



Nabta College
Program of Medicine and Surgery



Title:

**Knowledge, Attitudes, and Practices Regarding Hepatitis B Virus (HBV)
among Clerkship Medical Students at Nabta College, Sudan, 2026**

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الآية

إِنَّ فِي خَلْقِ السَّمَاوَاتِ وَالْأَرْضِ وَاخْتِلَافِ اللَّيْلِ
وَالنَّهَارِ لَآيَاتٍ لِّأُولِي الْأَلْبَابِ ۝ الَّذِينَ يَذْكُرُونَ اللَّهَ
قِيَامًا وَقُعُودًا وَعَلَىٰ جُنُوبِهِمْ وَيَتَفَكَّرُونَ فِي خَلْقِ
السَّمَاوَاتِ وَالْأَرْضِ رَبَّنَا مَا خَلَقْتَ هَذَا بَاطِلًا سُبْحَانَكَ
فَقِنَا عَذَابَ النَّارِ)

– القرآن الكريم، سورة آل عمران (190-191))

Dedication

This research is dedicated to my beloved parents, whose unwavering support, encouragement, and sacrifices have been the foundation of my academic journey.

We also dedicate this work to my family and friends for their continuous motivation and belief in my abilities. Special appreciation is extended to my professors and mentors at Nabta College , whose guidance and knowledge have greatly contributed to the completion of this study.

Acknowledgement

First and foremost, we thank Almighty Allah for giving us the strength, patience, and knowledge to complete this work.

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We are profoundly thankful to the administration of Nabta College, Program of Medicine and Surgery, for providing the necessary facilities and support. Our sincere appreciation extends to all the clerkship medical students who voluntarily participated in this study; without their honest responses, this work would not have been possible.

We also wish to acknowledge our families and friends for their unwavering encouragement, understanding, and financial and emotional support during our academic journey. Finally, we thank everyone who contributed directly or indirectly to the completion of this research.

Abstract

Background

Hepatitis B Virus (HBV) infection poses a significant occupational risk to medical students, especially during clinical clerkships. In conflict-affected settings like Sudan, disruptions to healthcare and education may exacerbate this vulnerability.

Objective

To assess the knowledge, attitudes, and practices (KAP) regarding HBV among clerkship medical students at Nabta College, Sudan, in 2024.

Methods

A descriptive cross-sectional study was conducted among 188 clerkship medical students (Levels 4 and 5) at Nabta College, including affiliated centers in Shendi (Sudan), Cairo (Egypt), and Jeddah (Saudi Arabia). Data were collected using a structured, self-administered online questionnaire covering sociodemographics, knowledge of transmission, attitudes towards vaccination and infected patients, and preventive practices. Data were analyzed using descriptive statistics and chi-square tests.

Results

Of 188 participants (56.4% male, mean age 24.1 ± 3.9 years), 66.0% demonstrated good knowledge of HBV. However, only 7.4% were fully vaccinated (three doses), while 61.2% had received no doses. Needle-stick injury was reported by 27.1% of students, and consistent glove use was only 39.4%. Positive attitudes were observed, with 92.6% agreeing that HBV vaccination should be mandatory and 94.7% supporting needle-stick injury reporting. Knowledge level was significantly associated with academic level ($p=0.048$), attendance at infection control training ($p=0.002$), and vaccination status ($p=0.015$). Conflict affected 89.9% of participants.

Conclusion

Despite good knowledge and positive attitudes, there is a critical gap in HBV preventive practices among clerkship medical students, characterized by extremely low full vaccination rates and suboptimal adherence to standard precautions. The high rate of needle-stick injuries combined with low immunity poses a serious occupational threat. Mandatory vaccination policies, enhanced infection control training, and conflict-resilient health education strategies are urgently needed.

Keywords: Hepatitis B Virus, Knowledge, Attitudes, Practices, Medical Students, Clerkship, Vaccination, Sudan, Conflict, Needle-stick injury.

الملخص

المقدمة:

يشكل عدوى فيروس التهاب الكبد الوبائي (ب) خطراً مهنيًا كبيراً على طلاب الطب، خاصة خلال فترة الامتياز السريري. في البيئات المتأثرة بالنزاعات مثل السودان، قد تؤدي الاضطرابات في الرعاية الصحية والتعليم إلى تفاقم هذه القابلية للإصابة.

الهدف:

تقييم المعرفة والاتجاهات والممارسات المتعلقة بفيروس التهاب الكبد الوبائي (ب) لدى طلاب الامتياز بكلية النبتة، السودان، 2024.

المنهجية:

أجريت دراسة وصفية مقطعية على 188 طالباً وطالبة من طلاب الامتياز (المستويين الرابع والخامس) في كلية النبتة، شملت مراكز تابعة في شندي (السودان)، القاهرة (مصر)، وجدة (المملكة العربية السعودية). تم جمع البيانات باستخدام استبيان إلكتروني منظم ذاتي التعبئة غطى البيانات الديموغرافية، والمعرفة بطرق الانتقال، والاتجاهات نحو التطعيم والمرضى المصابين، والممارسات الوقائية. تم تحليل البيانات باستخدام الإحصاء الوصفي واختبار مربع كاي.

النتائج:

من بين 188 مشاركاً (56.4% ذكور، متوسط العمر 24.1 ± 3.9 سنة)، أظهر 66.0% معرفة جيدة بفيروس الكبد الوبائي (ب). ومع ذلك، كان 7.4% فقط مطعمين بالكامل (ثلاث جرعات)، بينما لم يتلق 61.2% أي جرعة. أبلغ 27.1% من الطلاب عن تعرضهم للإصابة بالإبر، وبلغت نسبة الالتزام المنتظم بارتداء القفازات 39.4% فقط. لوحظت اتجاهات إيجابية، حيث وافق 92.6% على ضرورة إلزامية التطعيم ضد الفيروس، وأيد 94.7% الإبلاغ عن إصابات الإبر. ارتبط مستوى المعرفة ارتباطاً ذا دلالة إحصائية بالمستوى الأكاديمي ($p=0.048$)، وحضور التدريب على مكافحة العدوى ($p=0.002$)، وحالة التطعيم ($p=0.015$). تأثر 89.9% من المشاركين بالنزاع.

