



**HEPATITIS B INFECTION PREVENTION PRACTICE AND
VACCINATION STATUS AMONG HEALTHCARE WORKERS IN
HARGEISA CITY, SOMALILAND**

MPH THESIS

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**Hepatitis B Infection Prevention Practice and Vaccination Status among
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MASTER OF PUBLIC HEALTH IN EPIDEMIOLOGY**

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ACRONYMS AND ABBREVIATIONS

AOR	Adjusted Odds Ratio
CI	Confidence Interval
COR	Crude Odd Ratio
HAI	Hospital-Acquired Infections
HBV	Hepatitis B Virus
HAIs	Healthcare Associated Infections
HCWs	Healthcare Workers
IHRERC	Institutional Health Research Ethical Review Committee
KAP	Knowledge, Attitude, and Practice
LMICs	Low and Middle-income Countries
NGOs	Non-Governmental Organizations
NSI	Needle Stick-Injury
PPE	Personal Protective Equipment
WHO	World Health Organization

ABSTRACT

Background: Hepatitis B Virus (HBV) infection is an important global public health challenge, with sub-Saharan Africa disproportionately affected. Healthcare workers faced an increased risk of hepatitis B infection due to their exposure to bodily fluids. However, evidence on hepatitis B infection prevention practices and vaccination status among healthcare providers remains limited in Somaliland.

Objective: This study aimed to assess hepatitis B infection prevention practices and hepatitis B vaccination status among Healthcare Workers in Hargeisa City, Somaliland.

Methods: An institution-based cross-sectional study was conducted among randomly selected 348 healthcare workers from 14 health facilities in Hargeisa, Somaliland. A structured, interviewer-administered questionnaire was used to assess hepatitis B infection prevention practices and vaccination status. Multivariate logistic regression was used to assess factors associated with infection prevention practice and vaccination status at a 5% significance level.

Result: Nearly half 48% (95% CI: 46.7%–57.3%) of healthcare workers demonstrated good HBV prevention practices, and only 35.1% (95% CI: 30.0%–40.1%) were vaccinated. Poor prevention practice was significantly associated with poor knowledge (AOR = 2.07, 95% CI: 1.18–3.62), unfavourable attitudes (AOR = 2.30, 95% CI: 1.18–4.48), lack of personal protective equipment (PPE) (AOR = 4.68, 95% CI: 2.26–9.71), and vaccine unavailability (AOR = 3.78, 95% CI: 1.72–8.31). Regarding vaccination status, HCWs were significantly less likely to be vaccinated if they lacked access to PPE (AOR = 0.37, 95% CI: 0.17–0.81), lacked access to vaccines at their facility (AOR = 0.19, 95% CI: 0.09–0.44), were not offered free vaccination (AOR = 0.43, 95% CI: 0.21–0.90), did not adhere to preventive guidelines (AOR = 0.33, 95% CI: 0.14–0.76), or possessed poor knowledge regarding the vaccine (AOR = 0.36, 95% CI: 0.20–0.63).

Conclusion: A significant proportion of health professionals were having good hepatitis B virus infection prevention practices, while slightly more than one-third were vaccinated. Overall, there is a lack of best practices and low vaccination rates for hepatitis B prevention. Limited knowledge, unfavourable attitude, lack of personal protective equipment, absence of hepatitis B vaccines, and not adhering to HBV preventive guidelines were found to be significantly associated with hepatitis B infection prevention practices and vaccination status.

Key words: hepatitis B virus, hepatitis B vaccination, healthcare workers, infection prevention, and Somaliland.

1. INTRODUCTION

1.1 Background

Hepatitis B infection is a global public health problem around the world (Alege *et al.*, 2020a). The inflammation related with the hepatitis B virus can cause several major complications such as liver cirrhosis, hepatocellular carcinoma, and eventually death. HBV can be considered one of the major health problems in the world, causing severe morbidity and mortality. The most common modes of transmission of the hepatitis B virus are exposure to blood and blood products, body fluids during sexual intercourse, pregnancy and childbirth, and exposure to medical equipment. (Roien *et al.*, 2021). Blood-borne viruses like HBV commonly result in fatalities in both high-risk and general populations.

Globally, more than 300 million people have chronic liver infections, and about 600,000 people die annually from acute or chronic complications of hepatitis B infection (Tanga *et al.*, 2019). Millions of healthcare workers (HCWs) work in health facilities worldwide, and it is estimated that 600,000 to 800,000 puncture injuries occur among them annually, with approximately 50% of these needle stick injuries remaining unreported (Belete *et al.*, 2022a).

Hepatitis B prevalence is the highest in sub-Saharan Africa and East Asia, where between 5 and 10% of the adult population is chronically infected, as a study made in Somaliland indicated (Nour and Ali, 2022). In Low and Middle-income countries (LMIC), people develop chronic liver disease, cirrhosis of the liver, as well as hepatocellular carcinoma, due to hepatitis B complications during their adulthood. Somaliland is one of the sub-Saharan countries with an elevated endemicity of HBV and associated factors, which can facilitate the spread of hepatitis B infection (Nour and Ali, 2022). HCPs are highly susceptible to contracting HBV through mucosal exposure, contact with non-intact skin, improperly sterilized equipment, and contaminated blood or body fluids. Due to these occupational hazards, the incidence of HBV infection among healthcare professionals is four times higher than that of the general population (Aynalem *et al.*, 2022a).

1.2 Statement of the Problem

Hepatitis B virus (HBV) infection remains a significant public health challenge worldwide, with life-threatening complications such as chronic liver disease, cirrhosis, and hepatocellular carcinoma. Globally, it is estimated that 257 million people are living with chronic HBV infection, with the majority of cases concentrated in Southeast Asia and sub-Saharan Africa. Sub-Saharan Africa alone accounts for a substantial burden, with HBV prevalence rates ranging from 5% to 8% depending on the region (Allene and Delelegn, 2020, Nicolini *et al.*, 2019). Concerningly, up to 80% of hepatocellular carcinoma cases and over 60% of chronic liver disorders in countries such as Kenya and Ethiopia are attributed to chronic HBV infections (Bialfew *et al.*, 2018). In Somaliland, 46.15% cases suffered from hepatic cirrhosis (Al-Mamari, 2019).

Healthcare workers (HCWs) are disproportionately affected by HBV due to occupational exposure to blood and other bodily fluids, particularly through needlestick injuries. Globally, the World Health Organization (WHO) estimates that 3 million healthcare workers annually sustain work-related injuries from needles or syringes, resulting in approximately 66,000 HBV infections each year (Garzillo *et al.*, 2020). Studies have shown that the risk of occupational HBV transmission is heightened in resource-limited settings, where healthcare systems often lack adequate infection control measures, vaccination coverage, and awareness of preventive practices (Shah *et al.*, 2020b, Roien *et al.*, 2021). For example, in Ghana, the risk of HBV transmission following a needle-stick among unvaccinated HCWs can range from 6% to 30% (Afihene and Duduyemi, 2015).

In developing countries, including African nations, several factors exacerbate the risk of HBV transmission among HCWs. These include overcrowded healthcare facilities, inadequate safety equipment, reuse or improper disposal of needles, and a lack of awareness about HBV prevention practices. While the HBV vaccine is a verified and effective preventive measure, vaccine uptake and adherence among healthcare workers remain inconsistent, particularly in sub-Saharan Africa, where such data are limited (Afihene and Duduyemi, 2015, Roien *et al.*, 2021).

Despite the high burden of HBV in sub-Saharan Africa, there is limited research on HBV infection prevention practices and vaccination status among healthcare workers in Somaliland, particularly in Hargeisa City. Currently, no study has been conducted in this area that specifically assesses HBV prevention practices and vaccination status. Previous studies conducted in other developing countries have often highlighted the challenges of HBV prevention and vaccination status, but have failed to provide a comprehensive understanding of the infection prevention practices. Moreover, these studies have not adequately addressed practices and associated factors regarding HBV prevention and vaccination status.

The lack of study area-specific data and evidence-based recommendations has left a critical gap in the understanding of HBV prevention practices and vaccination status among HCWs in Hargeisa City. Addressing this gap is essential, as healthcare workers are not only at increased risk of infection themselves but also act as vectors for nosocomial transmission of HBV to patients and the wider community. This study aims to fill this gap by assessing HBV infection prevention practices and vaccination status among healthcare workers in Hargeisa City, Somaliland.

1.3 Significance of the Study

The findings of the study will be used to inform the administration of hospitals and health centres, to assess the extent of the problem, existing prevention practices, and to develop a vaccination unit to improve the quality of prevention practices against HBV infection. This finding will also be utilized by regional health administrations to develop effective education programs for the community about prevention strategies, risk factors, and the importance of regular screening for early identification of hepatitis B infection. Healthcare workers will use the findings of the study to understand the burden of the problem by enhancing their attitude, knowledge, and practice towards hepatitis B infection prevention and vaccination status. The findings of the study will provide supporting information for policymakers and healthcare planners to develop effective interventions. Future researchers will benefit from the study by getting the required information, as they will do similar research for this study.

1.4. Objectives

1.4.1. General Objective

- This study aimed to assess Hepatitis B infection prevention practice and vaccination status among healthcare workers in Hargeisa city, Somaliland, from July 15 to August 15, 2024.

1.4.2. Specific Objectives

- To assess the practice towards hepatitis B virus infection prevention among health workers in Hargeisa City, Somaliland.
- To determine the vaccination status of hepatitis B infection among healthcare workers in Hargeisa City, Somaliland.
- To assess factors associated with Hepatitis B infection prevention practice and factors affecting vaccination status among healthcare workers in Hargeisa City, Somaliland.

2. LITERATURE REVIEW

2.1 Hepatitis B Virus Infection Prevention Practice for Healthcare Workers

Hepatitis B virus (HBV) infection prevention practices among healthcare workers vary across different regions or countries, and are influenced by factors such as vaccination status, awareness, and adherence to safety procedures. These practices are important to minimize the risk of HBV transmission and ensure the safety of both health professionals and patients.

The handling of sharps is a key factor in reducing the risk of HBV transmission. A major sign of poor practice is recapping needles, which is widely discouraged but still commonly done. In regional studies, the levels of adherence vary greatly. In Kenya, 63% of healthcare workers recapped needles after use, leading to a 52% rate of needle stick injuries (OGADA, 2023). Similar findings are seen in Northern Vietnam, where 48.2% of workers improperly recapped needles using two hands (Hang Pham *et al.*, 2019).

Reporting mechanisms also show significant gaps. In Pakistan, while 65.8% of nurses adhered to safe needle practices (avoiding sharing), only 42.5% formally reported injuries to health authorities (Begum *et al.*, 2024). These findings suggest that even when knowledge exists, the practical application and reporting systems in developing regions remain weak.

Effective barrier protection is essential for preventing fluid-borne transmission. However, studies indicate a discrepancy between equipment availability and actual usage. In Libya, while 86.9% of healthcare workers reported wearing proper PPE, adherence to hand hygiene was critically low, with only 18% washing hands before starting work. Furthermore, 29.5% admitted to eating or drinking in clinical areas, a practice that directly violates infection control standards (Jerbi *et al.*, 2022).

Similarly, in Kenya, 14% of healthcare workers failed to change gloves between patients (OGADA *et al.*, 2023). This lack of hygiene consistency creates a vector for cross-contamination, as highlighted by a study in Saudi Arabia, which identified contaminated hands and equipment as major contributors to healthcare-associated infections (Abalkhail *et al.*, 2021).

waste management infrastructure is a critical concern. A study done in Ethiopia indicated the severity of this issue. Gaps in sterilization and improper hospital waste management were identified as major contributors to HBV transmission, with 10–20% of medical waste considered hazardous. Consequently, it was estimated that approximately 2.1 million healthcare workers in the region are exposed annually to injuries from HBV-contaminated sharps (Gebremeskel *et al.*, 2020).

Vaccination is the most effective prevention strategy against HBV. However, coverage rates in the East African and Eastern Mediterranean regions remain suboptimal. A study conducted in Puntland, Bosaso, reported that only 16.4% of healthcare workers had received the full three-dose vaccination course (Hussein *et al.*, 2022b). This extremely low coverage is often attributed to the unavailability of vaccines and high costs. Such low vaccination rates, combined with the high-risk practices mentioned earlier, significantly elevate the occupational risk for HBV among healthcare workers.

2.2 Vaccination Status among Healthcare Workers

Vaccination has a significant role in HBV prevention, although vaccination status varies significantly across regions. In China, 86% of healthcare workers reported receiving at least one dose of hepatitis B vaccination, while 60% completed all three doses. Factors such as age, hospital level, vaccination management, and access to free vaccination influenced completion rates. Healthcare workers in workplaces offering free vaccinations were 1.4 times more likely to complete the vaccine doses compared to those without access to free vaccines (Yuan *et al.*, 2019). In contrast, a study in Afghanistan revealed that 77.45% of healthcare workers had been screened for HBV, 56.37% of them had received at least one dose of the vaccine, and only 6.77% completed the full three-dose regimen (Roien *et al.*, 2021).

Low vaccination rates and limited awareness of HBV vaccination were also reported in Tanzania, where 56.9% of healthcare workers had received at least one dose, but only 33.6% completed the full dose of the vaccine. Reasons for low vaccination rates included lack of awareness, unaffordability, and unavailability of the vaccine. Furthermore, pre-vaccination screening revealed that 9.3% of the unvaccinated workers already tested positive for HBV markers (infection or antibodies), emphasizing the need for targeted interventions (Aaron *et al.*, 2017).

