

# Hepatitis B Vaccination Status and Associated Factors Among Healthcare Professionals Working in Health Centers at Akaki Kality Subcity of Addis Ababa, Ethiopia: A Cross-Sectional Study

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**Background:** People at high risk for hepatitis B virus include healthcare workers in contact with blood and human secretions. Hepatitis B virus is unique compared to other sexually transmitted infections because a highly efficacious vaccine exists. However, there have been few studies conducted around the vaccination status of hospital healthcare workers in Ethiopia. Little is known about vaccination penetration among healthcare professionals working in health centers in Ethiopia.

**Objective:** To assess hepatitis B vaccination status and associated factors among healthcare professionals working in health centers of Akaki Kality, Addis Ababa, Ethiopia.

**Methods:** A facility-based cross-sectional study was conducted. Using simple random sampling, 528 healthcare workers were selected. Data were collected using a pre-tested, structured self-administered questionnaire. Data were entered into Epi-data and analyzed using SPSS version 20. Multivariable binary logistic regression analysis was used to identify the significant associations. Adjusted odds ratios were computed to measure the strength of association, with statistical significance considered at  $p < 0.05$ .

**Results:** Among 505 respondents, only 244 (48%) had ever received a hepatitis B vaccine. Monthly income, religion, age, working unit and educational level were found to be statistically associated with vaccinated status.

**Conclusion:** This study showed that the percentage of healthcare professionals who had received a hepatitis B vaccination was very low. This is a serious public health concern and a challenge for a country with high prevalence of hepatitis B infection. There is a need to promote hepatitis B screening and vaccination among healthcare professionals. The government must play its part by increasing healthcare budgets and prioritize hepatitis B prevention by establishing a national awareness campaign, and making screening and vaccination services available at all public health centers.

**Keywords:** hepatitis B, vaccination, healthcare professional, health center, Addis Ababa

## Introduction

Hepatitis B is a potentially life-threatening blood-borne liver infection caused by the hepatitis B virus (HBV).<sup>1</sup> According to the most recent estimates from the Global Burden of Disease study and the World Health Organization (WHO), viral hepatitis is responsible for approximately 1.34 million deaths, annually. The number of HBV-positive individuals was the highest in the African region, accounting for 68% of the global burden.<sup>2,3</sup> Working in healthcare has long been recognized as

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a risk factor for HBV exposure. Hepatitis B, C and HIV (human immunodeficiency virus) infections are the most serious occupational health hazards faced by healthcare workers worldwide. A WHO report estimates that 40% of hepatitis B infection is as a result of occupational exposure, and it has been estimated that 14.4% of hospital workers are infected with hepatitis B virus at any given time.<sup>2,4</sup> The incidence of this infection among healthcare workers has been estimated to be 2–4 times the level in the general population.<sup>3</sup> A study conducted across two hospitals in Ethiopia on a sample of 267 healthcare workers found the overall prevalence of HBV infection to be 51.3%.<sup>5</sup>

Unlike other sexually transmitted infections (STIs), hepatitis B virus is vaccine preventable. As part of occupational safety measures, all healthcare workers are required to be vaccinated against HBV. According to a report from the US, the overall vaccination coverage against HBV among healthcare personnel was 69.5% and 63.4%, for one and three HBV vaccine doses, respectively.<sup>6</sup> Unfortunately, HBV vaccination coverage amongst healthcare workers in most low- and middle-income countries is only 18–39% compared to 67–79% in high-income countries.<sup>2,3,5–12</sup> Specific examples include penetration rates of 38.8% in tertiary care centers in North India,<sup>13</sup> 61.2% in Gauteng province of North Africa,<sup>14</sup> and 33.6% in Benin City in Nigeria.<sup>15</sup>

A study conducted in the public hospitals of Addis Ababa found the majority of the study subjects (72.4%) to have been exposed to blood and blood products. Reports of the prevalence of hepatitis B in Ethiopia vary.<sup>5,7–12</sup> Despite a high prevalence of the infection, exposure to blood and blood products, and a high prevalence of needle stick and other injuries from sharp objects, the vaccination status of healthcare workers varies from 3.6% to 30.3% in different regions of Ethiopia.<sup>9,16–19</sup> There are various reported factors associated with vaccination status including socio-demographic factors like seniority, gender, work experience, the working unit,<sup>6,20,21</sup> level of education, marital status, and age.<sup>17,21</sup> Other factors reported are vaccine unavailability and cost,<sup>17,22</sup> work pressures, changes of location, lack of knowledge,<sup>13,15,20</sup> being careful, and taking standard precautions.<sup>13–16,18,23</sup> Factors such as negligence, a low level of perceived susceptibility, fear of side effects, forgetfulness, attitude,<sup>20</sup> lack of time, and lack of motivation have also been reported as impacting the penetration of HBV vaccination.<sup>13,19,20,23</sup> Though there are few studies

conducted at hospitals, as far as the authors search is concerned, there are no studies conducted on hepatitis B vaccination status of healthcare professionals working at health centers in Ethiopia.

