

ENSIGN GLOBAL UNIVERSITY

KPONG, EASTERN REGION, GHANA

FACULTY OF PUBLIC HEALTH

DEPARTMENT OF COMMUNITY HEALTH

**ASSESSMENT OF KNOWLEDGE, ATTITUDE, AND PRACTICES IN BIOLOGICAL
HEALTH HAZARDS AMONG NURSES AND DOCTORS IN THE HO TEACHING
HOSPITAL IN THE VOLTA REGION OF GHANA**

BY

CHRIST-LOVE KAFUI GANU

(247100295)

**A THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH,
FACULTY OF PUBLIC HEALTH, ENSIGN GLOBAL COLLEGE IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE
MASTER OF PUBLIC HEALTH DEGREE**

SEPTEMBER 2025

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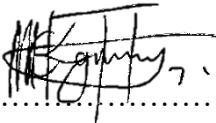
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SEPTEMBER, 2025


DECLARATION

I hereby certify that, except for references to other people's work, which I have duly cited, this project submitted to the Department of Community Health, Ensign Global University, Kpong, is the result of my own investigation and has not been presented for any other degree elsewhere.


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Signature Date 10-02-25

DEDICATION

This work is dedicated to all registered nurses and licensed medical doctors who have been employed at Ho Teaching Hospital and continue to serve tirelessly in the face of biological hazards.

ACKNOWLEDGEMENT

To begin with, I thank God for granting me the strength, wisdom, and perseverance to complete this work.

I wish to express my deepest gratitude to my supervisor, Dr. Stephen Manortey, for his mentorship, invaluable guidance, and patience throughout the course of this research. I am also indebted to the Faculty of Public Health, Ensign Global University, for providing the academic environment and support that made this study possible.

My heartfelt appreciation goes to the management and staff of Ho Teaching Hospital for granting me access and cooperating during data collection. I am particularly grateful to all the doctors and nurses who took part in this study despite their demanding schedules.

I would also like to acknowledge my family and friends for their constant encouragement, moral support, and prayers, which sustained me through challenging moments. To my colleagues in the program, thank you for your camaraderie and shared insights.

ABSTRACT

Background: Biological hazards, including Hepatitis B, HIV, Tuberculosis, and COVID-19, pose major occupational risks to healthcare workers. Despite training and policies, gaps often exist between knowledge, attitudes, and actual practices of infection prevention and control (IPC).

General Aim: The study assessed the knowledge, attitudes, and practices of doctors and nurses regarding biological health hazards at Ho Teaching Hospital in the Volta Region of Ghana.

Methodology: an analytical cross-sectional quantitative design was employed, involving 285 healthcare workers (248 nurses and 37 doctors) selected through stratified random sampling. Data were collected using a structured questionnaire administered via the KoBoCollect platform and analyzed using SPSS v28. Descriptive and inferential statistics, including Chi-square tests, were used to assess associations between knowledge, attitudes, and practices.

Results: The findings revealed that most respondents had adequate knowledge of biological hazards (85.3%) and positive attitudes toward their prevention (73%). However, IPC practices were predominantly poor, with only 22% demonstrating good practices. Chi-square analysis showed that knowledge alone was not significantly associated with safe practices, while attitudes were significantly associated with better practices ($\chi^2 = 0.17$, $df = 1$, $p = 0.036$).

Conclusion: The study concludes that while knowledge provides the foundation, attitudes serve as a key determinant of safe practices. Nevertheless, positive attitudes require reinforcement through supportive institutional systems. Strengthening IPC practices requires integrated strategies that combine knowledge, positive attitudes, and robust institutional support.

Keywords: Biological hazards, knowledge, attitudes, practices, infection prevention and control, healthcare workers, Ho Teaching Hospital.

LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratios
ART	Antiretroviral Therapy
CI	Confidence Intervals
COVID-19	Coronavirus Disease 2019
HBV	Hepatitis B Virus
HIV	Human Immunodeficiency Virus
HTH	Ho Teaching Hospital
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
IRB	Institutional Review Board
KAP	Knowledge, Attitudes, and Practices
MOH	Minsitry of Health
OR	Odds Ratios
PEP	Post-Exposure Prophylaxis
PLHIV	people living with HIV
PPE	Personal Protective Equipment
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
TB	Tuberculosis
UHAS	University of Health and Allied Sciences
UK	United Kingdom
WHO	World Health Organization

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

Biological health hazards are among the most significant occupational risks faced by healthcare workers worldwide (World Health Organization [WHO], 2022). These hazards encompass a range of pathogenic microorganisms, including viruses such as HIV, Hepatitis B and C, and SARS-CoV-2, as well as bacteria like *Mycobacterium tuberculosis* (Akkajit, Romin and Assawadithalerd, 2020). The World Health Organization estimates that more than three million healthcare workers are exposed to bloodborne pathogens annually, largely due to needle-stick and sharps injuries (WHO, 2022). These exposures are responsible for approximately 66,000 Hepatitis B, 16,000 Hepatitis C, and 1,000 HIV infections among healthcare workers each year, with over 90 percent of cases occurring in low- and middle-income countries (WHO, 2022). Despite the widespread implementation of infection prevention policies, biological health hazards continue to compromise the safety and well-being of frontline health personnel, with implications for both occupational health and healthcare system sustainability (Atakro *et al.*, 2019).