A broader perspective on vaccination status across Africa reveals significant regional discrepancies. A systematic review and meta-analysis showed that northern Africa had the highest vaccination coverage at 62.1%, while central Africa had the lowest at 13.4%. Doctors were more likely to be fully vaccinated compared to nurses, with pooled estimates of 52.4% and 26.3%, respectively. Furthermore, healthcare workers with more years of experience were more likely to be vaccinated than those with fewer years in the profession (Auta *et al.*, 2018).

2.3 Factors Associated with Hepatitis B Virus Infection, Prevention Practice, and Vaccination Status among Healthcare Workers

This section explores the various factors influencing hepatitis B virus (HBV) infection prevention practice and vaccination status among healthcare workers (HCWs), categorizing them into socio-demographic, knowledge/attitude, and organizational factors to provide a comprehensive overview.

2.3.1 Socio-demographic Factors

Socio-demographic characteristics significantly influence HBV prevention practice and vaccination status among HCWs. Factors such as gender, educational level, and work experience are key determinants. For instance, a study in Afghanistan found that higher levels of education were strongly associated with greater knowledge of HBV infection, and women had better knowledge compared to men (Roien et al., 2021). Similarly, a study in Pakistan identified that gender and certain risky practices, such as sharing cosmetics and razors, are significant risk factors for HBV (Ilyas et al., 2017). Furthermore, a meta-analysis in Ethiopia revealed that male HCWs and those with lower education levels were less likely to receive a full course of HBV vaccination (Awoke et al., 2020).

Conversely, another Ethiopian study found that males were more likely to have adequate preventive practice, and those with higher education levels also demonstrated better practices (Belete *et al.*, 2022b). These findings highlight the importance of socio-demographic factors in shaping HBV prevention practice and vaccination status.

2.3.2 Knowledge and Attitude Factors

Knowledge and attitude towards HBV are crucial in driving preventive practice and vaccination status among healthcare professionals. Studies globally show a range of knowledge levels and varied attitudes. A study in Vietnam indicated a low level of awareness regarding the high risk of perinatal HBV transmission and found that a significant portion of HCWs held negative beliefs, including the idea that HBV can spread through casual contact like sharing meals, and many had doubts about vaccine safety (Hang Pham et al., 2019). A study in Sudan found that the majority of participants had a positive attitude toward HBV precautions, but knowledge and safe behaviour rates were only moderate, highlighting the need for targeted educational initiatives (Mursy and Mohamed, 2019a). Similarly, a study conducted in Ethiopia revealed that while most participants demonstrated good overall knowledge, there were significant gaps in their understanding of HBV transmission routes, its treatability, and awareness of post-exposure prophylaxis (Hebo et al., 2019b). These inconsistencies

demonstrate the importance of comprehensive education in improving HBV prevention practice and vaccination status.

2.3.3 Organizational Factors

The primary organizational barriers to HBV vaccination for healthcare workers are systemic and resource-related, particularly the lack of vaccine availability, high costs, and insufficient institutional policies. A study in South Sudan linked low HBV vaccine uptake to factors such as the limited availability of vaccines and lack of clear guidelines and policy adherence within healthcare facilities (Alege *et al.*, 2020b). Similarly, a study across Africa identified cost as a primary barrier to vaccination, followed by lack of awareness, unavailability of vaccine at health facilities, and lack of training about HBV prevention (Shah *et al.*, 2020a). In Somalia, even though HCWs know HBV, low vaccination coverage resulted from limited vaccine availability or accessibility, high cost, lack of time, and fears about side effects (Hussein *et al.*, 2022b). These studies indicate that the work environment and the structure of health systems play a major role in ensuring the proper implementation of prevention practices and vaccination coverage.

2.4 Conceptual Framework

The conceptual framework is developed by reviewing different literature and illustrates the relationship between the independent variables and the outcome variables.

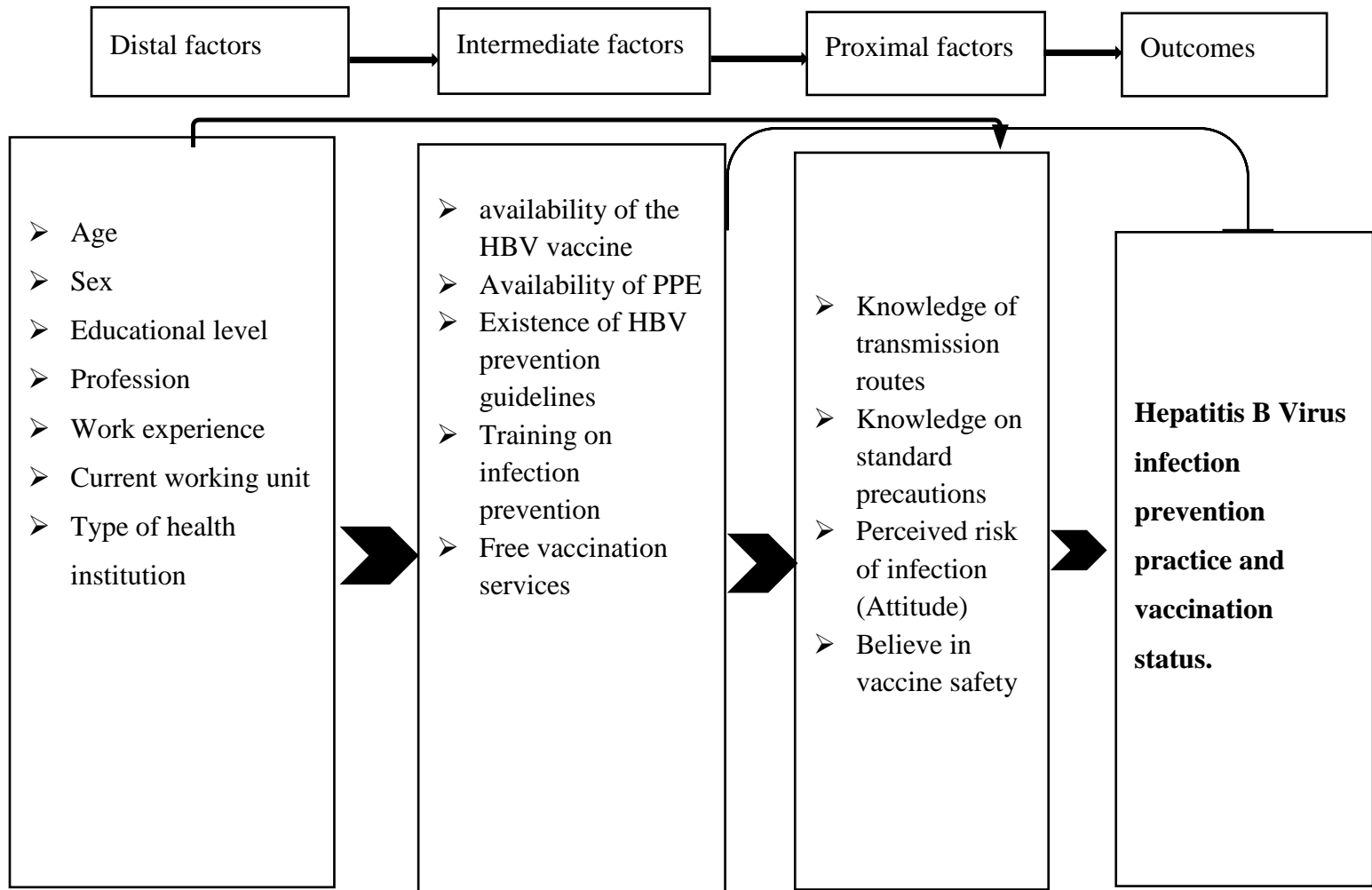


Figure 1. Conceptual framework among the group of independent variables and HBV infection prevention practice and vaccination status and developed by reviewing available literature.

3. MATERIALS AND METHODS

3.1 Study Area and Period

This study was conducted in Hargeisa city, the biggest urban setting in Somaliland and serves as the capital city. The estimated total population of Hargeisa city in 2024 is 1,176,617. It has one referral hospital, one regional hospital, seven health centers, and 12 private hospitals. The total healthcare workers in Hargeisa city were 1514, of which 600 of the workers were females and 914 were males. This study was conducted from July 15 to August 15, 2024.

3.2 Study Design

An institution-based cross-sectional study was conducted.

3.3 Population

3.3.1 Source population

All healthcare workers who were working at Hargeisa health facilities, Somaliland,

3.3.2 Study Population

Health workers who were working at Hargeisa city health facilities, Somaliland, during the study period.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion Criteria

Healthcare workers employed in healthcare facilities in Hargeisa city, Somaliland. These individuals should be actively engaged in patient care and willing to participate in the research, providing informed consent. Participants from various healthcare roles, such as doctors, nurses, midwives, laboratory technicians, pharmacists, dentists, radiology technicians, dialysis technicians, anaesthesia technicians, ophthalmologists, psychiatrists, and paediatricians.

3.4.2 Exclusion Criteria

Healthcare workers who are involved in administration and other hospital activities but not directly involved in patient care, and non-permanent workers.

3.5 Sample Size Determination

Objective 1: Hepatitis B Virus Infection Prevention Practice among Healthcare Workers. The sample size is calculated by using single population proportion formula, considering the following assumptions: confidence interval = 95%, critical value $Z_{\alpha/2} = 1.96$, a margin of error is 5% (0.05). The estimated proportion was taken from a study conducted at Jimma University Medical Centre, Southwest Ethiopia, among healthcare workers, which is 8.7%, and 10% of non-response rate was added to the final sample size (Hebo *et al.*, 2019a).

$$n = \frac{(Z_{\alpha/2})^2 P (1 - P)}{(d)^2}$$

$$n = \frac{(1.96)^2 0.087 (1 - 0.087)}{(0.05)^2}$$

$$n = 122$$

By adding 10% of the non-response rate, $n=134$.

Then multiplied by the design effect, which is 1.5.

Therefore, a final sample size was 201.

Objective 2: Hepatitis B Vaccination Status among Healthcare Workers. The sample size is calculated using the single population proportion formula, considering the following assumptions: a 95% confidence interval, a critical value of $Z_{\alpha/2} = 1.96$, and a margin of error of 5% (0.05). The estimated proportion was derived from a study conducted in Bossaso, Puntland, Somalia, among healthcare workers. from this study, 16.4% of the study participants were fully vaccinated (Hussein *et al.*, 2022a), and 10% of the calculated sample for possible non-response rate was added.

Vaccinated (16.4%), by using the formula,

$$n = \frac{(Z_{\alpha/2})^2 P (1 - P)}{(d)^2}$$

n is the minimum required sample size for the study

$Z_{\alpha/2}$ is the confidence interval at 95% (1.96)

P is the estimated proportion

d is the margin of error, which is 5 % (0.05)

$$n = \frac{(1.96)^2 0.164(1 - 0.164)}{(0.05)^2}$$

$$n = 211$$

By adding 10% of non-response rate, n=232.

Then multiplied by the design effect, which is 1.5.

Therefore, a final sample size was 348.

Objective 3: Factors Associated with Hepatitis B virus Infection Prevention Practice and vaccination status among Healthcare Workers.

Table 1: Sample size determination on factors associated with hepatitis B prevention practice and vaccination status among healthcare workers.

References	Associated factors	CI	Power	Ratio (unexposed: exposed)	Percentage in unexposed group	Odds ratio	Percentage in exposed group	Sample size
(Aynalem et al., 2022a)	Age	95%	80%	0.43	36.134%	2.27904	56.3%	249
(Belete et al., 2022a)	Educational level	95%	80%	0.244	45.5%	2.45	67.2%	280
(Belete et al., 2022a)	Profession	95%	80%	0.443	91.4%	0.11	53.9%	6 4

Hence, the minimum sample size to be included in this study was 348, the largest of the estimated sample sizes.