## Materials and Methods

### Study Area, Design and Period

A facility-based cross-sectional study was conducted in the health centers of Akaki Kality, subcity of Addis Ababa, the capital city of Ethiopia, from May 15 to June 15, 2020. At time of study, the subcity region contained 10 health centers.

### Study Population

The study population was healthcare professionals in roles such as health officers, nurses, midwives, and laboratory technicians. This sample population was selected due to their frequent contact with patients' blood and bodily fluids, and because they are considered to be at a higher risk of acquiring HBV.

### Sample Size

The study has got two specific objectives: Accordingly, the sample size was calculated for the two objectives and the larger sample size was taken.

For the first specific objective, it was calculated by using the single population proportion formula, assuming proportion ( $p$ ) of staff vaccinated (based on Black Lion hospital in 2015, where the proportion was 51%),  $p=51\%$ , a confidence level of confidence =95% ( $Z_{\alpha/2} = 1.96$ ), a significance of 5% and margin of error ( $d$ ) of 5%.

Using single population proportion formula, the minimum sample size required ( $n$ ) for the first objective was calculated to be 384. Assuming a non-response rate of 10%, it became 423 participants.

The required sample size for second objective was determined using double population proportion using Epi-info version 7.2.2.6 stat calc software as presented below. Factors that have significant association with corresponding odds ratio in previous studies are selected to calculate sample taking the following assumptions based on previous studies conducted in Shashemane. Confidence level 95%, Power of the study 80%, associated variable "cost of the vaccine". %exposed with outcome, %unexposed with the outcome. Adjusted odds ratio (AOR) 1.7 and a 10% nonresponse rate, the sample size became 528. And

therefore sample size for the second objective was taken as it gave optimum sample size.

## Sampling Procedure

For each health center, an allocation of personnel was calculated that was proportionate to the total size of the center. Potential participants in each health facility were selected by using a computer-generated random number method and a list of all the health workers who were at risk of contact with patients' blood and bodily fluid at the center.

## Data Collection Tools and Procedures

Data were collected using self-administered, structured questionnaires. The questionnaire tool was adapted from similar studies conducted on similar study populations. Data were collected by four diploma-holding healthcare professionals. Identified personnel were approached in the workplace setting.

## Description of Variables

The dependent variable was hepatitis B vaccination status.

The independent variables were socio-demographic variables, not feeling at risk, fear of side effects, current unit of work, behavioral factors, fear of needles, negligence or forgetfulness, work load, health service factors and availability of information, availability of the vaccine, and cost.

## Data Quality Assurance

The questionnaire was first prepared in English and then translated into the local language, Amharic. To confirm that the translation had been consistently carried out, the questionnaire was then translated back from Amharic to English by another language expert. The questionnaire was pilot-tested on 5% of the sample, and any necessary corrections to the questionnaire were made accordingly. Training was given for data collectors and supervisors. Completed questionnaires were checked by the supervisors on a daily basis for completeness.

## Data Processing and Data Analysis

Data entry was undertaken using Epi-data version 3.1 and analysis was conducted using SPSS 20 for Windows. Data were checked for completeness, and any incomplete questionnaire was excluded from the analysis. Following data entry, data cleaning was conducted to avoid any missing values, outliers, and other inconsistencies before analysis. Analysis was undertaken using commands like frequency, find, and list. The data was explored to visualize the

general features using descriptive statistics including frequency, and mean and standard deviation. A multivariable binary logistic regression analysis was used to identify the factors that were significantly associated with the dependent variable. Adjusted odds ratios were computed to determine the strength of association. Statistical significance was considered at a level of  $p < 0.05$ .

