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Hepatitis B Virus Vaccination Status and Its Associated Factors among Healthcare Providers in Public Hospitals in Mekelle, Northern Ethiopia

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Abstract

Introduction: Hepatitis B virus infection (HBV) is a serious infectious disease of the liver faced by healthcare providers (HCPs) worldwide. It is a major global health problem causing approximately 686,000 deaths worldwide annually, and in developing countries like Ethiopia, the rate of infection is still increasing. HBV vaccination is an important strategy to decrease transmission, and assessing its status and associated factors will help in promoting uptake.

Objective: The study aimed at assessing HBV vaccination status and its associated factors among HCPs of public hospitals in Mekelle, Northern Ethiopia.

Methods: Institution-based cross-sectional study was conducted from May to August 2021 in the 3 public hospitals in Mekelle city, Tigrai, North Ethiopia. A total of 343 HCPs were selected using stratified random sampling with proportional allocation. The data was collected using self-administered structured questionnaire covering socio-demographic characteristics, knowledge and attitude about the HBV, and the health service factors. Epi-Info v.7 and STATA v.15 statistical software were used for data entry and analysis, respectively. Ordinal logistic regression was performed to examine the relationship between HBV vaccination status and its associated factors.

Results: Among the HCPs 151(45.00%) were fully vaccinated, 96(29.00%) were partially vaccinated and 89(26.00%) were unvaccinated. Work experience (4.13, 95%CI: 2.32-7.38), availability of vaccine (2.86, 95%CI: 1.53-5.31), history of occupational exposure (2.39, 95%CI: 1.34-3.92) and age category 20-29 (3.10, 95%CI: 1.24-7.77) and age category 30-39(2.33, 95% CI:1.01-5.37) were identified as significantly associated factors**.**

Conclusion: The HBV vaccination status of HCPs was unsatisfactory, as more than half were not fully vaccinated. Work experience, availability of vaccine, history of occupational exposure, and age of HCPs should be considered to attain full vaccination of all HCPs.

Keywords: Hepatitis B virus, Vaccination, healthcare providers, Ordinal regression, Ethiopia

Introduction

Hepatitis B virus infection (HBV) is a serious infectious disease of the liver affecting millions of people throughout the world. HBV is by far the most dreaded and more infectious than the other blood-borne pathogens, it is 100 times more contagious than Human Immuno-deficiency virus (HIV). It is the fifth leading cause of death from infectious disease worldwide **[1]**. The most serious occupational health hazard faced by healthcare providers (HCPs) worldwide is exposure to blood borne pathogens like Hepatitis B. Health care providers are potentially exposed to blood and body fluids containing transmissible diseases and are at increased risk to acquire these pathogens **[2,3]**.

HBV is a major global health problem, causing approximately 686,000 deaths worldwide annually. According to World health organization (WHO), the global burden of HBV due to occupational exposure accounted 2.5%. Its prevalence was the highest in African (6.1%) **[4,5]**. The WHO also estimated that 6200 HBV infections occur each year among sub-Saharan African HCPs **[6]**. Many studies in Ethiopia revealed that occupational risks that expose HCPs to HBV is high **[7,8]**, and the prevalence was estimated 7.3–9% **[4]**.

HBV can be effectively prevented by vaccination, and the complete vaccine series induces protective antibody levels in more than 95% of the population **[9]**. The WHO states that primary vaccination consists of more than three doses of HBV vaccine administered intramuscularly with an interval of one month between the first and the second dose and three months between the second and the third dose. It recommends a full three doses of HBV vaccination for all HCPs who are at occupational risks of acquiring HBV and has estimated that the average HBV vaccination rate among HCPs ranges

from 18% to 39% in developing countries and 67–79% in developed countries **[10]**.

The Ethiopian Ministry of Health also recommends that all HCPs should get vaccinated against HBV prior to clinical attachments at their institutions **[11]**. The objective of this study was to assess HBV vaccination status and its associated factors among HCPs of public hospitals in Mekelle, Northern Ethiopia.