الاستنتاج:

على الرغم من وجود معرفة جيدة واتجاهات إيجابية، هناك فجوة حرجية في الممارسات الوقائية ضد التهاب الكبد الوبائي (ب) بين طلاب الامتياز، تتميز بمعدلات تطعيم كامل منخفضة للغاية والتزام دون المستوى الأمثل بالاحتياطات القياسية. يشكل المعدل المرتفع لإصابات الإبر إلى جانب انخفاض المناعة تهديداً مهنيًا خطيراً. هناك حاجة ماسة إلى سياسات تطعيم إلزامية، وتعزيز التدريب على مكافحة العدوى، واستراتيجيات تعليمية صحية قادرة على الصمود في النزاعات.

الكلمات المفتاحية: فيروس التهاب الكبد الوبائي (ب)، المعرفة، الاتجاهات، الممارسات، طلاب الطب، الامتياز، التطعيم، السودان، النزاع، إصابة الإبر.

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F

S

T
A
B
L
O
C
O
N
T
E
N
T

Alayya	I
Dedication	II
Acknowledgement	III
Abstract in English	IV
Abstract in Arabic	VI
Table of content	VIII
List of table	IX
List of Figures	IX
List of Abbreviations	X

CHAPTER ONE: INTRODUCTION

Introduction	1
Problem Statement	3
Justification	3

CHAPTER TWO: LITERATURE REVIEW

Introduction to Hepatitis B Virus and its Global Impact	6
Knowledge of HBV among Medical Students	6
Attitudes Towards HBV and Vaccination	7
Practices Regarding HBV Prevention and Control among Medical	8
Factors Influencing Knowledge, Attitudes, and Practices	9
The Impact of Confect on Medical Education and Health Practices	10

CHAPTER THREE: METHODOLOGY

Study Design	12
Study Setting and Duration	12
Study Population	12
Inclusion and Exclusion Criteria	13
Sampling Method and Sample Size	13
Data Collection Tools and Procedures	14
Data Analysis	15
Ethical Consideration	15

CHAPTER FOUR: RESULTS

Results .4	18
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Page

CHAPTER FIVE: DISCUSSION

CHAPTER SIX: CONCLUSION, RECOMMENDATION

LIST OF TABLES

Table 1. Sociodemographic Characteristics	17
Table 2. Perceptions and Attitudes	19
Table 3. Practices and Clinical Behavior	20
Table 4. Exposure and Preventive Measures	20
Table 5. Classification of Knowledge Level among Participants	21
Table 6. Association between Knowledge Level and Participant Characteristics	22

LIST OF FIGURES

Figure 1. Awareness and Knowledge about Hepatitis B	18
Figure 2. Knowledge of Transmission Routes	18
Figure 3. Vaccination Status of the Students	21

List of Abbreviations

DNA	Deoxyribonucleic Acid
HBsAg	Hepatitis B Surface Antigen
HBV	Hepatitis B Virus
HCC	Hepatocellular Carcinoma
HCW	Healthcare Worker

IRB	Institutional Review Board
KAP	Knowledge, Attitudes, and Practices
NSI	Needle-stick Injury
PEP	Post-Exposure Prophylaxis
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1. Background

Hepatitis B virus (HBV) infection remains a formidable global health challenge, posing a significant threat to public health worldwide. The World Health Organization (WHO) estimates that over 296 million people are living with chronic HBV infection, leading to approximately 820,000 deaths annually, primarily from cirrhosis and hepatocellular carcinoma (HCC) [1]. The burden of HBV is disproportionately high in sub-Saharan Africa and East Asia, where prevalence rates can exceed 8% in the general population, classifying these regions as areas of high endemicity [2]. Sudan, situated within sub-Saharan Africa, is considered an area of intermediate to high HBV endemicity, with varying prevalence rates reported across different regions and populations [3]. This epidemiological landscape underscores the critical importance of effective prevention and control strategies, particularly among vulnerable populations. Healthcare workers (HCWs) and, by extension, medical students, represent a particularly high-risk group for HBV infection due to their frequent exposure to blood and body fluids in clinical settings [4]. The risk of occupational exposure increases significantly during clinical rotations, where students engage in procedures such as venipuncture, injections, and surgical assistance. Consequently, adequate knowledge, positive attitudes, and safe practices regarding HBV prevention are paramount for this group, not only for their personal protection but also for preventing nosocomial transmission to patients and for their future roles as healthcare providers [5].

Despite the availability of a safe and effective vaccine against HBV since 1982, global vaccination coverage, especially among HCWs and medical students in resource-limited settings, remains suboptimal [6]. Studies from various countries have highlighted persistent gaps in knowledge regarding HBV transmission, prevention, and management among medical students, often coupled with suboptimal vaccination rates and adherence to universal precautions [7, 8]. These deficiencies can be attributed to several factors, including inadequate curriculum coverage, lack of awareness campaigns, limited access to vaccination services, and socio-economic barriers.

In Sudan, the context is further complicated by ongoing socio-political instability and

Armed conflict. The recent conflict, which began in April 2023, has severely disrupted healthcare infrastructure, educational institutions, and public health services [9]. This disruption has led to widespread displacement, limited access to essential medical supplies, and significant challenges in maintaining routine health programs, including vaccination initiatives. Medical students in this environment face unique stressors, including interrupted education, personal safety concerns, and reduced opportunities for practical training, all of which can impact their learning, attitudes, and adherence to infection control practices [10]. The ability of students to maintain appropriate knowledge, attitudes, and practices regarding HBV in such a challenging environment is crucial for mitigating the spread of the virus and for preparing a competent future healthcare workforce.

This study aims to evaluate the knowledge, attitudes, and practices concerning HBV among clerkship medical students at Natta College, Sudan, in 2024. Clerkship students, being in their clinical years (typically years 4, 5, and 6 in a 6-year program), are at the forefront of patient care and are thus at a higher risk of occupational exposure. Understanding their current status in terms of KAP is essential for identifying specific educational and policy interventions needed to enhance their protection and improve public health outcomes in a conflict-affected setting. The findings will provide valuable insights for medical educators, public health officials, and policymakers to develop targeted strategies to address HBV prevention and control among this critical population. The study will also consider the impact of the challenging environment on these aspects, providing a comprehensive understanding of the situation.