3.6 Sampling Procedure and Sampling Technique

The study was conducted across a total of 21 health facilities in Hargeisa, comprising 12 private hospitals, 2 public hospitals (one referral and one general), and 7 public health centres. The sampling procedure followed a two-stage stratified technique. Initially, facilities were stratified into public and private sectors. To ensure the sample was highly representative and captured the heterogeneity of the institutions, the study adopted a strategy to sample approximately two-thirds (67%) of the available facilities in each stratum purposively. Accordingly, 14 facilities were selected using simple random sampling, consisting of 8 private hospitals, 5 public health centres, and 1 public hospital. Following facility selection, proportional allocation was employed to determine the specific number of Health Care Workers (HCWs) to be interviewed at each site, ensuring that larger facilities contributed a proportional number of participants to

the final sample. Finally, individual HCWs were recruited using computer-generated simple random sampling from the personnel lists of the chosen facilities.

$$n_i = \frac{n \cdot N_i}{N}$$

n_i = Sample size per hospital

n = Total sample size

N_i = Total population of HCWs per hospital

N = Total population of HCWs in selected health facilities

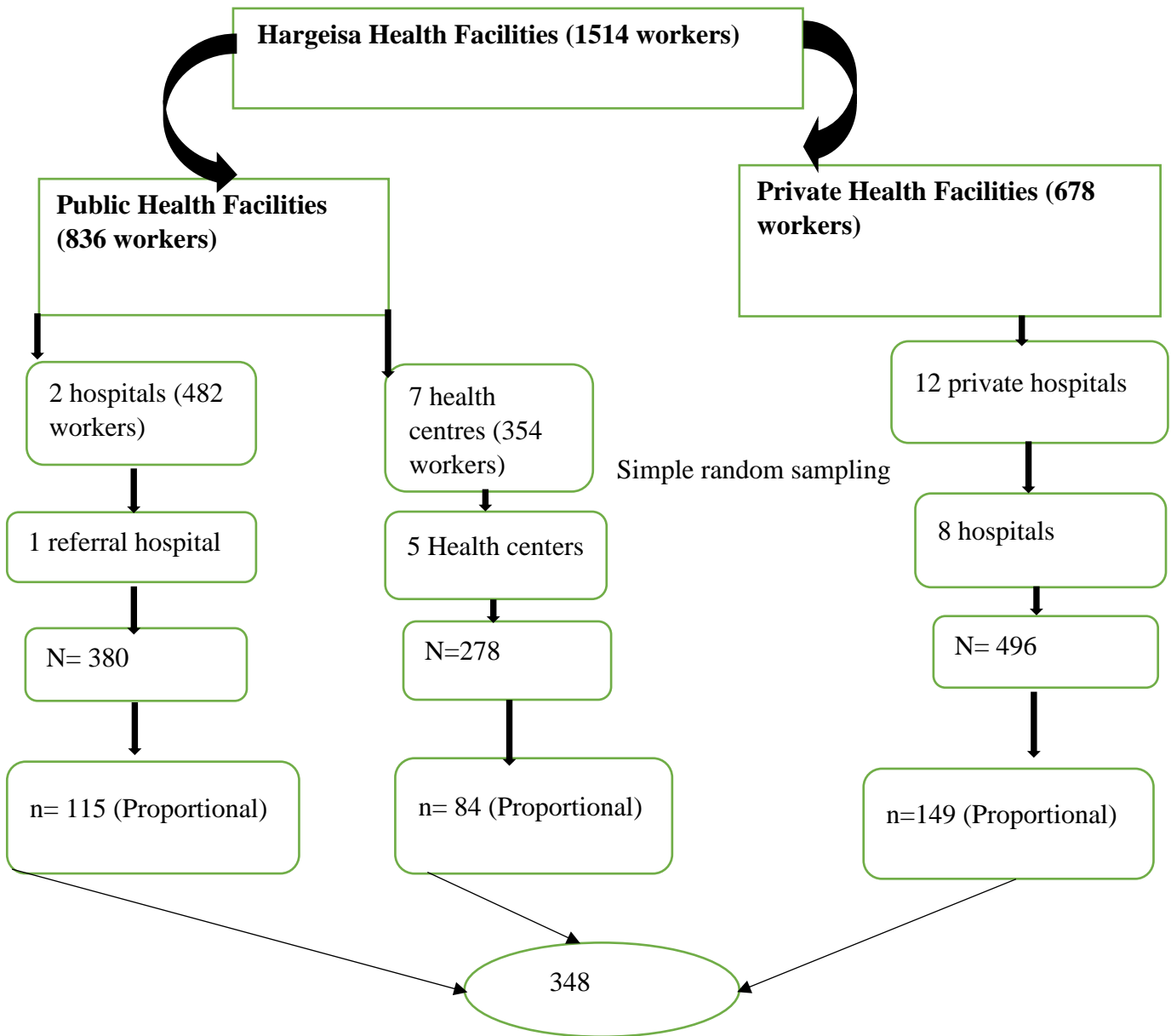


Figure 2. Schematic presentation of sampling procedure of health facilities in Hargeisa city, Somaliland.

3.7 Data Collection Methods

3.7.1 Data Collection Instruments

A structured questionnaire adapted from various literature and previous studies was used. The tool contains 9 items of socio-demographic characteristics, 20 items about knowledge of healthcare workers towards HBV infection and vaccination status, 19 items of attitude towards HBV and vaccination status, 25 items of hepatitis B prevention practice and vaccination status and a final part is 14 questions about associated factors of HBV infection prevention practice and vaccination status among study participants. The questionnaires were adapted from different literature (Abalkhail et al., 2021, Tamanna *et al.*, 2024, Aynalem et al., 2022a, Geberemariyam *et al.*, 2018).

3.7.2 Data Collectors and Supervisors

The data collection was carried out by 2 nurses, 2 midwives, and 2 supervisors with public health training all with bachelor's degrees who fluently speak both English and Somali, and have experience working at a health facility.

3.7.3 Data Collection Procedure

Data were collected using a structured interviewer-administered questionnaire. To ensure a representative professional mix, the study included various cadres of healthcare workers, including physicians, nurses, midwives, laboratory technicians, and other healthcare professionals. Participants were selected based on the randomized personnel lists obtained from each facility, and the specific individuals identified were approached during their shifts for consent and interviewing. The variables collected through the interview included socio-demographic characteristics, knowledge regarding Hepatitis B Virus (HBV), attitudes towards prevention, self-reported prevention practices, and vaccination history. Additionally, the Principal Investigator and supervisors conducted non-participant observations to cross-check actual practices against self-reported data.

3.8 Variables

3.8.1 Dependent Variables

Hepatitis B virus infection prevention practice and vaccination status.

3.8.2 Independent Variables

Socio-demographic factors (Age, Sex, Educational level, profession, current working unit and work experience); Knowledge and attitude factors (Knowledge of transmission routes, Knowledge of standard precautions, Perceived risk of infection (Attitude) Believe in vaccine safety) and Organizational factors (availability of the HBV vaccine, Availability of PPE, Existence of HBV prevention guidelines, Training on infection prevention, Free vaccination services).

3.9 Operational Definitions

Knowledge: we used 20 questions about knowledge with a yes or no response from interviews with healthcare workers. Those with a mean score or above were considered to have a good knowledge, and those below the mean score as having poor knowledge (Aynalem Debebe, 2024).

Attitude: we used 19 items about the attitude of healthcare workers with Likert scale responses. Those with a mean score and above were considered to have good attitude, and those below the mean score as having poor attitude (Aynalem Debebe, 2024).

Hepatitis B infection prevention practice: This was measured using 25 items related to standard precautions and risk reduction. Each correct practice was given a score of 1, and each incorrect practice was scored 0. The total score was computed for each participant. Participants who scored at or above the mean (average) score were classified as having "Good Practice", while those scoring below the mean were classified as having "Poor Practice" (Regassa and Fiseha, 2019).

HBV Vaccination Status: This was measured as a binary outcome based on the respondent's verification of vaccination recall. Participants were classified as "Vaccinated" if they had received at least one dose of the Hepatitis B vaccine, and "Unvaccinated" if they had never received any dose (Kyuregyan et al., 2021).

3.10 Data Quality Control

The questionnaire was prepared in English and was translated into Somali and was translated back to English again to ensure its consistency. Data collectors and supervisors were trained on data collection techniques, data management procedures, and ethical issues during data collection. A pre-test was done on 5% of the sample size at Haldoor Hospital to explore the clarity, simplicity, and understandability of the questions. The principal investigator and supervisors evaluated the questionnaires for accuracy and completeness every day.

3.11 Data Analysis

All the data were entered into Kobo Toolbox and then exported into Excel format to check for completeness and internal consistency. For analysis, the data were exported to Stata version 17. A descriptive analysis of data was displayed using numerical summary measures such as frequency tables, figures, and graphs. The composite score was computed for knowledge and practice using a mean score. Bivariate and multivariable logistic regression were done to show the association between hepatitis B infection prevention practice, vaccination status, and independent variables. All covariates that were significant at $p\text{-value} \leq 0.25$ in bivariate analysis were considered for further multivariable analysis guided by the conceptual framework to control all possible confounders at 5% significance level. Odds ratio was computed at 95% CI, and statistical significance was declared at $P\text{-value} < 0.05$.

3.12 Ethical Considerations

Ethical clearance was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University with reference number **IHRERC/168/2024**. The purpose, duration, and potential benefits of the study were clearly explained to all participants, and written informed consent was obtained prior to data collection. To ensure confidentiality, no names or personal identifiers were recorded on the questionnaires. Regarding the observation of prevention practices, strict privacy measures were implemented. Data collectors maintained a discreet distance to ensure they did not intrude on the interaction between the healthcare worker and the patient. Observations were focused strictly on the technical execution of procedures (e.g., hand hygiene, waste disposal) without recording any patient-specific information. Furthermore, to protect the professional privacy of the workers, no immediate feedback or corrections were given in the presence of patients or colleagues.

3.13. Dessimination of Results

The findings of the study will be disseminated to the Haramaya University school of Public Health Department of Epidemiology, relevant organizations and bodies that can utilize the study, including selected public health and private health facilities, the Somaliland regional health bureau, and relevant NGOs. The paper will be published on a reputable journal.

4. RESULTS

4.1 Socio-demographic characteristics

A total of 348 respondents participated in this study. The majority of healthcare workers were males (54.6%), aged 20–29 years (72.5%) and single (68.4%). Nurses (26.4%) and midwives (20.1%) comprised the largest professional groups, with the majority working in private hospitals (39.1%) and primarily in Medical surgery (23.3%) and Maternity (15.5%) wards. Nearly all had one to five years of work experience (72.1%), most held a first degree (69.2%), and more than two-thirds (69.3%) of healthcare workers earned between 150 and 300 dollars per month.

Table 2: Socio-demographic characteristics of the study participants at Hargeisa city, Somaliland, 2024(n=348).

Variables	Category	Frequency	Percentage (%)
Sex	Male	190	54.6
	Female	158	45.4
Age	20-29	252	72.5
	30-39	76	21.8
	40 ≥	20	5.7
Marital status	Single	238	68.4
	Married	101	29.0
	Divorced	9	2.6
Profession	Medical doctor	40	11.5
	Dentist	19	5.5
	Nurse	92	26.4
	Midwife	70	20.1
	Medical laboratory	43	12.4
	Radiology technician	13	3.7
	Pharmacist	31	8.9
	Dialysis technician	20	5.8
		Government hospital	121
Health institution	Health center	91	26.1
	Private hospital	136	39.1
Department	Medicine and surgery	81	23.3
	Medical laboratory	29	8.3
	Radiology	17	4.9
	Anaesthesia	26	7.5
	Psychiatry	19	5.5
	Optometry	37	10.6
	Gyn and Obs	54	15.5
	Dental	48	13.8
	Dialysis	21	6.0

	Paediatric	16	4.6
Work experience in Years	1-5	251	72.1
	6-10	73	20.9
	11-15	20	5.8
	16-20	1	0.3
	>21	3	0.9
Educational level	Diploma	50	14.4
	First degree	241	69.2
	Master's degree	57	16.4
Average monthly income (in USD)	150-300	241	69.3
	350-500	89	25.5
	>500	18	5.2

4.2 Knowledge of health workers on hepatitis B virus infection prevention

The majority of study participants, 201 (57.8%), had poor knowledge about hepatitis B infection.

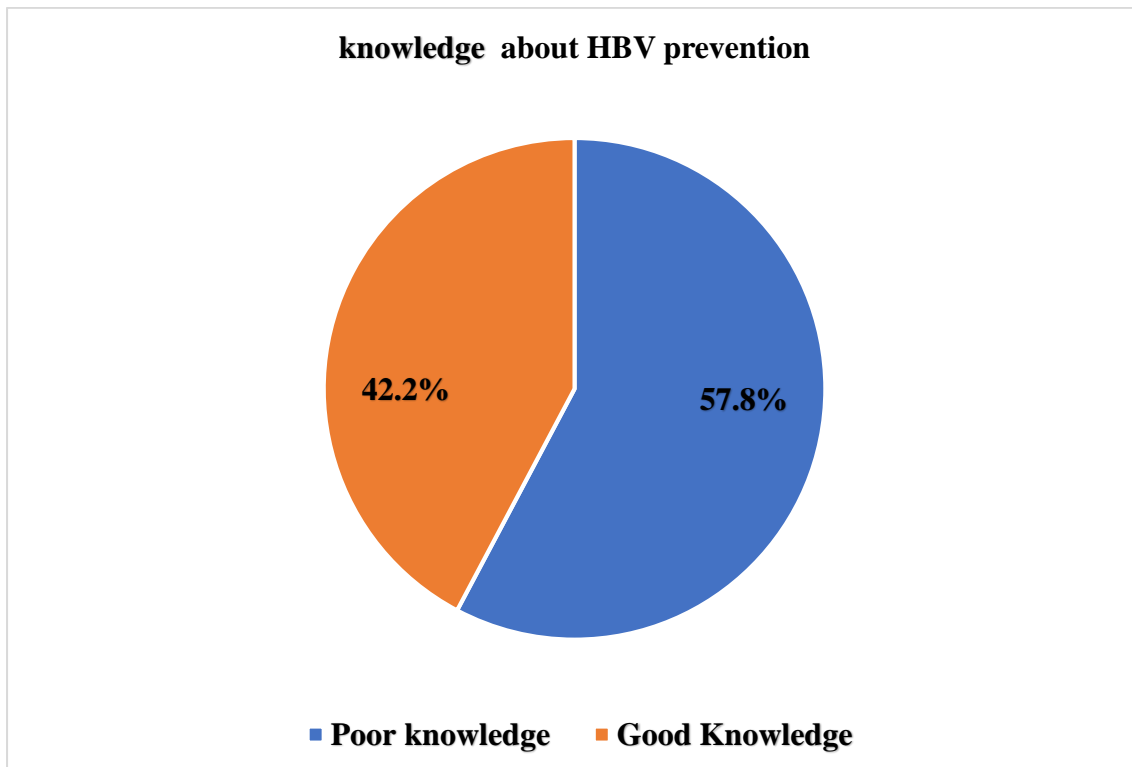


Figure 3. knowledge about hepatitis B virus infection among healthcare workers in Hargeisa city, Somaliland, 2024.