Methods and Materials

Study Design, Setting, and Sampling.

The institution-based cross-sectional study was conducted from May to August 2021 in the 3 public hospitals in Mekelle city, Tigrai, North Ethiopia. The source population of 1,613 HCPs, and the study population were 234(68.2%) from Ayder specialized hospital, 63(18.4%) from Mekelle hospital, and 46(13.4%) from Quiha hospital. The city has a population of over 510,346 **[12]**. A total of 343 study subjects were included in the study with proportionally allocation using stratified sampling technique. The sample size was determined using single population proportion formula with finite population correction formula by considering the prevalence of HBV vaccination among HCPs at 50% with 95% confidence level, 5% marginal error, and 10% non-response rate.

Operational Definition

- Healthcare providers: Healthcare personnel involved in day to day patient cares with direct involvement in patient care in hospital setting, which include physicians, midwives, nurses, health officers, anesthetists, dentals and laboratory technicians.
- Vaccination status: the status of being vaccinated with HBV vaccine depending on the number of doses received categorized into unvaccinated, partially vaccinated and fully vaccinated.
- Unvaccinated HCPs: HCPs who didn't received any doses of HBV vaccine.
- Partially vaccinated HCPs: HCPs who received only 1 or 2 doses of HBV vaccine.
- Fully vaccinated HCPs: HCPs who received a full course (3 doses) of HBV vaccine.

Data Collection and Analysis

The data were collected using self-administered questionnaire, based on finding from different literature. The three sections cover socio-demographic characteristics, attitude and knowledge about the HBV and health service factors. HBV vaccination status was considered as unvaccinated, partially vaccinated and fully vaccinated. Data collection recruited 5 BSc health professionals and one supervisor after two days intensive training on the study, data collection and the questionnaire. Data quality was considered in questionnaire designing, data collection and data entry, and confidentiality and privacy of the study subjects were maintained. The data were checked for completeness and consistency and entered into Epi Info version 7 software.

Ordinal logistic regression with proportional odds model was used in the analysis of ordinal data to examine the relationship between HBV vaccination status and the socio-demographic variables and health service factors of HCPs**.** Estimates of this odds ratio and corresponding confidence interval **[13]**. Data analysis was done using the STATA v.15 statistical software package. The results of the analysis were presented using tables, charts, and proportional odds ratio. Test of parallel lines was used to checked the assumption that relationship between each pair of outcome groups is the same (x2=6.76, p-value: 0.36). Akaike Information Criterion was considered in model selection (the model with low AIC was selected) **[14]**. Deviance statistics was used to test the goodness of fit of the ordinal model (deviance=78.96, p-value 0.132). And the overall model fitness was considered using log likelihood ratio, and the pseudo R2 (Nagelkerke=0.516).

Ethical Approval and Consent

Ethical clearance was obtained from the health research ethics review committee of Mekelle University, College of Health Sciences, School of Public Health. Permission to conduct the study was acquired from the administrative body of the public hospitals.

Result

A total of 336 HCPs participated in the study, with a response rate of 97.90%. Of the study participants, 44.9% were fully vaccinated, 28.6% were partially vaccinated, and 26.5% were unvaccinated for HBV.

Socio-economic characteristics

Table 1 shows that 125 (37.2%) of the respondents were in the age group 20-29 years, 152 (45.2%) were in the age group of 30-39 years, and 59 (17.6%) were age 40 and above. The mean age was 33 years, with a standard deviation of 6.67 years. The proportion of fully vaccination was found higher in males (48.40%) as compared to females (41.00%). With respect to education level, 95.00% of specialist doctors, 71.00% of second degree holders, 39.00% of first degree holders, and 37.70% of diploma level were found fully vaccinated. The median work experience of HCPs was 4 years with inter-quartile range of 6 years.