1.2 Problem Statement

Despite clerkship medical students representing a high-risk group for occupational Hepatitis B Virus (HBV) infection due to their direct interaction with patients and invasive medical procedures, studies indicate alarming gaps in their awareness levels and preventive practices. This problem is exacerbated in the Sudanese context by the ongoing armed conflict since April 2023, which has led to the deterioration of health infrastructure and disruption of the educational process in many medical colleges. This disruption may negatively impact students' adherence to biosafety standards and their access to vaccination services. Consequently, there is an urgent need to assess the current status of students at Nabta College and its affiliated centers, as decision-makers and medical educators lack up-to-date data reflecting the impact of these exceptional circumstances on students' preventive competence, thereby hindering the development of effective intervention strategies to protect future healthcare professionals and ensure patient safety.

1.3 Justification

This study derives its significance from several fundamental research and field considerations:

1. **High Occupational Risk:** Given the nature of clerkship students' work on the front lines of healthcare delivery, their protection from blood-borne diseases is a paramount priority to ensure the sustainability and safety of the future healthcare workforce.
2. **Contextual and Temporal Specificity:** Sudan is experiencing unprecedented conflict conditions that have directly impacted the quality of medical training and the availability of preventive resources. Therefore, understanding how students' practices are affected by these circumstances is vital for adapting educational curricula to the realities of crises.
3. **Public Health Security:** Enhancing students' knowledge and practices not only protects the students themselves but also directly contributes to reducing nosocomial

transmission within healthcare facilities and safeguarding the community from viral spread.

4. Addressing a Research Gap: The Sudanese research landscape lacks recent studies addressing medical students' awareness and practices regarding HBV amidst the current crisis, making this study a crucial reference for academic and health institutions in the region
5. Informing Institutional Policies: The findings will provide a scientific database for Natta College and similar institutions to develop mandatory vaccination policies and intensive training programs that are compatible with current logistical and security challenges

Objective.1.4

.General Objective

To conduct a comprehensive study and evaluation of the knowledge, attitudes and practices regarding Hepatitis B Virus (HBV) among clerkship medical students at Nabta

.College across its training centers in 2026

.Specifc Objectives

To evaluate the level of theoretica knowledge regarding HBV transmissionsymptoms, .symptoms and prevention among clerkship students

To determine the frequency and quality of preventive practices, includingvaccination status and the use of personal protective equipment

To compare the KAP levels among students across the three training centersShendi, Cairo, and Jeddah

To identify the factors associated with poor practices, such as lack of resourceinadequate training, or confict-related disruptions

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction to Hepatitis B Virus and its Global Impact

Hepatitis B virus (HBV) infection remains a significant global health concern, contributing substantially to morbidity and mortality worldwide. It is a DNA virus belonging to the Hepadnaviridae family, primarily affecting the liver and capable of causing both acute and chronic infections [11]. Chronic HBV infection can lead to severe liver diseases, including cirrhosis, liver failure, and hepatocellular carcinoma (HCC), which is one of the leading causes of cancer-related deaths globally [12]. The transmission of HBV occurs predominantly through percutaneous or permucosal exposure to infected blood or other body fluids. Common routes include mother-to-child transmission, unsafe injection practices, unprotected sexual contact, and sharing of contaminated sharp instruments [13]. Healthcare professionals, including medical students, are particularly vulnerable to occupational exposure, making their understanding and adherence to preventive measures crucial [14]. The global prevalence of HBV varies, with high endemicity observed in regions like sub-Saharan Africa and Southeast Asia, where over 8% of the general population may be chronically infected [15]. This geographical distribution highlights the need for region-specific studies to understand the local dynamics of the infection and the effectiveness of control strategies.

2.2. Knowledge of HBV among Medical Students

Adequate knowledge about HBV transmission, prevention, and management is fundamental for medical students, as they are future healthcare providers who will be at the forefront of patient care and public health initiatives. Numerous studies have explored the level of HBV knowledge among medical students globally, revealing varied findings. For instance, a study conducted in Saudi Arabia found that while medical students generally possessed good knowledge regarding major transmission routes like sharing needles and contaminated blood, there were notable gaps concerning less common routes and the importance of post-exposure prophylaxis [16]. Similarly, research from Pakistan indicated that a significant proportion of medical students lacked comprehensive knowledge about HBV, particularly regarding its long-term complications and the efficacy of vaccination [14].

In the context of Sudan, a study by Babiker et al. (2021) at the University of Medical Sciences and Technology (UMST) reported that 64.1% of participants demonstrated good knowledge of HBV [18]. This study highlighted that the majority correctly identified transmission through sharing needles and syringes (97.3%) and contaminated blood products (97.7%). However, knowledge gaps were observed in other areas, suggesting that while basic understanding is present, a more in-depth comprehension might be lacking. Another study focusing on medical colleges in North Sudan (Mohamed et al., 2021) also indicated good knowledge levels among students, yet pointed out that this knowledge did not always translate into good practices [19].

These findings collectively suggest that while medical students often have a foundational understanding of HBV, there is a persistent need to reinforce and expand their knowledge base, especially concerning practical aspects of prevention and management, to ensure they are adequately prepared for their clinical responsibilities.