Table 3 outlines healthcare workers' knowledge of Hepatitis B virus (HBV) transmission, clinical features, and prevention strategies. Most respondents (83.1%) reported having received education or training on HBV, and 89.9% recognized that vaccination can prevent the virus. Regarding transmission, 94.3% identified contaminated blood and blood products as a risk, and 81.1% acknowledged unsterilized syringes as a factor. However, misconceptions persist; 33.3% incorrectly believed HBV could be transmitted by handshaking, and 29.3% thought it could spread via the fecal-oral route. Additionally, only 40.8% accurately stated that stationery and doorknobs are not primary sources of infection, indicating possible overestimation of casual transmission risk.

Knowledge of disease progression was mixed; while 82.5% recognized jaundice as a symptom and 74.4% knew HBV causes liver cancer, only 20.1% believed it could be treated or cured. This reflects a troubling lack of understanding of the nature of HBV and its management. Alarmingly, only 17.8% acknowledged that infected individuals can transmit the virus, highlighting a significant gap in infection control awareness.

In terms of preventive measures, 89.4% recognized the importance of Personal Protective Equipment (PPE), but only 68.9% understood that Standard Precautions should apply to all patients. Knowledge of waste segregation (67.8%) and glove use (65.2%) was moderate, suggesting that while PPE is valued, adherence to appropriate protocols may be inconsistent.

Table 3: Knowledge of the healthcare workers about HBV prevention practice and vaccination status at Hargeisa city, Somaliland,2024. (n=348).

Variables	Correct Response	Correct Knowledge Yes n (%)	Incorrect Knowledge No (%)
Self-reported education/training on HBV	Yes	289 (83.1%)	59 (16.9%)
HBV can be prevented through vaccination	Yes	313 (89.9%)	35 (10.1%)
Transmitted by contaminated blood/blood products	Yes	328 (94.3%)	20 (5.7%)
Transmitted by unsterilized syringes, needles, and sharps	Yes	282 (81.1%)	66 (18.9%)
Transmitted through the fecal-oral route	No	246 (70.7%)	102 (29.3%)
Transmitted by handshaking	No	232 (66.7%)	116 (33.3%)
Stationery, telephones, and doorknobs are not the source	Yes	142 (40.8%)	206 (59.2%)
HBV can affect individuals of any age group	Yes	278 (79.9%)	70 (20.1%)
HBV causes liver cancer	Yes	259 (74.4%)	89 (25.6%)

HBV can affect organs other than the liver	Yes	178 (51.1%)	170 (48.9%)
Jaundice is a common symptom of HBV	Yes	287 (82.5%)	61 (17.5%)
People infected with HBV are at risk of infecting others	Yes	62 (17.8%)	286 (82.2%)
Hepatitis B can be cured/treated	Yes	70 (20.1%)	278 (79.9%)
Standard precautions are used for the care of all patients	Yes	240 (68.9%)	108 (31.1%)
Handwashing after patient contact is a standard precaution	Yes	257 (73.9%)	91 (26.1%)
PPE is important to control HBV infection	Yes	311 (89.4%)	37 (10.6%)
Gloves must be worn when handling infectious materials	Yes	227 (65.2%)	121 (34.8%)
Handwashing reduces the risk of transmission	Yes	272 (78.2%)	76 (21.8%)
Waste segregation prevents HBV transmission	Yes	236 (67.8%)	112 (32.2%)
Heard about infection prevention principles	Yes	216 (62.1%)	132 (37.9%)

4.3 Attitude of health workers towards hepatitis B infection prevention

The majority of study participants, 257(73.9%), had a positive attitude towards HBV infection prevention practice.

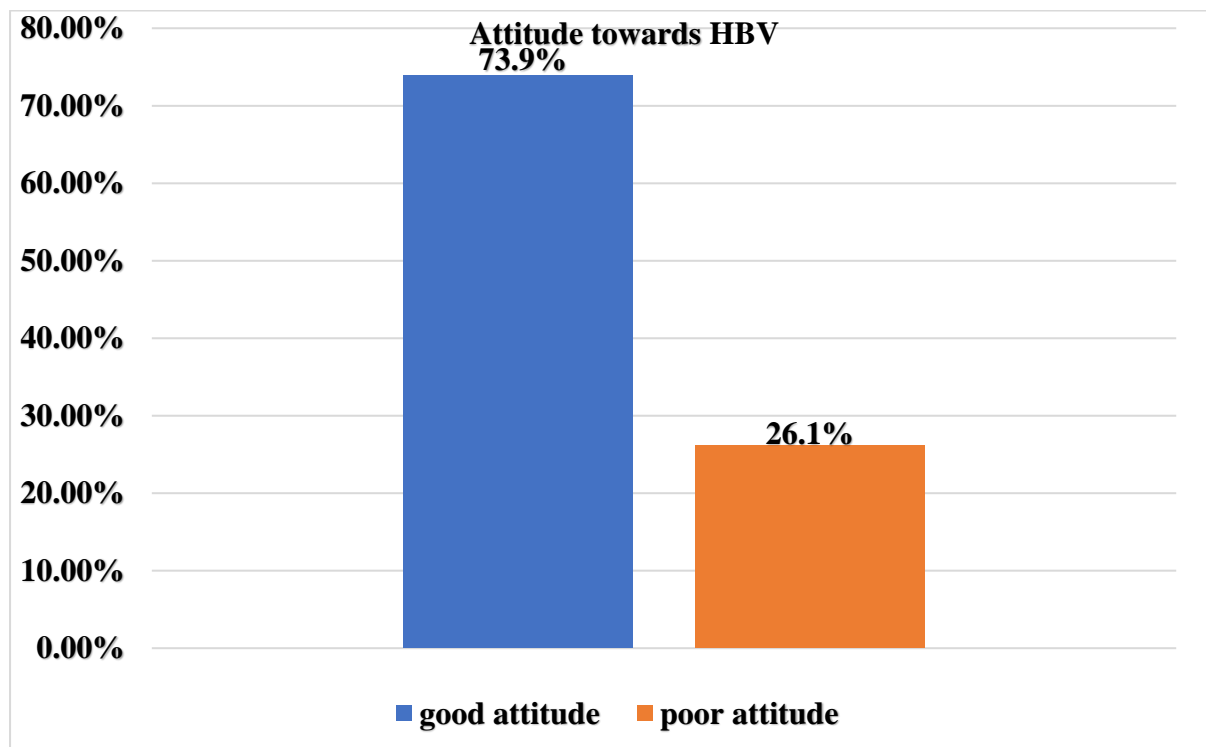


Figure 4. Attitude towards hepatitis B infection virus prevention practice and vaccination status among healthcare workers in Hargeisa city, Somaliland, 2024.

Table 4: Attitude of the healthcare workers about HBV prevention practice at Hargeisa city, Somaliland,2024. (n=348).

Attitude test questions	SAN (%)	A N (%)	NA/ND N (%)	DA N (%)	SD N (%)
Standard precaution is easy to follow.	83(23.85)	147(42.24)	24(6.90)	71(20.40)	23(6.61)
I believe that following infection control guideline will protect me from being infected with HBV at work	161(46.26)	142(40.80)	16(4.60)	24(6.90)	5 (1.44)
Standard precautions prevent the spread of infections from patients HCWs and vice versa.	137(39.37)	139(39.94)	36(10.34)	29(8.33)	7(2.01)
Infectious diseases like HBV can be treated hence PPE are required.	57(16.38)	167(47.99)	39(11.21)	56(16.09)	29(8.33)
Changing gloves is not necessary during procedures even if heavily contaminated.	125(35.92)	143(41.09)	17(4.89)	38(10.92)	25 (7.18)
Healthcare workers (HCWs) should use Personal Protective Equipment.	68(19.54)	119(34.20)	35(10.06)	87(25.00)	39(11.21)
Vaccination towards hepatitis B is mandatory.	150(43.10)	134(38.51)	28(8.05)	27(7.76)	9(2.59)
Being a health professional puts you at greatest risk of having hepatitis B.	126(36.21)	124(35.63)	29(8.33)	57(16.38)	12(3.45)
HBV is serious public health problem.	148(42.53)	156(44.83)	18(5.17)	20(5.75)	6(1.72)
I am at risk of getting hepatitis B.	44(12.64)	172(49.43)	42(12.07)	42(12.07)	48(13.79)
I am concerned about HBV infection at work.	39(11.21)	174(50.00)	28(8.05)	67(19.25)	40(11.49)
Hepatitis B vaccine is safe and effective.	88(25.29)	178(51.15)	25(7.18)	41(11.78)	16(4.60)
Changing of gloves during blood collection and tests is waste of time.	122(35.06)	149(42.82)	15(4.31)	43(12.36)	19(5.46)
All patients should be tested for HBV before they receive healthcare.	111(31.90)	151(43.39)	24(6.90)	61(17.53)	1(0.29)
Sharp injury at work do require reporting.	2(0.57)	174(50.00)	33(9.48)	104(29.89)	35(10.06)

I do want to become screened for hepatitis B.	67(19.25)	162(46.55)	30(8.62)	55(15.80)	34(9.77)
I do feel comfortable to take care of people with hepatitis B.	63(18.10)	149(42.82)	33(9.48)	67(19.25)	36(10.34)
It is logical to assume all patients are contagious unless their infection has been confirmed.	62(17.82)	137(39.37)	50(14.37)	80(22.99)	19(5.46)
Wearing PPE during surgery is necessary.	148(42.53)	143(41.09)	16(4.60)	24(6.90)	17(4.89)

Key: SA=Strongly agree (1), A=Agree (2), NA/ND=Neither agree nor disagree (3), D=Disagree (4), Strongly disagree (5).

4.4 Practice towards hepatitis B virus infection prevention

The majority (48%, 95% C.I. 46.7 – 57.3) of study participants had poor HBV prevention practice.

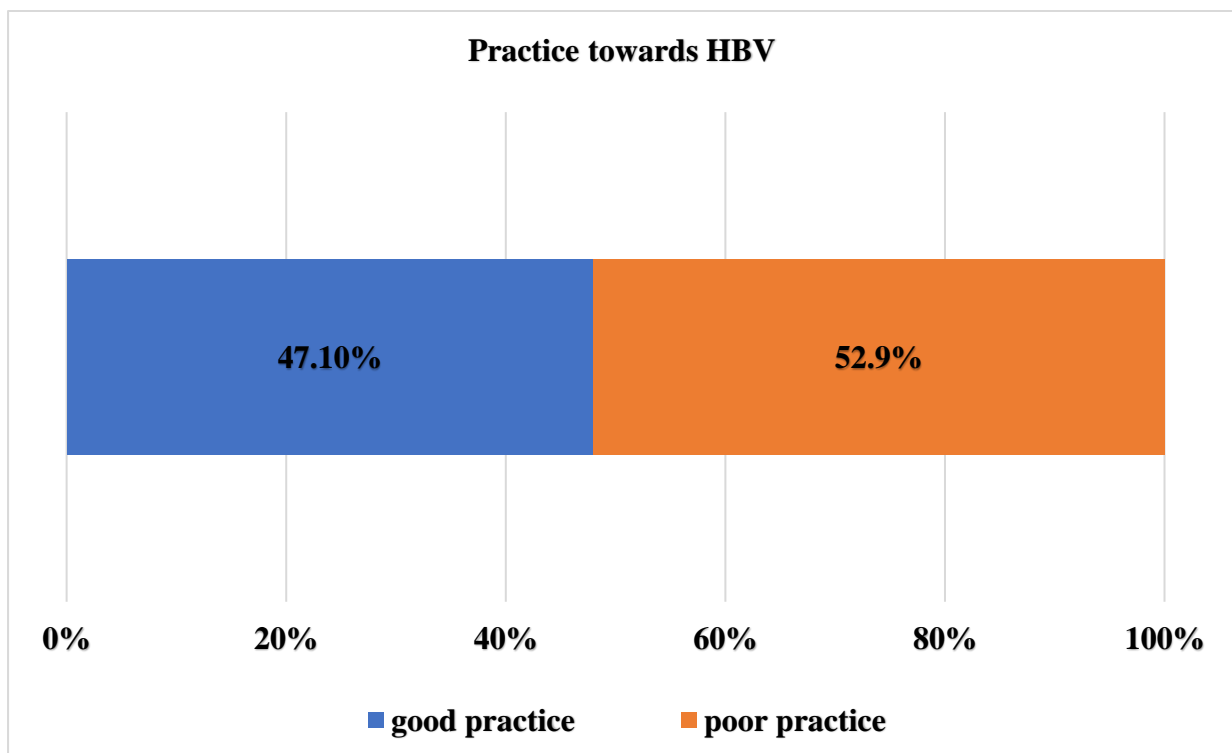


Figure 5. practice of healthcare workers on hepatitis B virus infection prevention.

Most study participants, 199 (57.18%), had not been screened for hepatitis B infection. Only 122 (35.06%) reported having received the HBV vaccine, while the majority, 226 (65%), indicated they had never taken the vaccine. Regarding prevention practices, more than half of the subjects, 207 (59.48%) and 213 (61.21%), had not used gloves on both hands or personal protective equipment (PPE) during their work, respectively. Of the respondents, 254

(72.99%) were related to mixed dry and liquid healthcare waste. A large number of healthcare professionals, 213 (61.21%), had not participated in a health education program on HBV infection (Table 5).

Table 5: Hepatitis B virus infection prevention practice and vaccination status in Hargeisa city, Somaliland, 2024. (n=348).