## Ethical Considerations

Ethical approval was obtained from the institutional review board of Rift Valley University Department of Public Health. Following this permission was sought and successfully obtained from Addis Ababa public health research and emergency management directorate Bureau, and from the Akaki Kality subcity health office. Further, permission to conduct the research was requested and obtained from the administrative body of Akaki Kality subcity Health Office. An information sheet was prepared and given to all study participants to obtain informed verbal consent. All participants were informed of the aim and purpose of the study and their participation was voluntary. Verbal informed consent was approved by the ethics committee, and that this study was conducted in accordance with the Declaration of Helsinki. The name of the participant was not asked, instead a code number was used to ensure anonymity and confidentiality throughout the study.

## Results

### Sociodemographic Characteristics

A total of 505 respondents completed the questionnaire, making the response rate 96%. Of this sample, 226 (44.8%) were nurses. The mean age of respondents was 29 years and 292 (57.2%) were female. Regarding educational status, 343 (67.9%) were holders of a first degree. 226 (44.8%) of the respondents were Orthodox Christians and 283 (56%) were single. The mean monthly income for the respondents was 6665.56 Ethiopian Birr. Among the respondents, 416 (82.4%) had less than 9 years' experience, and the mean duration of service was 6.37 years (Table 1).

### Hepatitis B Exposure of Study Participants

Of the sample, 404 (80%) said that their usual work involves the identification of patients, of which 166 (41%) did this by sending patient samples for laboratory diagnosis. Concerning the use of infection prevention measures when caring for hepatitis B patients, 503 (99.6%) participants responded that they do use these. Among these, 500 (99%) said that they dispose of sharp materials properly, whereas among

**Table 1** Socio-Demographic Characteristics of Healthcare Workers in Akaki Kality, Addis Ababa, Ethiopia. 2020

| Characteristics                 | Frequency | Percentage |
|---------------------------------|-----------|------------|
| <b>Age</b>                      |           |            |
| 19–24                           | 45        | 8.9        |
| 25–29                           | 225       | 44.6       |
| 30–35                           | 202       | 40         |
| Over 36                         | 33        | 6.5        |
| <b>Sex</b>                      |           |            |
| Female                          | 292       | 57.8       |
| Male                            | 213       | 42.2       |
| <b>Educational Status</b>       |           |            |
| Diploma                         | 162       | 32.1       |
| Degree                          | 343       | 67.9       |
| <b>Religion</b>                 |           |            |
| Orthodox                        | 226       | 44.8       |
| Muslim                          | 125       | 24.7       |
| Protestant                      | 141       | 27.9       |
| Other                           | 13        | 2.6        |
| <b>Marital Status</b>           |           |            |
| Single                          | 184       | 36.4       |
| Married                         | 283       | 56         |
| Widowed                         | 7         | 1.4        |
| Divorced and separated          | 31        | 6.1        |
| <b>Income in Ethiopian Birr</b> |           |            |
| Less than 3100 Birr             | 9         | 1.8        |
| 3101–5200 Birr                  | 135       | 26.7       |
| 5201–7300 Birr                  | 180       | 35.6       |
| 7301–9400 Birr                  | 143       | 28.3       |
| Over 9401 Birr                  | 38        | 7.5        |
| <b>Professional category</b>    |           |            |
| Health officer                  | 135       | 26.7       |
| Nurse                           | 226       | 44.8       |
| Laboratory technician           | 53        | 10.5       |
| Midwife                         | 91        | 18         |
| <b>Years of service</b>         |           |            |
| Less than 2 years               | 87        | 17.2       |
| 2–4 years                       | 96        | 19         |
| 4–6 years                       | 102       | 20.2       |
| Over 6 years                    | 220       | 43.6       |
| <b>Unit of Work</b>             |           |            |
| Emergency                       | 96        | 19         |
| Labor                           | 83        | 16.4       |
| Laboratory                      | 53        | 10.5       |
| Inpatient                       | 85        | 16.8       |
| Outpatient                      | 172       | 34.1       |
| Other                           | 16        | 3.2        |

respondents who reported not to use infection prevention measures (50%) said that this was because they do not have access to the protective equipment. When asked whether they deliver the same standard of care for hepatitis B patients, 339 (67.1%) responded they did (Tables 2 and 3).