2.3 . Attitudes Towards HBV and Vaccination

Attitudes play a crucial role in shaping health-seeking behaviors and adherence to preventive measures. Positive attitudes towards HBV prevention, vaccination, and infected individuals are essential for medical students to effectively manage patients and reduce stigma. Studies have shown that medical students generally hold positive attitudes towards HBV vaccination and infection control measures, recognizing the importance of protecting themselves and their patients [20]. For example, the UMST study in Sudan found that 66.4% of students had a fair attitude towards HBV, with 88.6% favoring early treatment upon diagnosis and 90.5% acknowledging the vaccine's effectiveness [18]. A significant proportion (83.2%) also believed they were at risk of HBV infection, indicating a level of self-awareness regarding occupational hazards. However, positive attitudes do not always translate into optimal practices. Some studies have revealed that despite recognizing the risks, medical students may still exhibit hesitant attitudes towards vaccination or adherence to universal precautions due to various factors, including perceived low risk, lack of immediate access to vaccines, or misconceptions [21]. The social stigma associated with HBV can also influence attitudes, with some studies indicating that HBV-positive

individuals may face social isolation, even among healthcare professionals [22]. Addressing these attitudinal barriers requires comprehensive educational programs that not only impart knowledge but also foster empathy and a strong sense of professional responsibility. The development of positive attitudes is particularly vital in clinical settings where direct patient contact increases the risk of exposure, making it imperative for students to internalize the importance of preventive behaviors and non-discriminatory practices towards HBV-infected individuals.

2.4. Practices Regarding HBV Prevention and Control among Medical

Students Practices are the ultimate manifestation of knowledge and attitudes, reflecting the actual behaviors adopted by individuals in response to health risks. For medical students, appropriate practices related to HBV prevention and control are critical, encompassing vaccination, adherence to universal precautions, and safe handling of sharps. Unfortunately, studies consistently reveal a gap between knowledge and practice among medical students, particularly in resource-limited settings [23]. Vaccination against HBV is the most effective preventive measure. However, vaccination coverage among medical students often falls short of optimal levels. A systematic review of studies in sub-Saharan Africa estimated the vaccination coverage rate among university students to be around 18.1% [24], highlighting a significant vulnerability. In Sudan, the UMST study reported that 47.7% of students had received the HBV vaccine, which, while better than some regional averages, still leaves a substantial portion unprotected [18]. Other studies in Sudan have shown even lower vaccination rates among healthcare workers and students, with one report indicating that only 15.0% of HCWs had completed the full three-dose schedule [25]. Key barriers to vaccination identified in these contexts include lack of vaccine availability, absence of mandatory vaccination policies, and financial constraints [26]. Adherence to universal precautions, such as wearing gloves, using protective eyewear, and proper hand hygiene, is another critical practice. However, compliance can be inconsistent. Studies have reported high rates of needle-stick injuries (NSIs) among medical students, which are a major route of HBV transmission in healthcare settings [27]. For instance, research in Ethiopia revealed that poor knowledge about universal precaution

guidelines and needle-stick injuries contributed to a high prevalence of HBV infection among medical students [28]. The UMST study indicated that only 21.4% of students had undergone HBV screening, and a mere 2.3% admitted to sharing personal items with an HBV-positive individual, suggesting that while some risky behaviors are low, proactive screening is also not widespread [18]. Furthermore, only 36.8% reported asking barbers to change blades or sterilize tools, indicating potential gaps in awareness regarding community-based transmission risks. These findings underscore the urgent need for interventions that translate knowledge and positive attitudes into consistent safe practices. This includes improving access to HBV vaccination, implementing mandatory vaccination policies for medical students, and providing rigorous training on infection control and sharps safety. Regular awareness sessions, as noted in the UMST study where 43.6% of students had attended one, can significantly improve KAP scores, but their reach and frequency need to be expanded [18].

2.5 . Factors Influencing Knowledge, Attitudes, and Practices

Several demographic and academic factors have been identified as influencing the KAP levels regarding HBV among medical students. The academic year of study is a prominent factor, with students in clinical years generally demonstrating higher levels of knowledge and better practices compared to their preclinical counterparts [29]. This is often attributed to increased clinical exposure, direct patient contact, and more focused education on infectious diseases during clerkship. For example, a study in Jordan found that final-year medical students had significantly better knowledge and practices regarding HBV compared to those in earlier years [30]. Gender can also play a role, though findings are mixed. Some studies suggest that female students may exhibit better practice scores, possibly due to higher health consciousness or adherence to preventive behaviors. Curricula that integrate comprehensive HBV education, including practical training on infection control and universal precautions, are more likely to produce students with high KAP levels [31].

2.6 . The Impact of Conflict on Medical Education and Health Practices

in Sudan The ongoing conflict in Sudan, particularly since April 2023, has created an environment of profound instability, severely impacting all sectors, including medical education and public health. The disruption of educational institutions, displacement of populations, and damage to healthcare infrastructure have posed unprecedented challenges for medical students and healthcare providers [32]. Access to essential resources, including medical supplies, vaccines, and educational materials, has been severely limited, further exacerbating the vulnerability of the population to infectious diseases like HBV. The psychological toll of conflict, characterized by stress, trauma, and uncertainty, can also negatively affect students' academic performance, their ability to focus on studies, and their overall well-being [33]. This challenging environment underscores the critical importance of understanding how medical students maintain their knowledge, attitudes, and practices regarding HBV amidst such adversity. It also highlights the urgent need for resilient educational strategies and support systems to ensure the continuity of medical training and the preparedness of future healthcare professionals in conflict-affected regions [34]

CHAPTER THREE

METHODOLOGY

3.1. Study Design

This study will employ a descriptive cross-sectional design to assess the knowledge, attitudes, and practices (KAP) regarding Hepatitis B Virus (HBV) among clerkship medical students.

3.2. Study Setting and Duration

The research will be conducted across multiple study settings to capture a broader perspective on the KAP of medical students, especially considering the impact of conflict and displacement. The primary setting will be Nabta College, Sudan, which is located in a conflict-affected region. Additionally, the study will include medical students from Shendi Center, Sudan, Cairo Center, Egypt, and Jeddah Center, Saudi Arabia. These additional centers are chosen to represent diverse environments, including a different region within Sudan and two major cities in neighboring countries that may host displaced Sudanese students or offer different educational and healthcare contexts. The study will be carried out during the academic year 2023-2024, with data collection planned over a four-week period in early 2026.

3.3. Study Population

The target population will include all clerkship medical students enrolled in their clinical years (typically years 4, 5, year program) at Nabta College, Sudan, and the selected centers in Shendi, Cairo, and Jeddah during the academic year 2025-2026. Clerkship students are specifically targeted due to their increased exposure to clinical environments and patients, which places them at a higher occupational risk for HBV infection and necessitates a robust understanding and adherence to preventive practices.