Variables	Yes Number (%)	No Number (%)
I always perform hand hygiene when I come in contact with patients	226(64.9)	122(35.1)
I often use gloves (both hands)	141(40.5)	207(59.5)
I always perform hand hygiene after taking off gloves	218 (62.6)	130(37.4)
I always wash my hands immediately after contacting any blood, body fluid, secretion, excretion, or dirty substances	241(69.3)	107(30.7)
I always wear gloves when drawing blood samples or coming in contact with blood	276(79.3)	72(20.7)
I always wear gloves when disposing of stool or urine	236(67.8)	112(32.2)
I always wear gloves when handling an impaired patient's skin	246(70.7)	102(29.3)
I always wear gloves when handling the patient's mucosa, saliva, or sputum culture	250(71.8)	98(28.2)
I always wear gloves when dressing wounds	275(79.1)	73(20.9)
I have taken the HBV vaccine	122(35.1)	226(64.9)
I always wear a mask or protective eye patch or goggles when performing operations	250(71.8)	98(28.2)
I always dispose of needles or any other single-use sharp objects in a sharp disposal container after use	266(76.4)	82 (23.6)
I have screened for hepatitis B	149(42.8)	199(57.2)
I apply an antiseptic hand rub to clean my hands	215(61.8)	133(38.2)
I practice high-level disinfection where sterilization is applicable	185(53.2)	163(46.8)
I mix dry and liquid healthcare wastes	94(27.1)	254(72.9)
I incinerate or bury used sharp materials	195(56.1)	153(43.9)
I change disinfectant chlorine solution as required	156(44.8)	192(55.2)
I wear the necessary personal protective equipment	135(38.8)	213(61.2)
I put the sharp disposal boxes in their proper place	228(65.5)	120(34.5)
I always report a needle stick injury	205(58.9)	143(41.1)
I discard waste materials in hospitals in their appropriate containers	261(75.0)	87(25.0)
I have participated in health education on HBV infection	135(38.8)	213(61.2)

4.5 Vaccination status regarding hepatitis B virus infection among healthcare workers

After healthcare workers recall, approximately two-thirds of (64.9%, 95% CI: 59.6-69.7) healthcare workers were unvaccinated against hepatitis B virus infection.

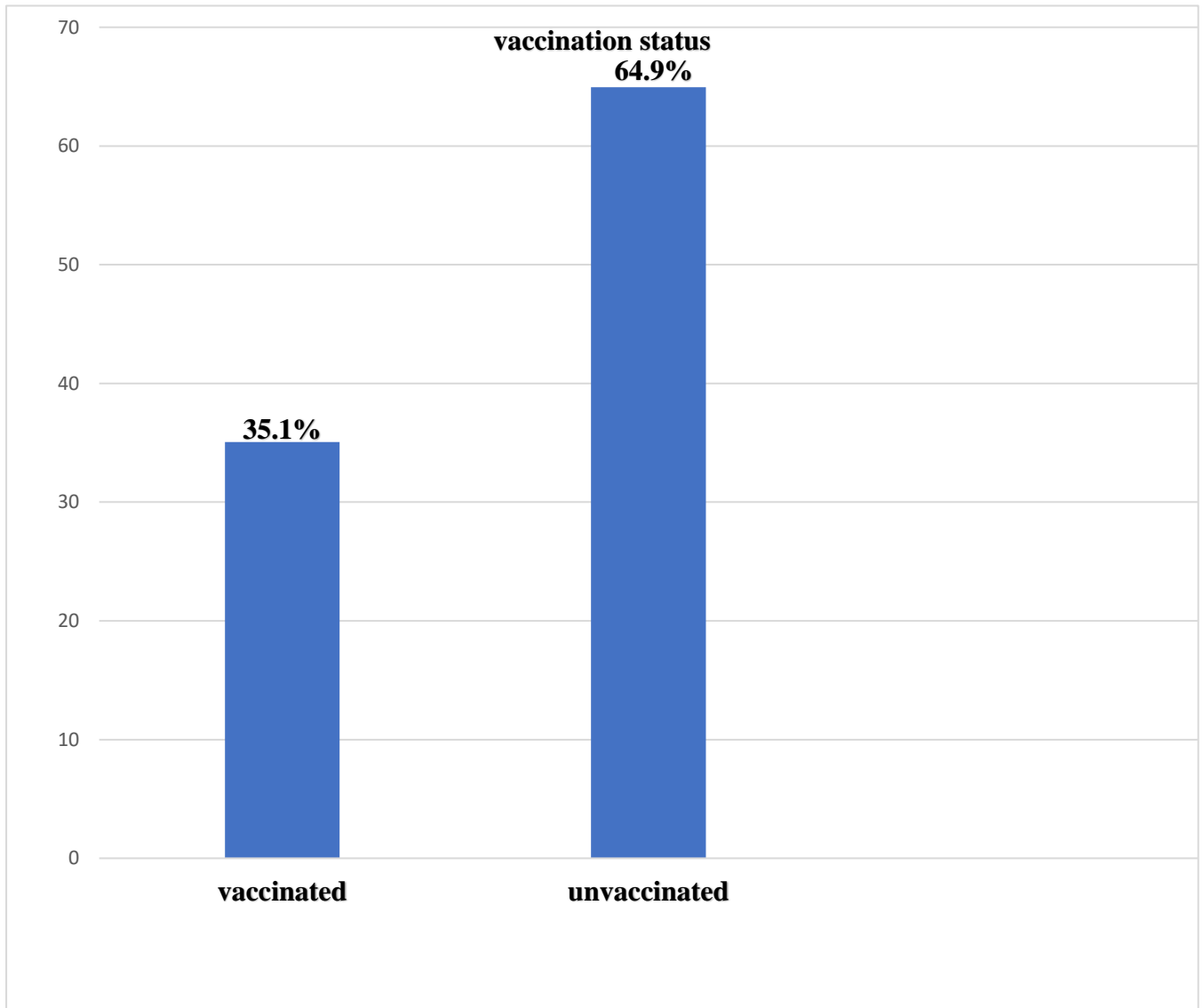


Figure 6. hepatitis B vaccination status among healthcare workers in Hargeisa city, Somaliland.

4.5. Factors associated with hepatitis B infection prevention practice

In bivariate analysis, factors such as educational level, knowledge level of healthcare workers, attitude level of healthcare workers, whether health facilities have personal protective equipment, whether they received any training on the use of personal protective equipment, whether health facilities have HBV vaccines, if health facilities offer free vaccination services to healthcare workers, the availability of HBV prevention guidelines at the health facility, adherence to hepatitis B prevention guidelines, and the existence of policies guiding new health

workers to be screened on HBV prevention were significant factors as they have at p-value ≤ 0.25 .

In multivariable logistic regression analysis, knowledge level, attitude level, whether the health facility has personal protective equipment, and whether it has HBV vaccines were significant factors.

Participants with poor knowledge were 2.1 times more likely to have poor HBV prevention practices compared to those with good knowledge (AOR = 2.07, 95% CI (1.18-3.62), $P < 0.01$). Additionally, participants with unfavourable attitudes were 2.3 times more likely to have poor HBV prevention practices compared to those with favourable attitudes (AOR = 2.30, 95% CI (1.18-4.48), $P < 0.01$). Similarly, the unavailability of PPE was linked to a 4.6 times higher likelihood of poor HBV prevention practices (AOR=4.68, 95% CI:2.26-9.71, $P < 0.00$) and the absence of the HBV vaccine was associated with a 3.8 times increased likelihood of poor HBV prevention practices (AOR = 3.78, 95% CI:1.72-8.31, $P < 0.00$).

Table 6: Bivariate and multivariate analysis of factors associated to hepatitis B infection prevention practices among healthcare workers in Hargeisa, Somaliland, 2024.

Variables	Category	Practice level		COR (95%)	AOR (95%)	P-Value
		Poor practice	Good practice			
Educational level	Master's degree	24(42.1%)	33(57.9%)	0.41(0.19-0.89)	0.35(0.13-0.98)	0.13
	First degree	125(51.9%)	116(48.1%)	0.61(0.32- 1.14)	0.47(0.20-1.06)	0.96
	Diploma	32(64.0%)	18(36.0%)	1	1	
Knowledge	Poor	125(62.2%)	76(37.8%)	2.67(1.72- 4.14)	2.07(1.18-3.62)	0.00*
	Good	56(38.1%)	91(61.9%)	1	1	
Attitude	Poor attitude	57(62.6%)	34(37.4%)	1.79(1.10-2.94)	2.30(1.18-4.48)	0.01*
	Good attitude	124(48.2%)	133(51.8%)	1	1	
Health facility has PPE	No	50(37.9%)	82(62.1%)	9.05(4.87-16.84)	4.68(2.26-9.71)	0.00*
	Yes	99(39.3%)	153(60.7%)	1	1	
Received training on the use of PPE	No	123(70.3%)	52(29.7%)	4.69(2.98- 7.37)	1.04(0.54-2.01)	0.85
	Yes	58(33.5%)	115(66.5%)	1	1	
Health facilities have HBV vaccines	No	152(73.8%)	54(26.2%)	10.97(6.57-18.31)	3.78(1.72-8.31)	0.00*
	Yes	29(20.4%)	113(79.6%)	1	1	
Health facility offers free vaccination	No	159(62.9%)	94(37.1%)	5.61(3.27-9.64)	1.52(0.65-3.53)	0.25
	Yes	22(23.2%)	73(76.8%)	1	1	
Available guidelines at the facility	No	139(67.5%)	67(32.5%)	4.94(3.11-7.85)	0.79(0.36- 1.72)	0.47
	Yes	42(29.6%)	100(70.4%)	1	1	
Adherence to the hepatitis B prevention guidelines	No	145(72.1%)	56(27.9%)	7.98(4.91-12.98)	2.19(0.98- 4.92)	0.05
	Yes	36(24.5%)	111(75.5%)	1	1	
Availability of a policy that guides the new health workers to be screened	No	142(67.3%)	69(32.7%)	5.17(3.23-8.27)	1.56(0.73-3.35)	0.39
	Yes	39(28.5%)	98(71.5%)	1	1	

Information, Education, and Communication materials on HBV prevention are available at the health facility	No	136(64.8%)	74(35.2%)	3.79(2.41-5.98)	0.96(0.45-2.07)	0.92
	Yes	45(32.6%)	93(67.4%)	1	1	

4.6. Factors associated with hepatitis B vaccination status

In the bivariate analysis, knowledge level of healthcare workers, whether health facilities have personal protective equipment, training on the use of personal protective equipment, availability of HBV vaccines, whether health facilities offer free vaccination services to healthcare workers, available guidelines, adherence to hepatitis B prevention guidelines, the existence of policies guiding the screening of new health workers, Information, Education, and Communication were analysed to be significant factors influencing HBV vaccination status.

In the multivariable regression, whether the health facility has personal protective equipment, offers HBV vaccines, adheres to hepatitis B prevention guidelines, provides free vaccination services, and the level of knowledge among healthcare workers about the HBV vaccine were significant factors.

Participants without PPE at their health facility were 63% less likely to have access to the HBV vaccine compared to those with PPE (AOR=0.37, 95% CI:0.17-0.81, P<0.01). Additionally, vaccine availability at health facilities, participants in facilities lacking the HBV vaccine were 81% less likely to receive the vaccine compared to those in facilities offering the hepatitis B vaccine (AOR=0.19, 95% CI:0.09-0.44, P<0.00). The absence of free vaccination services was associated with 57% times lower odds of having a good HBV vaccination status (AOR=0.43, 95% CI:0.21-0.90, P<0.00). Similarly, non-adherence to HBV preventive guidelines was linked to 67% times lower odds of having a good vaccination status (AOR=0.33, 95% CI:0.14-0.76, P<0.01), and participants with poor knowledge were 64% less likely to take the HBV vaccine compared to those with good knowledge (AOR=0.36, 95% CI:0.20-0.63, P<0.01).

Table 7: Bivariate and multivariate analysis of factors associated with hepatitis B vaccination status among healthcare workers in Hargeisa City, Somaliland, 2024.

Variables	Category	Vaccination Status		COR (95% CI)	AOR (95% CI)	P-Value
		Unvaccinated	Vaccinated			
The facility has personal protective equipment	No	85(88.5%)	11(11.5%)	0.16(0.08-0.32)	0.37(0.17-0.81)	0.01*
	Yes	141(55.10%)	111(44.9%)	1	1	
Received training on the use of personal protective equipment	No	147(84.0%)	28(16.0%)	0.16(0.10-0.26)	0.64(0.33-1.26)	0.20
	Yes	79(45.7%)	94(54.3%)	1	1	
The health facility has HBV vaccines	No	178(86.4%)	28(13.6%)	0.08(0.05-0.14)	0.19(0.09-0.44)	0.00*
	Yes	48(33.8%)	94(66.2%)	1	1	
Health facility offers a free vaccination service	No	194(76.7%)	59(23.3%)	0.15(0.09-0.26)	0.43(0.21-0.90)	0.02*
	Yes	32(33.7%)	63(66.3%)	1	1	
Available guidelines at the health facility	No	164(79.6%)	42(20.4%)	0.19(0.12-0.32)	1.04(0.46-2.37)	0.10
	Yes	62(43.7%)	80(56.3%)	1	1	
Adherence to the HBV prevention guidelines	No	169(84.1%)	32(15.9%)	0.12(0.07-0.19)	0.33(0.14-0.76)	0.01*
	Yes	57(38.8%)	90(61.2%)	1	1	
Information, Education, and Communication (IEC) are available at the health facility	No	157(74.9%)	53(25.1%)	0.34(0.21-0.53)	1.37(0.63-2.10)	0.80
	Yes	69(50%)	69(50%)	1	1	
Availability of a policy that guides the new health workers to be screened	No	161(76.3%)	50(23.7%)	0.28(0.18-0.44)	2.05(0.88-4.79)	0.09
	Yes	65(47.4%)	72(52.6%)	1	1	
level of knowledge on Vaccination	Poor knowledge	151(75.1%)	50(24.9%)	0.34(0.22-0.54)	0.36(0.20-0.63)	0.00*
	Good knowledge	75(51.0%)	72(48.10%)	1	1	

5. DISCUSSION

This study examined the prevalence of hepatitis B infection prevention practices and hepatitis B vaccination status among healthcare workers in Hargeisa, Somaliland. The study found that significant gaps in HBV prevention practice and vaccination status exist, with 52% engaging in poor prevention practice and 64.9% being unvaccinated. Poor knowledge, unfavourable attitudes, lack of Personal Protective Equipment (PPE), and unavailability of HBV vaccines about HBV infection were independent predictors of hepatitis B prevention practice.