## Hepatitis B Screening and Vaccine Utilization Status of Study Participants

Of the respondents, 359 (71.1%) reported that they had been tested for HBV. Of those tested, 162 (45.1%) had not received a test within the last 1–2 years. For those who had never been tested, the most commonly cited reason ( $n = 75$ ; 51.7%) was cost (Table 4). Regarding hepatitis B vaccination status, only 244 (48%) respondents said that they had ever received

**Table 2** Standard of Care Delivery Status Among Healthcare Workers in Akaki Kality, Addis Ababa, Ethiopia, 2020

| Standard of Care  | Frequency | Percentage |
|---|-----------|------------|
| <b>Deliver the same standard of care to HBV patient as toothers</b>       |           |            |
| Yes   | 339       | 67.1       |
| No  | 166       | 32.9       |
| <b>Reasons for not delivering the same standard (<math>n = 38</math>)</b> |           |            |
| Patients need special care  | 67        | 40.4       |
| Fear of exposure  | 99        | 59.6       |

**Table 3** HBV Exposure Status of Healthcare Workers in Akaki Kality, Addis Ababa, Ethiopia. 2020

| Exposure to HBV                                   | Frequency | Percentage |
|---|-----------|------------|
| <b>Ever encountered exposure from HBV patient</b> |           |            |
| Yes   | 127       | 27.1       |
| No  | 378       | 74.9       |
| <b>Time of exposure</b>                           |           |            |
| <1 year   | 78        | 61.4       |
| 1–2 years   | 27        | 21.3       |
| >3 years  | 15        | 11.8       |
| I forgetting                                      | 7         | 5.5        |
| <b>Measures taken after exposure</b>              |           |            |
| Rinsed it with water                              | 85        | 66.9       |
| Took post exposure prophylaxis                    | 31        | 24.4       |
| Diagnosed for hepatitis B                         | 11        | 8.7        |

**Table 4** Testing for HBV Infection Among Healthcare Workers in Akaki Kality, Addis Ababa, Ethiopia, 2020

| Screening                       | Frequency | Percentage |
|---------------------------------|-----------|------------|
| <b>Ever been screened</b>       |           |            |
| Yes                             | 359       | 71.1       |
| No                              | 146       | 28.9       |
| <b>When screened?</b>           |           |            |
| Less than 1 year                | 89        | 24.8       |
| 1–2 years                       | 162       | 45.1       |
| >3 years                        | 85        | 23.7       |
| I forget it                     | 23        | 6.4        |
| <b>If no, why?</b>              |           |            |
| Unavailability of the diagnosis | 47        | 32.4       |
| Cost                            | 75        | 51.7       |
| Negligence                      | 9         | 6.2        |
| Fear of positive results        | 12        | 8.3        |
| Workload                        | 2         | 1.4        |

a hepatitis B vaccine, whereas 261 (52%) responded they have never received the hepatitis B vaccine. Of those who had received the hepatitis B vaccine, 22 (9%) had received only one dose, whereas 107 (43.9%) had received two doses, 115 (47.1%) had received three doses and 2 (0.8%) had received three doses and a booster dose (Figure 1).

In total, 117 participants (48%) had completed the vaccination with an appropriate schedule. Of those who had not completed the schedule, 30 (23.6%) said that this was because they forgot to attend subsequent appointments to complete the schedule, 57 (44.9%) they said the subsequent

vaccination doses were too costly, 23 (18.1%) said that subsequent doses were unavailable, 14 (5.7%) had missed doses, and 3 (1.2%) said they were still awaiting subsequent doses to complete the schedule (see Tables 4 and 5).

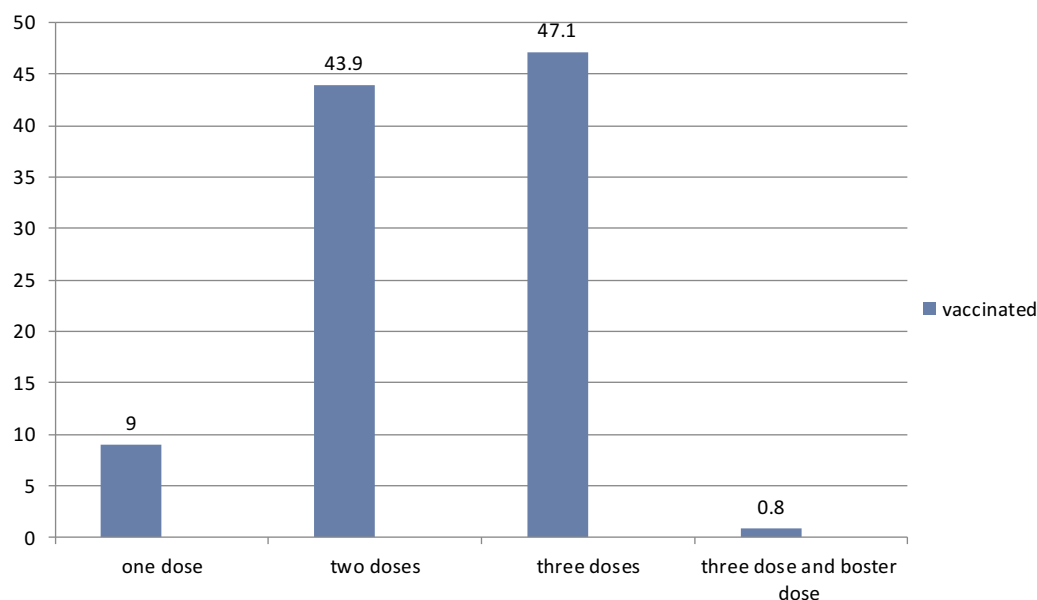
## Factors Associated with HBV Vaccination