3.4. Inclusion and Exclusion Criteria

Inclusion Criteria:

1. All undergraduate medical students currently enrolled in their clinical years (years 4, 5) at Nabta College, Shendi Center, Cairo Center, and Jeddah Center during the academic year 2025-2026.
2. Students who provide informed consent to participate in the study.
3. Students who have access to internet-enabled devices for online questionnaire completion.

Exclusion Criteria:

1. Students on academic leave, exchange programs, or those who do not complete the full questionnaire.
2. Students who are frozen due to war or any other circumstances (e.g., those whose studies are suspended or significantly interrupted due to conflict, displacement, or other unforeseen events) and are not actively engaged in their medical education during the study period.

3.5 . Sampling Method and Sample Size

A mandatory sampling technique will be employed due to logistical constraints, particularly in conflict-affected regions and across multiple international sites. Invitations to participate in the study will be distributed via official channels within each participating institution, such as student email lists or learning management systems. The sample size will be determined based on the total number of eligible students across all participating centers, aiming for a comprehensive representation given the practical limitations. A minimum sample size calculation will be performed using appropriate epidemiological formulas, considering an estimated prevalence of good KAP among medical students from previous studies, a desired level of precision, and a confidence interval. For instance, assuming a 50% prevalence of good KAP (to maximize sample size), a 5% margin of error, and a 95% confidence level, the required sample size would be approximately 384. However, considering the multi-center approach and potential for non-response, a larger target sample will be sought to ensure adequate statistical power for subgroup analyses.

3.6 . Data Collection Tools and Procedures

Data will be collected using a structured, self-administered online questionnaire developed in English and translated into Arabic to ensure accessibility for all participants. The questionnaire will comprise several sections:

1. Socio-demographic and Academic Characteristics: This section will gather information on age, gender, academic year, nationality, and prior exposure to HBV education or awareness campaigns.
2. Knowledge Assessment: This section will consist of multiple-choice questions designed to assess students' knowledge regarding HBV transmission routes, symptoms, prevention methods (including vaccination), and complications. Questions will be adapted from validated questionnaires used in similar studies [35, 36]
3. Attitude Assessment: This section will use a Likert scale to gauge students' attitudes towards HBV vaccination, infected individuals, the importance of universal precautions, and their perceived risk of infection. Statements will be formulated to capture both positive and negative attitudes.
4. Practice Assessment: This section will include questions on students' self-reported practices related to HBV prevention, such as vaccination status, adherence to universal precautions (e.g., glove use, safe needle handling), and post-exposure prophylaxis awareness. Questions will also cover practices related to community-based transmission risks, such as sharing personal items or barber tool sterilization.

The online questionnaire will be hosted on a secure platform (e.g., Google Forms, SurveyMonkey) to ensure data confidentiality and ease of access. A pilot study will be conducted with a small group of medical students (not included in the main study) to pre-test the questionnaire for clarity, comprehensibility, and cultural appropriateness, and to estimate the time required for completion. Based on the pilot results, necessary revisions will be made to the questionnaire. Participants will receive an invitation email containing a link to the questionnaire and an informed consent form. Participation will be voluntary, and anonymity will be maintained throughout the study. Reminders will be sent periodically to maximize response rates.

3.7 . Data Analysis

Collected data will be exported from the online platform into a statistical software package (e.g., SPSS, R, or Stata) for analysis. Descriptive statistics (frequencies, percentages, means, standard deviations) will be used to summarize the socio-demographic and academic characteristics of the participants and to describe the overall levels of knowledge, attitudes, and practices. Inferential statistics will be employed to examine associations and differences:

Chi-square tests will be used to assess associations between categorical variables (e.g., gender and vaccination status). Independent t-tests or ANOVA will be used to compare mean knowledge, attitude, and practice scores across different groups (e.g., academic years, nationalities).

Logistic regression may be used to identify predictors of good KAP levels, controlling for potential confounding variables. A p-value of less than 0.05 will be considered statistically significant. Data cleaning and validation will be performed prior to analysis to ensure accuracy and completeness.

3.8. Ethical Considerations

Ethical approval for the study will be obtained from the Institutional Review Board (IRB) of Nabta College, Sudan, and from the relevant ethical committees of the participating institutions in Shendi, Cairo, and Jeddah. Informed consent will be obtained from all participants prior to their involvement in the study. The consent form will clearly explain the study's purpose, procedures, potential risks and benefits, and the voluntary nature of participation. Participants will be assured of anonymity and confidentiality, with all collected data being de-identified and stored securely. Access to the data will be restricted to the research team. The study will adhere to the principles of the Declaration of Helsinki and local ethical guidelines. Participants will have the right to withdraw from the study at any time without penalty. The findings of the study will be disseminated through academic publications and presentations, ensuring that the results contribute to the broader scientific community while protecting the privacy of the participants.

CHAPTER FOUR

RESULT

Table 1. Sociodemographic Characteristics (N = 188) A total of 188 participants were included in the study. Table 1 summarizes the sociodemographic characteristics. The majority were male (56.4%), and participants were distributed between Level 4 (52.1%) and Level 5 (47.9%). The mean age was 24.1 years (SD = 3.9), ranging from 19 to 45 years. Most participants resided inside Sudan (79.8%), while 20.2% resided outside Sudan.