Regarding HBV prevention practices, a significant proportion of study participants showed poor practices (52%) for preventing HBV infection. This finding is higher than that reported among HCWs in Kabul, Afghanistan, which showed that only 38.78% of participants had poor hepatitis B prevention practice (Roien et al., 2021). This discrepancy may be attributed to differences in awareness, training, or access to preventive measures between study participants. But this finding is consistent with other studies conducted in Khartoum, Sudan (51.8%) (Mursy and Mohamed, 2019b) and in Muqdisho, Somalia (51.0%) (Hassan *et al.*, 2023), which reported comparable proportions. This may be due to similar educational, cultural, and socio-economic factors that contribute higher level of poor practice.

On other hand, this study found a lower level of poor practice compared to studies conducted in Woldia University, Northeast Ethiopia (Gebremeskel et al., 2020) and Shashemene Zonal Town, Ethiopia (Abebaw et al., 2017), which demonstrated 60.5% and 87.1% of study participants had inadequate practice, respectively. This may be due to variation in HBV prevention programs, access to resources, and the socio-demographic characteristics of study participants may play a big role in practice level.

Furthermore, this study found that the unavailability of PPE in healthcare facilities was associated with a fourfold increase in the odds of poor HBV prevention practices among healthcare workers. Similar findings were reported in a study conducted in Ethiopia, which demonstrated that healthcare workers without access or who failed to use PPE properly were significantly more likely to engage in poor practices (Sheik et al., 2024). Lack of Personal Protective Equipment (PPE) may lead healthcare professionals to be susceptible to HBV infection, and without adequate PPE, may face workers with practical challenges that contribute to poor prevention practice.

Regarding the effects of knowledge and attitude on HBV Prevention practices, the study found that those with poor knowledge about HBV were two times more likely to have poor HBV prevention practices among healthcare workers than their counterparts. This finding is consistent with a study in Bangladesh, which stated that those with poor knowledge were two times more likely to have hepatitis B infection than those with good knowledge (Tamanna et al., 2024). This may be attributed to the fact that participants with poor knowledge were less aware of prevention measures for hepatitis B infection, and a low knowledge level can also contribute to inadequate protective measures, such as improper personal protective equipment and not receiving vaccination.

In contrast, a study in Ethiopia reported that those with good knowledge were almost two times less likely to have poor practices (Aynalem et al., 2022b). This variation could be due to a lack of proper awareness and inadequate health education about HBV.

Participants with negative attitudes towards HBV were two times more likely to exhibit poor HBV prevention practices among healthcare workers. This result aligns with a study done in Bangladesh, where those who have a poor attitude were six times more likely to have poor practice about HBV than their counterparts (Tamanna et al., 2024). Participants with negative attitudes were less motivated to engage in prevention practices. Therefore, they are unaware of the infection and its control measures.

Finally, vaccine unavailability was associated with almost a fourfold increased likelihood of poor HBV prevention practice among healthcare workers. This study contrasts with findings from study conducted in South Sudan which depicted health professions who have health facilities with HBV vaccine were three times more likely to have good practice than those who have not (Alege et al., 2020b) and study done in China that demonstrated workers who worked health facility that has vaccine were two times increased the likelihood of good practice compared to their counterparts (Yuan et al., 2019). This variation may be due to differences in health facility infrastructure, access to vaccination, and cultural attitudes towards vaccination in the regions. In health facilities where the vaccine is available, health professionals may receive the vaccine, which can lead to better prevention practices, while in facilities without the vaccine, workers are less preventive against hepatitis B infection. The study also found that nearly two-thirds of healthcare workers were unvaccinated against the hepatitis B virus infection. Thus, this coincides with the World Health Organization's (WHO) estimated mean HBV vaccination rate among healthcare workers in developing countries, which ranged from 18% to 39%. Significant factors associated with hepatitis B vaccination status included whether the health facility has personal protective equipment, availability of HBV vaccines, Adherence

to hepatitis B prevention guidelines, provision of free vaccination services, and the level of knowledge among healthcare workers about the HBV infection. This result aligns with a previous study conducted in India, which reported that 35% of the laboratory technicians were fully vaccinated against HBV (Koria and Lala, 2012) and a study conducted in Nigeria, which revealed that 36.25% of HCWs had completed vaccination (Obi and Ofili, 2013).

The results in this study were found to be higher when compared to several studies conducted in Ethiopia. A study conducted in Bulle Hora Woreda among healthcare workers has revealed an unusual result of only 1.2% of the healthcare workers were vaccinated against HBV infection (Chaudhari et al., 2009). A study conducted in Addis Ababa showed that 3.5% had ever been vaccinated, even though none of them had been fully vaccinated (Zelalem, 2011). Another study conducted in Bahir Dar revealed that only 20% of healthcare workers reported that they were fully vaccinated (Abeje and Azage, 2015). Another study conducted in Georgia has also revealed a lower rate of vaccine uptake of 12% (Topuridze et al., 2010). The reason for the discrepancy could be attributed to differences in demographic characteristics of the study population, differences in the availability of vaccines, and discrepancies in health policies between countries.

However, it is lower when compared to 53% of healthcare workers in Pakistan who had received the vaccine (Saad *et al.*, 2013) and a study in Iraq in which 45% of the respondents were vaccinated (Othman *et al.*, 2013). Otherwise, it is very low when compared to another study conducted in Iraq, which had revealed a high percentage of healthcare workers vaccinated with 65.7% (Noaman *et al.*, 2012), and a study in Kuwait showing 74.7% of the respondents had ever received the vaccine, while 84% of them had completed (Habiba *et al.*, 2012).

According to this study, Participants without PPE at their health facility were less likely to have access to the HBV vaccine compared to those with PPE. This finding is consistent with a study conducted in Athens among healthcare workers (Rachiotis et al., 2005). This may be due to resource constraints in healthcare facilities that limit both PPE usage and access to vaccination. Additionally, regional policies and healthcare workers' attitudes towards PPE may influence the result.

On the other hand, participants in facilities lacking the HBV vaccine were less likely to receive the vaccine compared to those facilities offering the hepatitis B vaccine. This finding is consistent with previous studies conducted in South Sudan, which stated that healthcare workers who worked in health facilities without HBV vaccine were three times more likely to have poor vaccination status compared to those who had HBV vaccine (Alege et al., 2020b).

The possible explanation might be due to the unavailability of the vaccine, limiting access and opportunity for immunization.

Additionally, the absence of free vaccination services was associated with lower odds of having a good HBV vaccination status. This finding is consistent with a study conducted in Bahir Dar, Ethiopia (Ayana Hordofa and Hussen Hassan, 2021), which demonstrated that the absence of free vaccination at health facilities was associated with a lower likelihood of HBV vaccination. This may be due to the financial barriers that hinder access to vaccination when it is not free at a health facility, and workers prefer free vaccination, which decreases vaccination uptake.

Similarly, this study revealed that non-adherence to HBV preventive guidelines was linked to lower odds of having a good vaccination status. This finding is consistent with a study conducted in Ghana (Efua *et al.*, 2024), which indicated that non-adherence to HBV preventive protocols has the lowest odds of taking hepatitis B vaccination. This may be attributed to a lack of awareness or education regarding the importance of adhering to vaccination guidelines.

Moreover, participants with poor knowledge were less likely to take the HBV vaccine compared to those with good knowledge. This finding is consistent with a study done in Sudan (Alege *et al.*, 2020b), which showed that study participants with good knowledge about HBV were four times more likely to be vaccinated compared to their counterparts. This might be because healthcare professionals who were knowledgeable about HBV infection were more aware of the risk of infection, the importance of taking the vaccine, and its safety.

5.1. Strengths and limitations of the study

5.1.1 Strengths of the Study

This is the first study to investigate HBV prevention practices and vaccination status among healthcare workers (HCWs) in Hargeisa, Somaliland. By addressing a previously unexplored area, it provides baseline evidence that can inform policymakers, healthcare institutions, and public health practitioners.

5.1.2 Limitations of the Study

The study findings should be interpreted in the context of the following limitations. First, there may be a social desirability bias as HCWs may have reported a favourable way for prevention practice and utilization of healthcare services. To mitigate social desirability bias, we assured confidently of the HCWs to respond to questions honestly, non-judgmental questions were not used to reduce the pressure to provide favourable answers, and a framed questionnaire was used to avoid leading questions. Being a cross-sectional study, it only indicated associations, rather than causality, on factors associated with hepatitis B prevention practice and vaccination status. Since the data were collected through healthcare workers' recall, which introduces recall bias. To minimize recall bias, we limited the recall period by asking participants about recent practices and vaccination history within a specific timeframe (the past year), and used structured and clearly defined questions to reduce ambiguity and improve accuracy in recall.

6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

The findings indicated a high rate of poor practice of HBV infection prevention and vaccination status among HCWs, with more than half of the study participants exhibiting poor adherence to recommended guidelines. Specifically, almost one in two study participants showed poor HBV prevention practices, and two third of them were not vaccinated for HBV. This finding indicates a significant gap in the implementation of effective infection control measures in healthcare settings within Hargeisa city. Poor knowledge regarding HBV infection and negative attitudes were strong predictors of poor infection prevention practices among HCWs. Additionally, unavailability of PPE, absence of the HBV vaccine, and non-adherence to preventive guidelines increased the likelihood of poor prevention practice.

6.2 Recommendation

- Healthcare workers should be provided with personal protective equipment (PPE) and receive additional training from hospitals and health centres' administration to ensure good practice against HBV.
- It is recommended that the Ministry of Health develop necessary programs to improve preventive measures against HBV among HCWs.
- The regional health administration should establish and enforce comprehensive HBV vaccination programs to protect healthcare workers and reduce the risk of infection.
- The regional health administration and healthcare planners should prioritize the provision of free HBV vaccines at all health facilities to encourage uptake and safeguard healthcare workers.
- Healthcare workers' belief and confidence about the safety of HBV vaccine should be built by hospital and health centre administrations.
- It also recommended that healthcare planners should allocate resources to health facilities to achieve HBV vaccination completion.

7. REFERENCES

- Aaron, D., Nagu, T. J., Rwegasha, J. and Komba, E. 2017. Hepatitis B vaccination coverage among healthcare workers at national hospital in Tanzania: how much, who and why? *BMC infectious diseases*, 17, 786.
- Abalkhail, A., Al Imam, M. H., Elmosaad, Y. M., Jaber, M. F., Hosis, K. A., Alhumaydhi, F. A., *et al.* 2021. Knowledge, attitude and practice of standard infection control precautions among health-care workers in a university hospital in Qassim, Saudi Arabia: a cross-sectional survey. *International journal of environmental research and public health*, 18, 11831.
- Abebaw, T.-A., Aderaw, Z. and Gebremichael, B. 2017. Hepatitis B virus vaccination status and associated factors among health care workers in Shashemene Zonal Town, Shashemene, Ethiopia: a cross sectional study. *BMC research notes*, 10, 260.
- Abeje, G. and Azage, M. 2015. Hepatitis B vaccine knowledge and vaccination status among health care workers of Bahir Dar City Administration, Northwest Ethiopia: a cross sectional study. *BMC infectious diseases*, 15, 30.
- Afihene, M. Y. and Duduyemi, B. M. 2015. Knowledge, attitude and practices concerning Hepatitis B infection, among healthcare workers in Bantama, Ghana: a cross sectional study.
- Al-Mamari, A. 2019. Determine seroprevalence and associated risk factors of HBV infection among pregnant women and it relationship with blood transfusion at Hargeisa Group Hospital, Hargeisa, Somaliland. *Int J Clin Virol*, 3, 1-9.
- Alege, J. B., Gulom, G., Ochom, A. and Kaku, V. E. 2020a. Assessing level of knowledge and uptake of hepatitis B vaccination among health care workers at Juba Teaching Hospital, Juba City, South Sudan. *Advances in preventive medicine*, 2020.
- Alege, J. B., Gulom, G., Ochom, A. and Kaku, V. E. 2020b. Assessing level of knowledge and uptake of hepatitis B vaccination among health care workers at Juba Teaching Hospital, Juba City, South Sudan. *Advances in preventive medicine*, 2020, 8888409.
- Allene, M. D. and Delelegn, G. G. 2020. Assessment of knowledge, practices and associated factors toward prevention of hepatitis B virus infection among students of medicine and health sciences in Debre Berhan University, NorthShewa, Ethiopia: a cross-sectional study. *International Journal of Surgery Open*, 24, 79-84.
- Auta, A., Adewuyi, E. O., Kureh, G. T., Onoviran, N. and Adeloje, D. 2018. Hepatitis B vaccination coverage among health-care workers in Africa: a systematic review and meta-analysis. *Vaccine*, 36, 4851-4860.
- Awoke, N., Mulgeta, H., Lolaso, T., Tekalign, T., Samuel, S., Obsa, M. S., *et al.* 2020. Full-dose hepatitis B virus vaccination coverage and associated factors among health care workers in Ethiopia: A systematic review and meta-analysis. *PLoS One*, 15, e0241226.
- Ayana Hordofa, M. and Hussen Hassan, A. 2021. Hepatitis B vaccination status and associated factors among healthcare professionals working in health centers at Akaki Kaliti subcity of Addis Ababa, Ethiopia: a cross-sectional study. *Risk Management and Healthcare Policy*, 1575-1582.
- Aynalem, A., Deribe, B., Ayalew, M., Mamuye, A., Israel, E., Mebratu, A., *et al.* 2022a. Practice towards hepatitis B virus infection prevention and its associated factors among undergraduate students at Hawassa University College of Medicine and Health Sciences, Hawassa, Sidama, Ethiopia, 2021: cross-sectional study. *International Journal of Hepatology*, 2022.
- Aynalem, A., Deribe, B., Ayalew, M., Mamuye, A., Israel, E., Mebratu, A., *et al.* 2022b. Practice towards Hepatitis B Virus Infection Prevention and Its Associated Factors