Table 1: Socio-demographic characteristics of HBV vaccination status among HCPs in public hospitals, Mekelle, 2021 (n=336)

Variable	Categories	Vaccination Status			
		Fully vaccinated	Partially vaccinated	Unvaccinated	Total
Sex	Male	88(48.40%)	50(27.50%)	44(24.10%)	182
	Female	63(41.00%)	46(30.00%)	45(29.00%)	154
Marital status	Single	31(24.40%)	40(31.50%)	56(44.10%)	127
	Married	103(55.00%)	55(29.50%)	29(15.50%)	187
	Divorced	14(77.80%)	1(5.50%)	3(16.70%)	18
	Widowed	3(75.00%)	0(0.00%)	1(25.00%)	4
Profession	Medical Doctor	37(65.00%)	9(16.00%)	11(19.00%)	57
	Nurse	42(40.00%)	36(34.00%)	28(26.00%)	106
	Health officer	31(65.00%)	9(18.00%)	8(17.00%)	48
	Lab Professional	13(43.00%)	7(23.00%)	10(34.00%)	30
	Anesthetics	4(19.00%)	9(43.00%)	8(38.00%)	21
	Midwife	15(31.00%)	14(29.00%)	19(40.00%)	48
	Dental	9(35.00%)	12(46.00%)	5(19.00%)	26
Education level	Diploma	23(37.70%)	18(29.50%)	20(32.80%)	61
	First degree	89(39.00%)	73(32.00%)	65(29.00%)	227
	Master	20(71.00%)	5(18.00%)	3(11.00%)	28
	Specialist	19(95.00%)	0(0.00%)	1(5.00%)	20
Department	Surgical	14(21.00%)	30(45.00%)	23(34.00%)	67
	Laboratory	13(43.00%)	6(20.00%)	11(37.00%)	30
	Delivery	36(47.00%)	17(22.00%)	23(31.00%)	76
	Emergency	45(46.00%)	27(28.00%)	25(26.00%)	97
Age category	20-29	29(23.00%)	43(34.00%)	53(43.00%)	125
	30-39	73(48.00%)	47(31.00%)	32(21.00%)	152
	40&above	49(83.00%)	6(10.00%)	4(7.00%)	59
Experience	<5 years	47(24.00%)	67(34.00%)	81(42.00%)	195
	≥5 years	104(74.00%)	29(21.00%)	8(5.00%)	141
Income category	<3000	1(11.00%)	1(11.00%)	7(78.00%)	9
	3000-5000	26(31.00%)	25(30.00%)	33(39.00%)	84
	5001-7000	47(35.00%)	48(36.00%)	39(29.00%)	134
	>7000	77(71.00%)	22(21.00%)	10(8.00%)	109

Health service factors of HCPs toward HBV

Two hundred forty-three (72.30%) and 222(66.00%) of the respondents said that the HBV vaccine was available and accessible in the public hospitals, respectively. With regard to the exposure, about 250(74.40%) and 258(76.80%) of the respondents had history of occupational exposure and had sustained needle stick injury, respectively (Table 2).

Table 2: Health service factors HBV vaccination status of HCPs in public hospitals of Mekelle city, 2021 (n=336)

Variables	Response	Frequency n (%)
HBV vaccine Availability	Yes	243 (72.30%)
	No	93 (27.70%)
Accessibility of HB vaccine	Yes	222 (66.00%)
	No	114 (34.00%)
Ever taken training on standard precaution	Yes	235 (70.00%)
	No	101 (30.00%)

Ever had history of occupational exposure	Yes No	250 (74.40%) 86 (25.60%)
Ever attended training on infection prevention	Yes No	223 (66.40%) 113 (33.60%)
Ever had sustained needle stick injury	Yes No	258 (76.80%) 78 (23.20%)

HBV vaccination status of the HCPs

Among the HCPs, 151(45.00%) were fully vaccinated, 96(29.00%) partially vaccinated and 89(26.00%) were unvaccinated. About 96(29.00%) of them also partially vaccinated, from those 96 respondents who received partially 50(52.00%) respondents received two times (two doses) and the rest 46(48.00%) respondents were received one times (one dose). Among the 89(26.00%) unvaccinated HCPs, the reasons mentioned for not being vaccinated were: 67(75%) stated the vaccine was not available, 13(15%) mentioned work overloads, 6(7%) said they had no information and 3(3%) mentioned fear of side effects.