Variable	Category	n (%)
Gender	Male	106 (56.4%)
	Female	82 (43.6%)
Academic Level	Level 4	98 (52.1%)
	Level 5	90 (47.9%)
Age (years)	Mean $\pm$ SD	24.1 $\pm$ 3.9
	Range	19 – 45
Current Residence	Inside Sudan	150 (79.8%)
	Outside Sudan	38 (20.2%)

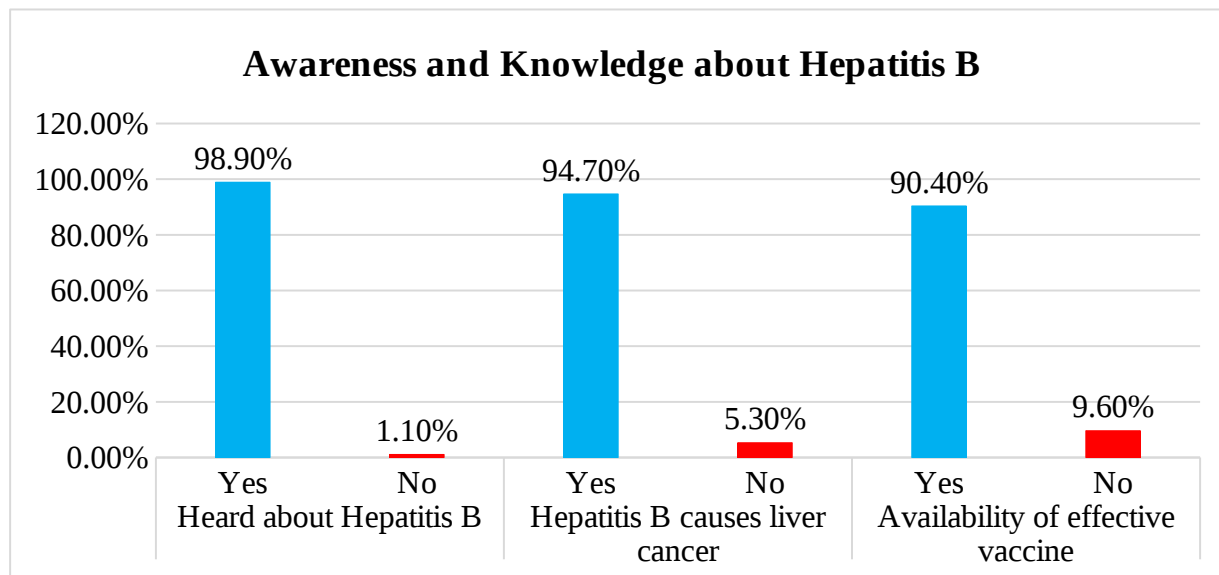


Figure 1. Awareness and Knowledge about Hepatitis B, Figure 1 presents data on awareness and knowledge about Hepatitis B. Nearly all participants (98.9%) responded affirmatively to an awareness-related question. A large majority (94.7%) agreed that HBV vaccination should be mandatory, and 90.4% perceived risk during clinical training.

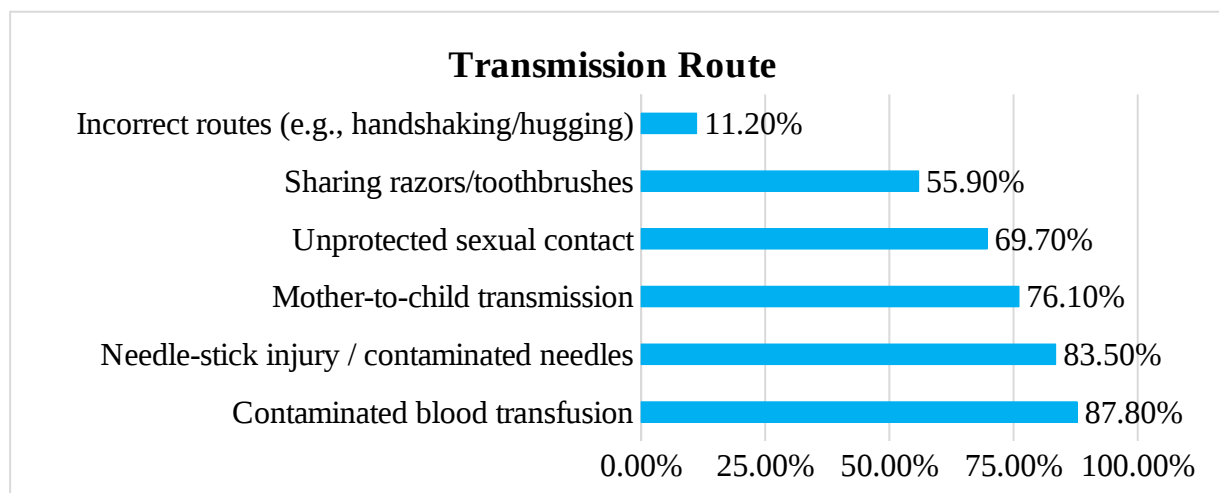


Figure 2. Knowledge of Transmission Routes. The most frequently recognized routes were contaminated blood/blood products (87.8%) and needle-stick injury/contaminated sharps (83.5%). Mother-to-child transmission was identified by 76.1%, unprotected sexual contact

by 69.7%, and sharing razors/toothbrushes by 55.9%. Incorrect routes (e.g., casual contact) were endorsed by 11.2% of participants.

Table 2. Perceptions and Attitudes, Table 2 displays participants' perceptions and attitudes. The vast majority agreed or strongly agreed that HBV vaccination should be mandatory (92.6%) and that needle-stick injuries should be reported (94.7%). Perceived risk during clinical training was endorsed by 90.4% of participants. Regarding comfort treating HBV patients, 60.7% agreed or strongly agreed, while 21.8% disagreed or strongly disagreed, and 17.6% were neutral.

Variable	Agree / Strongly Agree n (%)	Neutral n (%)	Disagree / Strongly Disagree n (%)
Perceived risk during clinical training	170 (90.4%)	6 (3.2%)	12 (6.4%)
HBV vaccination should be mandatory	174 (92.6%)	10 (5.3%)	4 (2.1%)
Reporting needle-stick injury	178 (94.7%)	5 (2.7%)	5 (2.7%)
Comfort treating HBV patients	114 (60.7%)	33 (17.6%)	41 (21.8%)

Table 3. Practices and Clinical Behavior. Table 3 summarizes clinical practices. When asked about the best prevention method in clinical settings, 89.4% selected “use gloves and standard precautions,” while 5.9% selected “avoid patients” and 4.8% selected “handwashing only.” Regarding glove use during procedures, 39.4% reported always using gloves, 48.4% sometimes, 10.1% rarely, and 2.1% never.

