCWs: Health care workers; Lab: Laboratory; OPD: Outpatient department; OR: Operation room; SPSS: Statistical package for social sciences; VCT: Voluntary counselling and testing; WHO: World Health Organization.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
Both authors contributed equally in the design, data collection, analysis and preparation of the manuscript. Both authors read and approved the final manuscript.

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References
1. Centers for Disease Control (CDC). A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States. Morb Mortal Wkly Rep. 2006;55(16):1–25.
2. Centers for Disease Control and Prevention. Guidelines for infection control in health care personnel. Infect Control Hosp Epidemiol. 1998;19:445.
3. Centers for Disease Control and Prevention. Blood borne infectious diseases: HIV/AIDS, hepatitis B, hepatitis C. Available at http://www.cdc.gov/niosh/topics/bbep/.
4. Koif R. Immunologically mediated extrahepatic manifestations of viral hepatitis. In: Koif R, editors. Autoimmune liver disease. New York: Raven; 1991.
5. World Health Organization. Global Alliance for Vaccines and Immunization (GAVI). Available at http://www.who.int/immunization/ topics/bbep/.
6. Khan FY, Ross AJ. Hepatitis B Immunization amongst doctors and laboratory personnel in KiwuZulu-Natal, South Africa. Afr J Prim Health Care Fam Med. 2013;5(1).
7. Saha JK, Azad K, Hossain MZ, Amin MR, Wazib A, Rahman MK. Prevalence of Hepatitis B Virus among the Physicians of Department of Medicine of Dhaka Medical College Hospital, Dhaka. J Dhaka Med Coll. 2013;22(1):11–15.
8. Abebe A, Nokes D, Nejere A, Enequasselie F, Messele F, Cutts F. Sero-epidemiology of hepatitis B virus in Addis Ababa Ethiopia: transmission patterns and vaccine control. Epidemiol Infect. 2003;131(1):757–70.
9. Yami A, Alemseged F, Hassen A. Hepatitis B and C viruses infections and their association with Human Immune Deficiency virus: a cross-sectional study among blood donors in Ethiopia. Ethi J Health Sci March. 2011;21(1):67–75.
10. Negeo A, Sitay Z, Medhin G. Prevalence of Hepatitis B surface antigen (HBsAg) among visitors of Shashemene General Hospital voluntary counselling and testing center. BMC Res Notes. 2011;4(35):1–5.
11. Shimelis T, Torben W, Medhin G, Tebeje M, Adualem A, Demesse F, et al. Hepatitis B virus infection among people attending the voluntary counselling and testing center and anti retroviral therapy clinic of St Paul’s General Specialized Hospital Addis Ababa. Ethiopia Sex Trans Infect. 2006;84(1):37–41.
12. Huten Y, Hairu A, Chiarello L, Catlin M, Stilwell B, Ghebrehiwet T, et al. Best infection control practices for intradermal, subcutaneous, and intramuscular needle injections. Bull World Health Organ. 2003;81(7):491–500.
13. Molinari J. Infection control: Its evolution to the current standard precautions. J Am Dent Assoc. 2003;134(5):569–74.
14. Awases MI, Nyoni AG, Chatara R. Migration of health professionals in six countries: a synthesis report. Brazzaville: World Health Organization Regional Office for Africa; 2004.
15. Centers for Disease Control and Prevention, Division of Health care Quality Promotion. Surveillance of healthcare personnel with HIV/AIDS, as of December 2001–2003. Available at http://www.cdc.gov/niosh/hip/BLLOOD/hipv-personnel.htm.
16. Canadian Center for Occupational Health and Safety. Needle sticks and sharps injuries. Available at http://www.ccprofiles.ca/oshanswers/diseases/needlestick_injuries.html.
17. Anagaw B, Shiferaw Y, Anagaw B, Belyuhn Y, Eruki W, Fantahun F, et al. Seroprevalence of hepatitis B and C viruses among medical waste handlers at Gondar town Health Institutions, Northwest Ethiopia. BMC Res Notes. 2012;5:55.
18. Geberemichael A, Gelaw A, Moges F, Dagnew M. Seroprevalence of hepatitis B virus infections among health care workers at the Bule Hora Woreda Governmental Health Institutions, Southern Oromia, Ethiopia. J Environ Occup Sci. 2013;2(1):14.
19. World Health Organization. Health Care Worker Safety. Available at: http://www.who.int/occupational_health/activities/1am_hcw.pdf.
20. Khan N, Ahmed SM, Khalid MM, Siddiqi SM, Merchant AA. Effect of gender and age on the knowledge, attitude and practice regarding Hepatitis B and C and vaccination status of Hepatitis B among medical students of Karachi Pakistan. JPMA. 2010;60(6):450–5.
21. Africa PN. Knowledge, attitudes and practices of health care workers regarding hepatitis B vaccination, in the Ekuhruleni Metro, Gauteng Province. MPH dissertation. Medunya Campus: University of Limpopo; 2010.
22. Loulergue P, Moulif B, Vital-Trecanc G, Abisia Z, Demontpionia C, Menager C, et al. Knowledge, attitudes and vaccination coverage of healthcare workers regarding occupational vaccinations. Vaccine. 2009;27(31):4240–3.
23. Dannemet E, Tegnfl A, Torner A, Giesecke J. Coverage of hepatitis B vaccination in Swedish healthcare workers. J Hosp Infect. 2006;63(2):201–4.
24. Mengal HI, Howteerakul N, Suwannapong N, Rajatun F. Factors relating to acceptance of hepatitis B virus vaccination by nursing students in a tertiary hospital. Pakistan J Health Popul Nutr. 2008;26(1):46–53.
25. Hatipoglu CA, Yektin MA, Ergin F, Ippekkan K, Erdinc F, Bulut C, et al. Vaccination of healthcare workers against hepatitis B virus in a teaching hospital. J Hosp Infect. 2007;67(2):200–2.
26. Burnett RJ, Francois G, Mphahlele MJ, Mureithi JG, Ngwrga P, Satekegma MM, et al. Hepatitis B vaccination coverage in healthcare workers in Gauteng Province, South Africa. Vaccine. 2011;29(25):4293–7.
27. Suckling RM, Taetmeyer M, Nguku PM, AlAbb SS, Kibaru J, Chakaya JM, et al. Susceptibility of health care workers in Kenya to hepatitis B; new strategies for facilitating vaccination uptake. J Hosp Infect. 2006;64(3):271–7.
28. Cental Statistics Agency (CSA). Summary and statistical report of the 2007 population and housing census; population size by age and sex. Addis Ababa, Ethiopia: Federal Democratic republic of Ethiopia population census commission; 2008.