- among Undergraduate Students at Hawassa University College of Medicine and Health Sciences, Hawassa, Sidama, Ethiopia, 2021: Cross-Sectional Study. *International Journal of Hepatology*, 2022, 2673740.
- Aynalem Debebe, A. 2024. *Practice Towards Hepatitis B Virus Infection Prevention and Its Associated Factors among Undergraduate Students at Hawassa University College of Medicine and Health Sciences, Hawassa, Sidama, Ethiopia, 2021*. HU.
- Begum, D., Rozario, M. D., Nasrin, M., Akter, H., Gharami, T. and Dina, M. 2024. Knowledge of Hepatitis-B Management and its Prevention among the Senior Staff Nurses Working at Bangabandhu Sheikh Mujib Medical University (BSMMU). *Nursing*, 4, 53-60.
- Belete, D., Wondale, D., Kiros, T. and Demissie, B. 2022a. Knowledge, Attitude, Practices, and Associated Factor towards Hepatitis B Virus Infection among Health Care Professionals at Tibebe Ghion Specialized Hospital, Bahir Dar, Northwest Ethiopia, 2021: A Cross Sectional Study. *International Journal of Hepatology*, 2022.
- Belete, D., Wondale, D., Kiros, T. and Demissie, B. 2022b. Knowledge, Attitude, Practices, and Associated Factor towards Hepatitis B Virus Infection among Health Care Professionals at Tibebe Ghion Specialized Hospital, Bahir Dar, Northwest Ethiopia, 2021: A Cross Sectional Study. *International Journal of Hepatology*, 2022, 3726423.
- Bialfew, Y., Hailu, G. and Samuel, T. 2018. Prevalence and associated factors of hepatitis B virus infection among blood donors in Debre Markos blood Bank Centre, Northwest Ethiopia, 2018. *Epidemiology (Sunnyvale)*, 8, 2161-1165.1000363.
- Chaudhari, C., Bhagat, M., Ashturkar, A. and Misra, R. 2009. Hepatitis B immunisation in health care workers. *Medical Journal Armed Forces India*, 65, 13-17.
- Efua, S.-D. V., Adwoa, W. D. and Atoko, M. A. 2024. Adherence to the three-component Hepatitis B virus vaccination protocol among healthcare workers in hepatitis B virus endemic settings in Ghana. *Vaccine: X*, 16, 100421.
- Garzillo, E. M., Arnese, A., Coppola, N., Corvino, A., Feola, D., Monaco, M. G. L., *et al.* 2020. HBV vaccination status among healthcare workers: A cross-sectional study. *Journal of Infection Prevention*, 21, 23-27.
- Geberemariam, B. S., Donka, G. M. and Wordofa, B. 2018. Assessment of knowledge and practices of healthcare workers towards infection prevention and associated factors in healthcare facilities of West Arsi District, Southeast Ethiopia: a facility-based cross-sectional study. *Archives of Public Health*, 76, 1-11.
- Gebremeskel, T., Beshah, T., Tesfaye, M., Beletew, B., Mengesha, A. and Getie, A. 2020. Assessment of knowledge and practice on hepatitis B infection prevention and associated factors among health science students in Woldia University, Northeast Ethiopia. *Advances in preventive medicine*, 2020, 9421964.
- Habiba, S. A., Alrashidi, G. A., Al-Otaibi, A. E., Almutairi, G. R., Makboul, G. and El-Shazly, M. K. 2012. Knowledge, attitude and behavior of health care workers regarding hepatitis B infection in primary health care, Kuwait. *Greener J Med Sci*, 2, 077-83.
- Hang Pham, T. T., Le, T. X., Nguyen, D. T., Luu, C. M., Truong, B. D., Tran, P. D., *et al.* 2019. Knowledge, attitudes and medical practice regarding hepatitis B prevention and management among healthcare workers in Northern Vietnam. *PloS one*, 14, e0223733.
- Hassan, Y. S. A., Hassan, S. A. and Ahmed, N. R. 2023. Uptake of hepatitis B vaccination and associated factors among health sciences students, Mogadishu, Somalia. *Frontiers in Public Health*, 11, 1203519.
- Hebo, H. J., Gameda, D. H. and Abdusemed, K. A. 2019a. Hepatitis B and C viral infection: prevalence, knowledge, attitude, practice, and occupational exposure among

- healthcare workers of Jimma University Medical Center, southwest Ethiopia. *The Scientific World Journal*, 2019.
- Hebo, H. J., Gemed, D. H. and Abdusemed, K. A. 2019b. Hepatitis B and C viral infection: prevalence, knowledge, attitude, practice, and occupational exposure among healthcare workers of Jimma University Medical Center, southwest Ethiopia. *The Scientific World Journal*, 2019, 9482607.
- Hussein, N. A., Ismail, A. M. and Jama, S. S. 2022a. Assessment of hepatitis B vaccination status and associated factors among healthcare workers in Bosaso, Puntland, Somalia 2020. *BioMed Research International*, 2022.
- Hussein, N. A., Ismail, A. M. and Jama, S. S. 2022b. Assessment of hepatitis B vaccination status and associated factors among healthcare workers in Bosaso, Puntland, Somalia 2020. *BioMed Research International*, 2022, 9074294.
- Ilyas, U., Manzoor, I., Shahbaz, A., Jalil, H., Sheikh, M. and Shafiqat, Z. 2017. Awareness and practice of safety measures related to transmission of hepatitis B & C among barbers and saloon workers of Lahore, Pakistan. *Int J Comm Health Med Res*, 3, 84-91.
- Jerbi, R., Saleh, Z., Skander, M., Alwaseea, N., Ahmed, F., Alaqeli, E., et al. 2022. Practice of Standard Precautions among Health Care Workers in the Blood Bank at Maitiga Hospital, Tripoli, Libya. *AlQalam Journal of Medical and Applied Sciences*, 534-537.
- Koria, B. and Lala, M. 2012. A study of knowledge, attitude and practice of hepatitis-B infection among the laboratory technicians in the civil hospital, Ahmedabad, Gujarat. *Health line*, 3, 63-65.
- Kyuregyan, K. K., Kichatova, V. S., Isaeva, O. V., Potemkin, I. A., Malinnikova, E. Y., Lopatukhina, M. A., et al. 2021. Coverage with timely administered vaccination against hepatitis B virus and its influence on the prevalence of HBV infection in the regions of different endemicity. *Vaccines*, 9, 82.
- Mursy, S. M.-e. M. and Mohamed, S. O. O. 2019a. Knowledge, attitude, and practice towards Hepatitis B infection among nurses and midwives in two maternity hospitals in Khartoum, Sudan. *BMC public health*, 19, 1-7.
- Mursy, S. M.-e. M. and Mohamed, S. O. O. 2019b. Knowledge, attitude, and practice towards Hepatitis B infection among nurses and midwives in two maternity hospitals in Khartoum, Sudan. *BMC public health*, 19, 1597.
- Nicolini, L. A., Orsi, A., Tatarelli, P., Viscoli, C., Icardi, G. and Sticchi, L. 2019. A global view to HBV chronic infection: evolving strategies for diagnosis, treatment and prevention in immunocompetent individuals. *International journal of environmental research and public health*, 16, 3307.
- Noaman, A., Ahmed, A. and Alanee, S. 2012. KAP Study about Hepatitis B among medical and paramedical staff in Tikrit City. *The Medical Journal of Tikrit University*, 18, 261-268.
- Nour, H. and Ali, I. 2022. Sero-Prevalence of Hepatitis B Virus Infection and Associated Factors among Pregnant Women Attending Antenatal Care at Edna Adan University Hospital Hargeisa, Somaliland, 2022-A Cross-Sectional Study. *Int J Womens Health Wellness*, 8, 2474-1353.
- Obi, A. and Ofili, A. 2013. Hepatitis B Vaccination Uptake among Doctors in Benin City, Edo State, Nigeria. *Journal of Community Medicine & Health Education*, 3, 246.
- OGADA, F., Halestrap, P. and Walekhwa, M. 2023. Healthcare Workers' Hepatitis B Virus Preventive Practices at a Mission Hospital in Kenya.
- OGADA, F. O. 2023. *KNOWLEDGE, ATTITUDES, AND PRACTICES TOWARDS HEPATITIS B INFECTION AMONG HEALTHCARE WORKERS AT AIC KIJABE HOSPITAL*. Kabarak University.

- Othman, S. M., Saleh, A. M. and Shabila, N. P. 2013. Knowledge about hepatitis B infection among medical students in Erbil city, Iraq. *European Scientific Journal*.
- Rachiotis, G., Goritsas, C., Alikakou, V., Ferti, A. and Roumeliotou, A. 2005. Vaccination against hepatitis B virus in workers of a general hospital in Athens. *La Medicina del lavoro*, 96, 80-86.
- Regassa, B. T. and Fiseha, G. 2019. Poor practices of medical and health sciences students for the prevention of hepatitis B viral infections in Ethiopia. *International Journal of Infection Control*, 15.
- Roien, R., Mousavi, S. H., Ozaki, A., Baqeri, S. A., Hosseini, S. M. R., Ahmad, S., *et al.* 2021. Assessment of knowledge, attitude, and practice of health-care workers towards hepatitis B virus prevention in Kabul, Afghanistan. *Journal of Multidisciplinary Healthcare*, 3177-3186.
- Saad, A., Amer, E., Humayun, A. and Imran, F. 2013. Awareness and frequency of hepatitis B vaccination in high-risk health care workers at a tertiary care hospital. *Rawal Med J*, 38, 3-6.
- Shah, S. M., Rodin, H., Pogemiller, H., Magbagbeola, O., Ssebambulidde, K., Zewde, A., *et al.* 2020a. Hepatitis B awareness and vaccination patterns among healthcare workers in Africa. *The American Journal of Tropical Medicine and Hygiene*, 103, 2460.
- Shah, Y., Haq, N., Riaz, S., Tahir, M., Mohammad, F. and Saood, M. 2020b. Knowledge, attitude and practice regarding hepatitis B in nurses working in different hospitals of Quetta city, Pakistan. *International Journal of Nursing Critical Care*, 6, 24-34p.
- Sheik, A. A., Getnet, F., Aden, M. A., Yusuf, A. M. and Dhicis, A. A. 2024. HEPATITIS B VIRUS INFECTION AND ASSOCIATED FACTORS AMONG BLOOD DONORS IN ETHIOPIA: A CROSS-SECTIONAL STUDY. *Journal of Public Health Research & Community Health Development*, 8.
- Tamanna, S. S., Paul, K. D., Al Banna, M. H., Zannat, Z., Paul, A. K., Sultana, S., *et al.* 2024. Assessment of preventive practices towards hepatitis B infection among nursing students in Bangladesh: role of knowledge, attitudes and sociodemographic factors. *BMC nursing*, 23, 190.
- Tanga, A. T., Teshome, M. A., Hiko, D., Fikru, C. and Jilo, G. K. 2019. Sero-prevalence of hepatitis B virus and associated factors among pregnant women in Gambella hospital, South Western Ethiopia: facility based cross-sectional study. *BMC infectious diseases*, 19, 1-7.
- Topuridze, M., Butsashvili, M., Kamkamidze, G., Kajaia, M., Morse, D. and McNutt, L. 2010. Barriers to hepatitis B vaccine coverage among healthcare workers in the Republic of Georgia: An international perspective. *Infection Control & Hospital Epidemiology*, 31, 158-164.
- Yuan, Q., Wang, F., Zheng, H., Zhang, G., Miao, N., Sun, X., *et al.* 2019. Hepatitis B vaccination coverage among health care workers in China. *PloS one*, 14, e0216598.
- Zelalem, D. 2011. Sero prevalence of HBV and potential risk factors among health professionals in public hospitals of Addis Ababa, Ethiopia. *A thesis presented to school of graduate studies of Addis Ababa University*.

8. APPENDICES

8.1. Information sheet and informed voluntary consent form for the heads of health facilities

1. Introduction:

My name is **Mohamed Ibrahim Jama**. I am the Principal Investigator of the study to be conducted in Hargeisa health facilities, Somaliland. I am studying for my Master's degree at Haramaya University, the College of Health and Medical Sciences. I kindly request you to lend me your attention to explain you about the study and your institution being selected as the study setting.