Variable	Category	n (%)
Best prevention method in clinical setting	Use gloves & standard precautions	168 (89.4%)
	Avoid patients	11 (5.9%)
	Hand washing only	9 (4.8%)
Glove use during procedures	Always	74 (39.4%)
	Sometimes	91 (48.4%)
	Rarely	19 (10.1%)
	Never	4 (2.1%)

Table 4. Exposure and Preventive Measures. Table 4 reports exposure history and preventive measures. A large proportion (89.9%) reported being affected by conflict. A history of needle-stick injury was reported by 27.1% of participants. Only 27.7% had undergone HBV testing (antibodies/virus), and 39.4% had attended infection control training.

Variable	Yes n (%)	No n (%)
Affected by conflict	169 (89.9%)	19 (10.1%)
History of needle-stick injury	51 (27.1%)	137 (72.9%)
HBV testing (antibodies/virus)	52 (27.7%)	136 (72.3%)
Attended infection control training	74 (39.4%)	114 (60.6%)

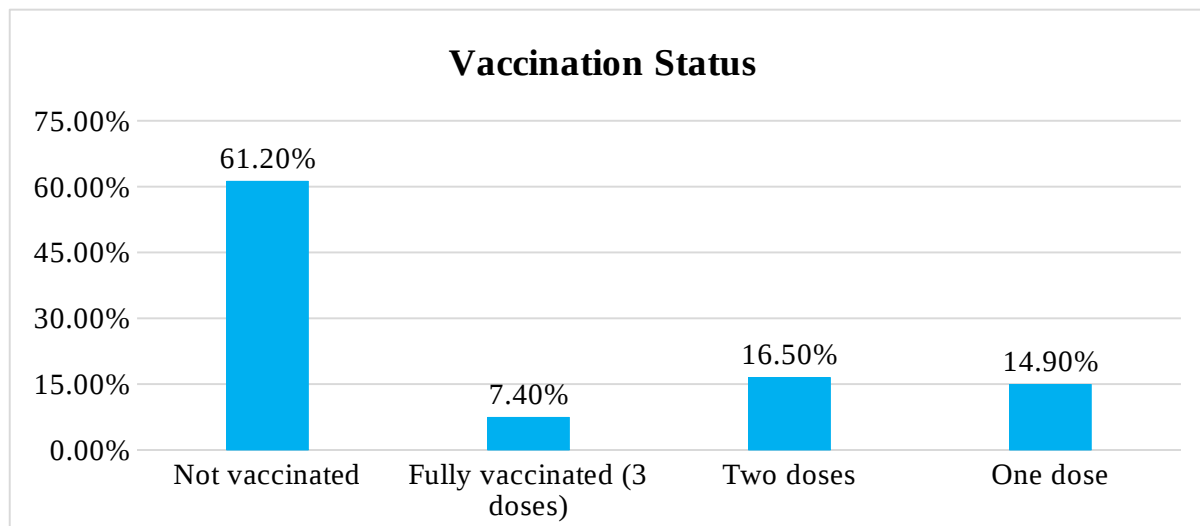


Figure 3. Vaccination Status of the Students. The majority (61.2%) were not vaccinated. Among those vaccinated, 14.9% had received one dose, 16.5% two doses, and only 7.4% were fully vaccinated (three doses).

Table 5. Classification of Knowledge Level among Participants (N = 188). Table 5 classifies participants' knowledge levels based on a 9-point scale. Using a cutoff of 75% correct responses (score of 7–9), 66.0% of participants demonstrated good knowledge, while 34.0% had poor knowledge (score 0–6).

Knowledge Level	Score Range	n (%)
Good Knowledge	7 – 9 (≥75%)	124 (66.0%)
Poor Knowledge	0 – 6 (<75%)	64 (34.0%)

Table 6. Association between Knowledge Level and Participant Characteristics (Chi-square Test, N = 188). Academic level was significantly associated with knowledge ($p = 0.048$), with Level 5 students showing a higher proportion of good knowledge (71.1%) compared to Level 4 students (61.2%). Residence was also significant ($p = 0.031$); participants residing outside Sudan had a higher proportion of good knowledge (78.9%) than those inside Sudan (62.7%). Attendance of infection control training was strongly associated with knowledge ($p = 0.002$), as 78.4% of trained participants had good knowledge compared to 57.9% of untrained participants. Vaccination status was significantly associated with knowledge ($p = 0.015$), with 75.3% of vaccinated participants demonstrating good knowledge versus 60.0% of unvaccinated participants. Gender was not significantly associated with knowledge level ($p = 0.412$).

Variable	Category	Good Knowledge n (%)	Poor Knowledge n (%)	P-value
Gender	Male	68 (64.2%)	38 (35.8%)	0.412
	Female	56 (68.3%)	26 (31.7%)	
Academic Level	Level 4	60 (61.2%)	38 (38.8%)	0.048*
	Level 5	64 (71.1%)	26 (28.9%)	
Residence	Inside Sudan	94 (62.7%)	56 (37.3%)	0.031*
	Outside Sudan	30 (78.9%)	8 (21.1%)	
Infection Control Training	Yes	58 (78.4%)	16 (21.6%)	0.002*
	No	66 (57.9%)	48 (42.1%)	
Vaccination Status	Vaccinated (≥ 1 dose)	55 (75.3%)	18 (24.7%)	0.015*
	Not vaccinated	69 (60.0%)	46 (40.0%)	

CHAPTER FIVE

DISCUSSION,

Discussion

This study aimed to assess the knowledge, attitudes, and practices (KAP) regarding Hepatitis B Virus (HBV) among health science students at Level 4 and Level 5. The results revealed that 66% of the participants possessed a good level of knowledge, which aligns with previous studies conducted in Sudan and its northern regions (e.g., Mohamed et al., 2021 [1]) that indicated a relatively high awareness among medical students. However, the study uncovered a concerning gap between theoretical knowledge and actual practice, particularly concerning vaccination programs.

Participants demonstrated high awareness of the primary transmission routes, with 87.8% identifying contaminated blood transfusion and 83.5% identifying needle-stick injuries as significant sources. These percentages are consistent with regional studies in Somalia and Ethiopia (Ali et al., 2024 [2]; Haile et al., 2024 [3]). Nevertheless, the 11.2% who believed in transmission through handshaking or hugging indicate the persistence of some misconceptions that require correction through educational curricula.