Analysis of participant responses identified that monthly income, working unit, educational level, age, and religion were found to be significantly associated with the likelihood of having received HBV vaccination (see Table 6).

## Discussion

This study showed that the level of reported hepatitis B vaccination among healthcare workers in health centers in Addis Ababa was similar to that reported in study conducted on a similar sample in Nigeria. Having said that, the vaccination rate reported in the present study is higher than that of studies conducted in a tertiary care center in north India,<sup>13</sup> as well as health centers in Gauteng province of North Africa,<sup>14</sup> Benin City in Nigeria,<sup>15</sup> Shashemane,<sup>19</sup> Hawasa,<sup>18</sup> and Bahir Dar.<sup>16</sup> These studies were conducted over a five-year period, and as such there may have been improvements in the vaccination rate of the populations studied due to the widespread global efforts made to raise awareness of healthcare professionals in order to increase the uptake of Hepatitis B testing and vaccination in recent years.

The multivariate analysis shows that respondents in the age group of 30–35 years and over 35 years were more

**Figure 1** Number of hepatitis B vaccine doses taken by healthcare workers, Akaki Kality, Addis Ababa, Ethiopia, 2020.

**Table 5** Hepatitis B Vaccination Status of Healthcare Workers at Akaki Kality, Addis Ababa, Ethiopia. 2020

| Vaccination Status   | Frequency | Percentage |
|--|-----------|------------|
| <b>Completed vaccination with an appropriate schedule (n=76)</b> |           |            |
| Yes  | 117       | 48         |
| No   | 127       | 52         |
| <b>Reasons for not completing (n=53)</b>                         |           |            |
| Forgot the schedule  | 30        | 23.6       |
| Costly   | 57        | 44.9       |
| Unavailability of the vaccine                                    | 23        | 18.1       |
| Missed doses   | 14        | 11         |
| Others   | 3         | 2.4        |
| <b>Reasons for not being vaccinated (n=152)</b>                  |           |            |
| Unavailability of the vaccine through Government channels        | 128       | 49         |
| Cost   | 117       | 44.8       |
| Fear of side effects of the vaccine                              | 10        | 3.8        |
| Negligence, fear of needles and Workload                         | 5         | 2.3        |

**Table 6** Factors Associated with Vaccination for Hepatitis B Virus Among Healthcare Professionals in Akaki Kality, Addis Ababa, Ethiopia. 2020