2. The study/project title: Hepatitis B infection prevention practice and vaccination status among healthcare workers in Hargeisa city in Somaliland, 2024.

3. Purpose/aim of the study: The finding of this study may be used as a guide for healthcare providers and health facilities administrators in Hargeisa city to take appropriate intervention. Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfilment of a Master's program in public health for the principal investigator.

4. Procedure and duration: The data collector will interview healthcare workers who were working their health facilities at a time that will be conducted for study by using a questionnaire which will be prepared in English. The questionnaire contains 91 questions. If they are agreeing to involve the interview, the data collector will conduct after all procedures were completed and it will take a maximum of 30-40 minutes at workplace.

5. Risks and benefits: The risk of being participating in this study is a very minimal. But only taking few minutes from the study participant's time. There would not be any direct payment for participants in this study. But, the findings from this research will reveal important information for health institutions and other local health planners.

6. Confidentiality: The information that will be provided will kept confidential. There will be no information that will identify the participants in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual person. The questionnaire will be coded to exclude showing names. No reference will be used in oral or written reports that could link participants to the research.

7. Rights: Participation for this study is fully voluntary. The participants have the right to declare to participate or not in this study. If they decide to participate, they have the right to withdraw from the study at any time and this will not label them for any loss of benefits which they otherwise are entitled. They do not have to answer any question that they do not want to

answer. The hospitals and health centres have also the right to stop this study from being conducted if any misdeeds and unethical procedures are observed during the data collection process in the Hospitals and health centres premises.

8. Contact Address: If there are any questions for any time about the study or the procedures, please contact:

Principal investigator: MOHAMED IBRAHIM,

e-mail: mohamedguul313@gmail.com, Mobile phone: +251-976368951

Institutional Health Research Ethics Review Committee; Office phone: +251-254-66-2011, P.O. Box 235, Harar, Ethiopia.

9. Declaration of informed voluntary consent: I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any inquiries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that participants have the right to withdraw from the study at any time they want. I also informed that the institution has the right to terminate this study from being conducted if any misdeeds and unethical ways are observed during the data collection process. Therefore, I declare my voluntary consent on behalf of _____hospitals/ health centre management to allow this study to be conducted in the health facilities with my initials (signature).

Name and signature of head of health facilities: _____Date_____

Name and signature of the PI: _____Date_____

8.2. Participant information sheet and informed voluntary consent form for Healthcare workers

1. Introduction:

My name is----- I am working as a data collector for the study being conducted in Hargeisa health facilities by Mr. Mohamed Ibrahim Jama who is studying for his master's degree at Haramaya University, college of health and medical sciences. I kindly request you to lend me your attention to explain you about the study and your health facilities is being selected as the study participants.

2. Title of the study: Hepatitis B infection prevention practice and vaccination status among healthcare workers in Hargeisa city in Somaliland, 2024.

3. Purpose/aim of the study: The findings of this study may be used as a guide for health care providers and health facilities administrators in Hargeisa city to take appropriate intervention. moreover, the aim of this study is to write a thesis as a partial requirement for the fulfilment of a Master's program in public health for the principal investigator.

4. Procedure and duration: I will have an interview with you using a questionnaire which contains 91 questions to give me relevant information that is beneficial for the research. The interview will take about 30-40 minutes, so I friendly ask you to provide me this time for the interview.

5. Risks and benefits: The risk of participating in this study is very little, but only taking a few minutes from your time. There will not be direct payment in order to participate in this study. But the findings from this research may reveal important information for the health institutions and to the community in all.

6. Confidentiality: The information you will give us will be confidential. There will be no information that will show you in particular. The questionnaire will be coded to exclude showing names. No reference will be used in oral or written reports that can link participants to the research.

7. Rights: Participation for this study is fully voluntary. The participants have the right to participate or refuse in this study. If they decide to participate, they have the right to withdraw from the study at any time and this will not label them for any loss of benefits which they otherwise are entitled. They have a choice to refuse any question that they do not want to answer.

8. Contact Address: If there are any questions for any time about the study or the procedures, please contact:

Principal investigator: MOHAMED IBRAHIM,

e-mail: mohamedguul313@gmail.com, Mobile phone: +251-976368951

Institutional Health Research Ethics Review Committee; Office phone: +251-254-66-2011, P.O. Box 235, Harar, Ethiopia.

9. Declaration of informed voluntary consent: I have understood the aim of the study, rules, risks and benefits, issues of confidentiality, the rights of participating and the contact address for any question. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to take part in this study.

Name and signature of participant: _____ Date _____

Name and signature of data collector: _____ Date _____

8.3. Data Collection Tool

Section one: socio demographic characteristics

No	Question	Options	Remark
1	Sex	Male Female	
2	Age in complete years	_____	
3	Marital status	Single Married Divorced widowed Separated	
4	Profession	_____	
5	Work experience in years	_____	
6	Type of health institution	Hospital Health center Private	
7	Current working unit	_____	
8	Educational level	Diploma BSc degree Master's degree PhD	
9	Average monthly income	_____	

Section two: knowledge items

No	Question	Options	Remark
10	Have you been thought about HBV and its vaccine?	Yes No	
11	Can HBV affect any age group?	Yes No	
12	Do you think that HBV causes liver cancer?	Yes No	
13	Do you think that HBV can affect other organ other than liver?	Yes No	
14	Is jaundice one of the common symptoms of HBV?	Yes No	
15	Can Hepatitis B be transmitted by contaminated blood and blood products?	Yes No	
16	Can Hepatitis B be transmitted by un-sterilized syringes, needles and surgical instruments?	Yes No	
17	Can hepatitis B have transmitted by fecal-oral?	Yes No	
18	Could we prevent HBV transmission?	Yes No	
19	Are Standard precautions used for the care of all patients regardless of their diagnosis and perceived infection status?	Yes No	
20	Do you think Washing hands after contact with the patient's environment is one of the elements in standard precaution?	Yes No	
21	Is PPE important in infection control because it acts as a barrier between infectious materials such as viral and bacterial contaminants and your skin, mouth, nose, or eyes?	Yes No	
22	Do gloves must be worn every time during handling potentially infectious materials?	Yes No	
23	Have you ever heard about infection prevention principles?	Yes No	
24	Do washing hands with soap or use of an alcohol-based antiseptic decreases the risk of transmission of healthcare acquired infections?	Yes No	
25	Can hepatitis B transmit by handshaking?	Yes No	
26	Are People who infected with hepatitis B are at risk of infecting others?	Yes No	
27	Do you think that Hepatitis B can be cured/treated?	Yes No	
28	Stationeries, telephones and doorknobs are not source of infection.	Yes No	
29	Segregation of clinical and non-clinical wastes is useful to prevent transmission of hepatitis B infection.	Yes No	

Section three: attitude questions

Attitude question	Strongly agree (SA) %	Agree (A)%	Neither agree nor disagree (NA/ND) %	Disagree (DA)%	Strongly disagree (SD)%
30. Standard precaution is easy to follow.					
31. I believe that following infection control guideline will protect me from being infected with HBV at work					
32. Standard precautions prevent the spread of infections from patients to HCWs and vice versa.					
33. Infectious diseases like HBV can be treated.					
34. Changing gloves is necessary during procedures even if heavily contaminated.					
35. HCWs should use PPE because it may not harm patients psychologically.					
36. Vaccination towards hepatitis B is mandatory					
37. Being a health professional puts you at greatest risk of having hepatitis B.					
38. HBV is serious public health problem.					
39. I am at risk of getting hepatitis B.					
40. I am concerned about HBV infection at work.					
41. Hepatitis B vaccine is safe and effective.					
42. Changing of gloves during blood collection and tests is not waste of time.					
43. All patients should be tested for HBV before they receive health care.					
44. Sharp injury at work require reporting.					

45. I want to become screened for hepatitis B.					
46. I feel comfortable to take care of people with hepatitis B.					
47. It is logical to assume all patients are contagious unless their infection has been confirmed.					
48. Wearing PPE during surgery is necessary.					

Section four: practice questions

No	Question	Options	Remark
49	I always perform hand hygiene when I come in contact with patients.	Yes No	
50	How often do you use glove (both hands)?	Yes No	
51	I always perform hand hygiene after taking off gloves.	Yes No	
52	I always wash hands immediately after contacting any blood, body fluid, secretion, excretion, or dirty substances.	Yes No	
53	I always wear gloves when drawing blood samples or come in contact with blood	Yes No	
54	I always wear gloves when disposing of stool or urine.	Always Never	
55	I always wear gloves when handling impaired patient skin.	Yes No	
56	I always wear gloves when handling the patient's mucosa, saliva or sputum culture.	Yes No	
57	I always wear gloves when dressing wounds.	Yes No	
58	Have ever taken HBV vaccine?	Yes No	
59	If yes, how many doses?	One Two Three	
60	Reasons for not being comfortable receiving vaccination from that point	No privacy observed Unfriendly vaccinators High cost of vaccination Regular absence of vaccinators	

		Lack of vaccine	
61	I always wear mask or protective eye patch or goggle when performing operations/procedures that might induce the spraying of blood, body fluid, secretions, or excretions.	Yes No	
62	I always dispose of needles, blades, or any other single use sharp objects in a sharp disposal container after use.	Yes No	
63	Have you ever screened for hepatitis B?	Yes No	
64	Do you apply antiseptic hand rub to clean hands?	Yes No	
65	Do you practice high-level disinfection where sterilization is not applicable	Yes No	
66	Do you mix dry and liquid healthcare wastes?	Yes No	
67	Do you incinerate or bury used sharp materials	Yes No	
68	When do you change disinfectant chlorine solution?	I don't know within 48 hours	
69	Do you wear the necessary personal protective equipment (PPE) such as gloves, apron, goggles and mask, if splashes and spills of any body fluids are likely?	Yes No	
70	Where do you usually put sharp disposal boxes?	hand reach area/anywhere at corridor in safety boxes	
71	I always report for a needle stick injury.	Yes No	
72	I discard wastes materials in hospitals on their appropriate container.	Yes No	
73	Have you participated in health education on HBV infection?	Yes No	
74	Observation questions	Wear glove out of three patients Wash hand out of three patients	

		Needle recap and disposal out of three patients_____ Wearing Apron out of three patients Use antiseptics out of three patients_____	
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Section five: prevention practice and vaccination status

No	Question	Options	Remark
75	The facility has personal protective equipment	Yes No	
76	Reasons for not wearing the personal protective equipment	Discomfort caused by the PPEs I regard them unsafe Difficult to use Wastes time	
77	Received any training on the use of personal protective equipment	Yes No	
78	Health facility have HBV vaccines	Yes No	
79	Affordability of the vaccine	Not affordable Somewhat affordable Affordable	
80	Health facility offers free vaccination services to health care workers	Yes No	
81	Available guidelines followed by all health workers in this facility	Yes No	
82	Privacy observed at the point of vaccination	Yes No	
83	Adherence to the hepatitis B prevention guidelines.	Yes No	

84	Availability of policy that guides for the new health workers to be screened against HBV before commencing their duties	Yes No	
85	Distance hinder accessing the HBV vaccination services	Yes No	
86	IEC materials are available at this facility	Yes No	
87	Frequency of conducting vaccination	Daily Once a week Once a month	

8.4. Curriculum vitae

1. Personal information

A. Full Name: Mohamed Ibrahim Jama

B. Sex: Male

C. Date of Birth: 1/1/1993

D. Place of Birth: Hargeisa, Somaliland

E. Marital Status: Single

f. Nationality: Somalilander

g. Contact Address: phone: - 0976368951/0634636621,
e-mail- mohamedguul313@gmail.com

2. Educational Background

Education level	School	Academic Years
Primary school	Osman Ibnu-Afan primary school	2003-2011
Secondary school	Mohamoud. A. Ali secondary school	2011-2014
Diploma	Global college	2020-2022
Computer certificate	Tisqaad college	2017-2018
BSc degree in medical laboratory	Edna-Aden University	2014-2018

Profile

Structured Laboratory Technician offering background in collecting, processing and analysing various specimens. Familiar with basic medical terminology, laboratory protocols and testing procedures.

Expertise in urinalysis and blood typing. Recognized for performing laboratory tests and procedures with attention to detail, optimum quality and expedience.

Work Experience

Manhal speciality hospital & Gargaar hospital

- Key activities included:
- Service as laboratory technician
- Patient care
- Collecting any kind of samples

- Analysing different samples (haematology, serology, urine, stool, biochemistry, bacteriology, immunohematology)
- Interpreting results
- Daily and monthly Reporting and record
- Maintain the instruments

Somaliland Beverage Industry (SBI)

Key activities included:

- Sample testing
- Enhancing the quality of beverages
- Microscopic analysis of samples from beverage
- Rejected unstandardized beverages
- Quality control of beverages
- Maintain the instruments

Skills

- Medical laboratory technologist
- Strong analytic, conceptual, communication and interpersonal skills
- Doing different haematological tests
- Doing all biochemistry tests
- Performing serological tests
- Urine analysis
- Stool examination
- Culture and sensitivity.
- Strong interpersonal skills

Languages

- Somali: Native
- English: Fluent
- Arabic: intermediate

References

1. Fikru Debebe Mekonnen Email: debebefikru@yahoo.com
2. Hussein Mohamoud Nour Email: saxnuuni77@gmail.com
3. Abdirahman Osman Abdalla Email: cadamiosman112@gmail.com