The most striking finding of this study is the low rate of full vaccination, with only 7.4% having received all three doses, while 61.2% had not received any dose at all. This rate is significantly lower than those reported in other studies (Hassan et al., 2024 [4]), reflecting serious challenges in vaccine access, especially given the current conditions in Sudan, where 89.9% of participants reported being affected by conflict.

Furthermore, 27.1% of students reported experiencing needle-stick injuries, a high proportion that places this group at a real risk of infection, particularly with low vaccination rates. Although 94.7% supported the necessity of reporting such injuries, adherence to consistent glove use did not exceed 39.4%, indicating a weakness in applying standard precautions during clinical training. Statistical analysis revealed a significant association between knowledge level and academic level ($p=0.048$), attendance at infection control training ($p=0.002$), and vaccination status ($p=0.015$). These findings confirm that specialized training and progression through academic years play a pivotal role in enhancing health awareness, consistent with the results of studies by Babied (2021 [5]).

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

Conclusion

In conclusion, the targeted health science students possess a good knowledge base and positive attitudes towards HBV prevention. However, there is a clear deficiency in actual preventive practices, evidenced by low rates of full vaccination and inconsistent adherence to glove use. The high incidence of needle-stick injuries amidst a lack of vaccine-acquired immune protection poses a direct threat to the safety of future medical personnel. The study also highlights the impact of conflicts and security conditions as potential barriers to completing immunization and training programs.

Recommendation

Based on these findings, it is strongly recommended that HBV vaccination becomes a prerequisite for all students before commencing clinical training in hospitals, with vaccines provided at subsidized or no cost within academic institutions. There is an urgent need to intensify workshops and training courses on "Standard Infection Control Precautions" and safe handling of sharp instruments, with an emphasis on practical application rather than theoretical aspects alone. Furthermore, establishing a specialized unit within colleges to monitor needle-stick injuries and provide immediate post-exposure prophylaxis to affected students is essential. Regular awareness campaigns should be implemented to correct misconceptions about virus transmission routes and educate students on the importance of antibody testing to confirm vaccine efficacy. Finally, developing flexible strategies to ensure the continuity of health training and access to preventive services for students affected by conflicts and unstable conditions is crucial for maintaining public health safety.

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Appendices

(1) الاستبيان

استبيان حول المعرفة والمواقف والممارسات المتعلقة بفيروس التهاب الكبد الوبائي (B)

مقدمة

عزيزي الطالب/الطالبة،

يهدف هذا البحث إلى تقييم مستوى المعرفة والمواقف والممارسات المتعلقة بفيروس التهاب الكبد الوبائي (B) بين طلاب الطب في المرحلة السريرية (المستوى الرابع والخامس) في كلية نبتة. مشاركتكم تطوعية تماماً، وسنُعامل جميع البيانات بسرية تامة ولأغراض البحث العلمي فقط.

القسم الأول: البيانات الديموغرافية

1. الجنس:

- ذكر

- أنثى

2. المستوى الدراسي:

- المستوى الرابع

- المستوى الخامس

3. العمر: سنة

4. مكان الإقامة الحالي:

- داخل السودان

- خارج السودان

5. هل تأثرت دراستك بالنزاع الحالي؟

- نعم

- لا

القسم الثاني: تقييم المعرفة

1. هل سمعت عن فيروس التهاب الكبد الوبائي B من قبل؟

- نعم

- لا

2. ما هي طرق انتقال فيروس التهاب الكبد B؟ (يمكن اختيار أكثر من إجابة)

- نقل الدم الملوث

- الوخز بالإبر الملوثة

- من الأم المصابة إلى الجنين

- الاتصال الجنسي غير المحمي

- مشاركة أدوات الحلاقة أو فرشاة الأسنان

- المصافحة أو العناق (خطأ)

3. هل يمكن لفيروس التهاب الكبد B أن يسبب سرطان الكبد؟

- نعم

- لا

- لا أعرف

4. هل يوجد لقاح فعال للوقاية من التهاب الكبد B؟

- نعم

- لا

- لا أعرف

5. ما هي أفضل طريقة للوقاية من العدوى في البيئة السريرية؟

- غسل اليدين فقط

- استخدام القفازات والالتزام بالاحتياطات القياسية

- تجنب التعامل مع المرضى تماماً

القسم الثالث: المواقف

يرجى تحديد مدى موافقتك على العبارات التالية:

1. أعتقد أنني معرض لخطر الإصابة بفيروس التهاب الكبد B أثناء التدريب السريري.

- موافق بشدة

- موافق

- محايد

- غير موافق

- غير موافق بشدة

2. يجب أن يكون لقاح التهاب الكبد B إلزامياً لجميع طلاب الطب.

- موافق بشدة

- موافق

- محايد

- غير موافق

- غير موافق بشدة

3. سأقوم بإبلاغ المشرف فوراً في حال تعرضي لوخز إبرة ملوثة.

- موافق بشدة

- موافق

- محايد

- غير موافق

- غير موافق بشدة

4. أشعر بالراحة عند تقديم الرعاية الطبية لمريض مصاب بالتهاب الكبد B.

- موافق بشدة

- موافق

- محايد

- غير موافق

- غير موافق بشدة

القسم الرابع: الممارسات

1. هل تلقيت لقاح التهاب الكبد الوبائي B؟

- نعم، جرعة واحدة

- نعم، جرعتين

- نعم، ثلاث جرعات (كامل)

- لا، لم أتلّق اللقاح

2. هل تلتزم دائماً بارتداء القفازات عند سحب الدم أو التعامل مع السوائل الحيوية؟

- دائماً

- أحياناً

- نادراً

- أبداً

3. هل سبق لك التعرض لوخز إبرة أو إصابة بألة حادة أثناء التدريب؟

- نعم

- لا

4. هل قمت بإجراء فحص مخبري للتأكد من خلوك من الفيروس أو وجود أجسام مضادة؟

- نعم

- لا

5. هل حضرت أي دورات تدريبية أو ورش عمل حول مكافحة العدوى مؤخراً؟

- نعم

- لا

شكراً لمشاركتكم في هذا البحث.

(2) Picture