Factors associated with HBV vaccination status of HCPs

In bi-variable analysis, education level, profession, age, income, experience, availability of vaccine, occupational exposure, and training on infection prevention were statistically significantly associated with the HBV vaccination status of HCPs. In the multivariable analysis age, work experience, availability of vaccine, and history of occupational exposure were identified as having statistically significant association with HBV vaccination status of HCPs **(Table 3)**

Table 3: Factors of HBV vaccination status among HCPs in public hospitals of Mekelle, Northern Ethiopia, 2021 (n=336)

Variables	**Category**	**Vaccination Status**					
		Fully vacci.	**Partially vaccine.**	**Unvaccin.**	**COR (95%CI)**	**AOR (95%CI)**	**P-value**
Experience	<5 years	47	67	81	9.39(5.81-15.18) **	4.13(2.32-7.38) **	<0.001
	≥5 years	104	29	8	1	1	
Age category	20-29	29	43	53	15.03(6.96-32.14)**	3.10(1.24-7.77)*	0.016
	30-39	73	47	32	15.16(2.46-10.91) **	2.33(1.01-5.37)*	0.049
	≥40	49	6	4	1	1	
Availability	yes	136	74	31	1	1	
	No	15	22	58	9.03(5.46-15.03)**	2.86(1.53-5.31)*	<0.001
Occupa. exposure	yes	128	72	50	1	1	
	No	23	24	39	3.10(1.94-4.95)**	2.39(1.34-3.92) *	0.002

For HCPs with less than five years of work experience, the odds of being unvaccinated versus the higher odds was 4.13 times [AOR=4.13, 95%CI:2.32-7.38] that of HCPs with five or above years' work experience. For HCPs with 20-29 years of age, the odds of being unvaccinated versus the higher odds was 3.10 times [AOR=3.10, 95% CI:1.24-7.77) that of HCPs with 40 or above years of age. For HCPs working in the public hospitals where HBV vaccination is unavailable, the odds of being unvaccinated versus the higher odds was 2.86 times [AOR=2.86, 95%CI: 1.53-5.31] that of HCPs working in the public hospitals where HBV vaccination is available.

For HCPs working in the public hospitals who were no history of occupational exposure, the odds of being unvaccinated versus the higher odds was 2.29 times [AOR=2.29, 95%CI:1.34-3.92] that of HCPs working in the public hospitals have history of occupational exposure of HBV, given the other predictors constant. The results in bivariate and multivariable ordinal logistic regression described that the estimated coefficients of all predictors had a positive effect on the HBV vaccination status of HCPs.

Discussion

This study assesses the HBV vaccination status and its associated factors among HCPs of public hospitals in Mekelle, Northern Ethiopia. In the present study, work experience, availability of vaccine, history of occupational exposure, and age of HCPs were significantly associated with the vaccination status of HCPs. According to the study result, 45% of respondents received fully HBV vaccine. This is higher than similar studies in Ethiopia, Shashemene (12.9%) **[15]**, Bahir Dar (5.4%) **[16]** and tertiary hospital in Ethiopia (28.7%) **[17]**. Similarly, this study is higher than the study conducted in North India (38.8%) **[18]**, Burkina Faso (10.9%) **[19]**. This

difference could be due to the significant time difference between this study and the previous studies which conducted 3 to 5 years back that contributes to this variation.

The result of this study is lower than the studies conducted in Zambia (54.7%) **[20]**, tertiary care in India (56.5%) **[18]**. The fact that most of the respondents in the current study were young and had fewer years of practice may be responsible for the low rate of vaccination as it is found in this study that younger age is significantly difference and discrepancy might be due to the difference in the socio-economic characteristics of the participants and availability of vaccine in the countries. Other reasons for unvaccinated by the participants in our study were work load 14.6%, lack of information 6.7% and fear of side effect of the vaccine 3.4%. This is somewhat similar with studies done in different places like in South East Nigeria where 22.2% had as a reason for unvaccinated **[21]**.