| Variable                             | Category           | Vaccinated |     | COR (95% CI)         | AOR(95% CI)         | p. value |
|--------------------------------------|--------------------|------------|-----|----------------------|---------------------|----------|
|                                      |                    | Yes        | No  |                      |                     |          |
| Age of respondent                    | 19–24 year         | 13         | 32  | 1                    | 1                   | 1        |
|                                      | 25–29              | 65         | 160 | 1(0.494,2.026)       | 1.017(0.93,2.630)   | 0.973    |
|                                      | 30–35              | 137        | 65  | 5.188(2.553,10.542)  | 3016(1.021,8.904)   | 0.046    |
|                                      | >36                | 29         | 4   | 17.846(5.226,60.943) | 6.572(1.208,35.743) | 0.029    |
| Religion of respondent               | Orthodox Christian | 118        | 108 | 1                    | 1                   | 1        |
|                                      | Muslim             | 68         | 57  | 1.09(0.704,1.692)    | 1.466(0.842,2.553)  | 0.176    |
|                                      | Protestant         | 54         | 87  | 0.568(0.370,0.872)   | 0.531(0.311,0.906)  | 0.020    |
|                                      | Other              | 4          | 9   | 0.407(0.522,1.359)   | 0.543(0.109,2.717)  | 0.457    |
| Years of service                     | Less than 2 years  | 21         | 66  | 1                    | 1                   | 1        |
|                                      | 2–4                | 24         | 72  | 1.048(0.534,2.056)   | 1.291(0.568,2.933)  | 0.541    |
| Monthly income of respondent in Birr | 3100–4500          | 11         | 17  | 1                    | 1                   | 1        |
|                                      | 4501–5900          | 10         | 22  | 0.702(0.242,2.038)   | 0.694(0.216,2.228)  | 0.539    |
|                                      | 5901–7300          | 17         | 29  | 0.906(0.345,2.381)   | 1.15(0.399,3.310)   | 0.796    |
|                                      | 7301–8700          | 25         | 32  | 1.207(0.481,3.034)   | 1.422(0.509,3.975)  | 0.502    |
|                                      | 8701–10,000        | 32         | 16  | 3.091(1.175,8.13)    | 3.166(1.006,9.963)  | 0.049    |
|                                      | 10,001–11,500      | 22         | 11  | 3.091(1.083,8.818)   | 3.977(1.167,13.548) | 0.027    |
| Working Unit                         | Emergency          | 11         | 18  | 1                    | 1                   | 1        |
|                                      | Labor              | 21         | 17  | 0.262(0.56,1.230)    | 2.171(0.770,6.118)  | 0.143    |
|                                      | Laboratory         | 12         | 12  | 0.529(0.119,2.363)   | 2.126(0.670,6.748)  | 0.200    |
|                                      | In patient         | 10         | 29  | 0.429(0.089,2.063)   | 0.676(0.229,1.993)  | 0.477    |
|                                      | OPD                | 56         | 49  | 0.148(0.032,0.684)   | 1.905(0.774,4.687)  | 0.161    |
|                                      | Other              | 7          | 3   | 0.5(0.123,2.041)     | 6.478(1.220,34.390) | 0.028    |
| Education status-                    | Diploma            | 18         | 38  | 1                    | 1                   | 1        |
|                                      | Degree             | 99         | 89  | 2.348(1.251,4.408)   | 2.2(1.110,4.364)    | 0.024    |

**Abbreviations:** AOR, adjusted odds ratio; HBV, hepatitis B virus; SPSS, statistical package for social sciences; STI, sexually transmitted infection; WHO, World Health Organization.



likely to have received hepatitis B vaccination than those aged 19–24 years. This is consistent with previous studies<sup>17,21</sup> and maybe due to older healthcare workers having a greater fear of infection exposure. And also due to their lack of experience or more up-to-date on job training the younger may not take the vaccination. Income was also found to be a predictor of vaccination status, with higher incomes being associated with a higher likelihood of having been vaccinated. This may be because of the cost of the vaccination itself, as the hepatitis B vaccine is not provided for free in government health centers.

The working unit was another factor significantly associated with the likelihood of having received a hepatitis B vaccination. It may be that some units are at a lower infection risk than others, and therefore are more reluctant to take the vaccine. Those with bachelors' degrees were more likely to have been vaccinated compared staff with diplomas, echoing the findings reported by previous studies.<sup>17,21</sup> This may be due to an intrinsic connection between educational level and salary, with holders of bachelors' degrees being paid more compared to staff with diplomas. Alternatively, or additionally, it may be more directly down to the level of education attainment, with diploma holders being less aware of the seriousness of HBV infection. Finally, followers of the Protestant religion were less likely to have been vaccinated compared to those of the Orthodox religion. In contradiction to previously published studies, the factors of gender, work experience,<sup>6,20,21</sup> marital status,<sup>17,21</sup> unavailability, and cost of the vaccine<sup>17,22</sup> were not found to be significantly associated with vaccine uptake in the present study.

The strength of the current study is that the study was conducted among healthcare professionals working in health center, whereas many previously published studies have focused on hospital workers. However, due to the cross-sectional study design, recall and temporal bias may have been introduced into the sample. Similarly, the study did not include the hepatitis tests.

## Conclusion

In a study of 505 randomly selected healthcare workers from health centers across the Akaki Kality subcity of the Addis Ababa, Ethiopia, almost half the respondents reported that they had received at least a partial dosing schedule of the hepatitis B vaccine. However, of these, only half reported to have received three complete doses of hepatitis B vaccine. Vaccination penetration was significantly associated with the age, religion, income, and

working unit of the respondent. Efforts must be made to vaccinate healthcare workers against HBV free of cost or at lower cost as this is a serious public health concern and challenge for healthcare workers in health centers throughout low- and middle-income countries.

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## Disclosure

The authors declare that they have no competing interests in relation to this work.

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