According to the finding from this study, HCPs working in the public hospitals where HBV vaccination is unavailable, the odds of being unvaccinated versus the higher odds was 2.86 [AOR=2.86, 95%CI 1.53-5.31] that of HCPs working in public hospital where HVB vaccination was available. This is in line with the study conducted in East Wollega, HCPs working in health institution in which the vaccine was available were nearly five times more likely to be vaccinated than those working in the health institution in which the vaccine was unavailable **[22]**. HCPs working in the public hospitals who were no history of occupational exposure, the odds of being unvaccinated versus the higher odds was 2.29 times [AOR=2.29, 95%CI:1.34-3.92] that of HCPs working in the public hospitals have history of occupational exposure of HBV. Similarly, with the study conducted in East Wollega, history of occupational exposure is statistically significant and increases the odds of higher order of HCPs by2.1with (OR=2.1, 95%CI: 1.2=3.6) **[22]**.

In this study, HCPs with less than five years work experience, the odds of being unvaccinated versus the higher odds was approximately four times [AOR=4.13, 95%CI:2.32-7.38] that of HCPs with five- or above years' work experience. In the same way a study conducted in East Wollega, the HBV vaccination of HCPs were to increase with increasing year of experience (OR=3.8, 95%CI: 1.8-7.9) **[22]**. In the same way study in Wolayita Sodo, HCPs who work at least 5 years were two times more to be vaccinated as compared to those who give service for less than five years **[23]**. In Amhara regional state study conducted work experience of HCPs were significant factor of HBV vaccination status **[17]**. This implies that stayed in the public hospitals had more chance of getting HBV vaccine.

Age category is one associated factor of HBV vaccination status of HCPs in the public hospitals. with age group of 20-29 years, the odds of being unvaccinated versus the higher odds was 3.10 times [AOR=3.10, 95% CI:1.24-7.77] that of HCPs with age group of 40 or above years old. This is in line with the study conducted in south east, Nigeria, which the age group 31-40 years, the odds of higher was 1.30 times more than that of less than 30 years old **[21]**. There could be recall bias because of the self-reported vaccination status. Besides, HCPs waiting for the next vaccine schedule were taken as partially vaccinated.

Conclusion

The study revealed that the vaccination status of HCPs in the public hospitals against HBV was unsatisfactory. The factors associated with HBV vaccination status of HCPs were work experience, availability of vaccine, history of occupational exposure and age of HCPs in the public hospitals. Hospital management in collaboration with other stakeholders should deploy a more effective vaccination plan to fully vaccinate all HCPs considering age and work experience.

Abbreviations

AIC Akaike Information Criterion
AIDS Acquired Immune Deficiency Syndrome
AOR Adjusted Odds Ratio
BIC Bayesian information criterion
CDC Center for Disease Control
CI Confidence Interval
CSA Central Statistical Agency
ETB Ethiopian Birr
FMOH Federal Ministry of Health
HBV Hepatitis B Virus infection
HBsAg Hepatitis B surface Antigen
HCP Healthcare Provider
HIV Human Immuno-deficiency Virus
IM Intramuscular
POM Proportional Odds Model
VIF Variance Inflation Factor
WHO World Health Organization

Data Availability

The authors ensure the availability of data and material of this research work, and readers can access the data upon request to the corresponding author.

Consent: The authors give our consent for publication of this original research work.

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Conflicts of Interest: The authors declare that we have no conflict of interest.

Authors' Contributions

HK conceived the study idea, designing tools, data collection and management and designed the analysis. AB wrote the draft manuscript. All the authors HK, AB, KA fully participated in data processing, analysis, and the write-up. The authors agree to be accountable for all aspects of the work related to the accuracy or

integrity of any part of the work. All authors have read and approved the manuscript.

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