Within Sub-Saharan Africa, the burden of biological health hazards is especially acute and pervasive. A meta-analysis by Auta *et al.* (2017), drawing on data from 21 African countries, reported that 81.2% of healthcare workers had experienced at least one occupational exposure to a biological hazard during their careers. Notably, 57.1% had sustained a needlestick or sharps injury, while 48% had been exposed to blood or body fluids likely to carry bloodborne pathogens such as HIV or Hepatitis B. Respiratory exposures are equally alarming (Auta *et al.* 2017). Studies from high TB-burden countries, including South Africa and Nigeria, show that more than 60% of health professionals had cared for patients with active tuberculosis without

adequate respiratory protection (Malotle *et al.*, 2017; Ogoina *et al.*, 2014). These statistics portray a healthcare environment in which exposure is not exceptional but recurrent, crossing facility types and professional roles (Dash, Das, and Satapathy, 2021). The scale and regularity of such exposures demand systematic attention, as they represent a serious threat to healthcare worker safety and the uninterrupted delivery of essential health services (Ejeh *et al.*, 2020) .

In Ghana, the situation closely mirrors the broader regional pattern. A national study by Tawiah *et al.* (2022) found that 63% of nurses had suffered at least one needlestick injury in the preceding year, with fewer than 45% reporting the incident or receiving post-exposure prophylaxis (PEP). Hepatitis B infection remains a leading occupational risk, with prevalence among healthcare workers ranging from 8% to 15%, a figure well above the global average (Botchway *et al.*, 2020). Alarming, only 42% of Ghanaian healthcare professionals have completed the full Hepatitis B vaccination series, despite national immunization policies and vaccine availability (Botchway *et al.*, 2020). The COVID-19 pandemic further exposed the vulnerability of frontline staff: a study by Lartey *et al.* (2023) reported significant infections among health workers, linked to inadequate respiratory protection and high clinical loads. Exposure to airborne pathogens like tuberculosis continues to be widespread, particularly in urban Teaching Hospitals, where patient congestion and poor ventilation remain persistent challenges (Odonkor and Sallar, 2024). Collectively, these findings confirm that biological hazard exposure is not only prevalent in Ghana's healthcare system but also inadequately mitigated, placing health professionals at continuous occupational risk.

Despite the high prevalence of biological exposures among healthcare workers in Ghana and the broader Sub-Saharan region, studies reveal that these risks persist not only due to infrastructural limitations but also because of significant behavioral and institutional gaps (Nassirou-Sabo and Toudou-Daouda, 2024). For instance, many healthcare workers who suffer occupational exposure fail to report incidents or seek timely post-exposure prophylaxis, often

due to lack of awareness, underestimation of risk, or fear of stigma (Kshatri *et al.*, 2022). Moreover, vaccination uptake against preventable infections like Hepatitis B remains suboptimal, even in facilities where vaccines are available (Dash, Das, and Satapathy, 2021). These patterns point to critical gaps in healthcare workers' knowledge of infection risks, attitudes toward occupational safety, and adherence to standard protective practices (Atakro *et al.*, 2019). Understanding these dimensions collectively, as captured under the Knowledge, Attitude, and Practice (KAP) framework, is essential to designing effective interventions. Therefore, this study seeks not only to quantify exposure but to explore the KAP profile of health professionals at Ho Teaching Hospital, with the aim of identifying actionable pathways for improving occupational safety and infection control compliance.

1.2 Problem Statement

Despite the high burden of occupational exposure to biological hazards among healthcare professionals in Ghana, there is a critical gap in understanding how frontline workers perceive and respond to these risks at the facility level (Odonkor and Sallar, 2024). National data highlight elevated prevalence of exposures such as needlestick injuries, Hepatitis B infections, and respiratory pathogen transmission; yet, this information provides limited insight into the underlying behavioral, cognitive, and procedural factors that influence safety practices among health workers (Tawiah *et al.*, 2022). In particular, there is a lack of empirical evidence on the extent to which healthcare professionals possess accurate knowledge of infection risks, adopt protective attitudes, and consistently practice recommended precautions in real-world clinical settings (Auta *et al.*, 2017).

This issue is particularly critical at teaching and referral hospitals like Ho Teaching Hospital, where the complexity of medical procedures, high patient volumes, and limited resources significantly elevate the risk of biological hazard exposure. In 2024 alone, 155 doctors and nurses reported occupational exposures to biological hazards to the hospital's Occupational

Health and Safety Unit, underscoring the urgent need for improved safety measures (Ho Teaching Hospitals, 2025). Despite these high exposure rates, there has been no comprehensive assessment of the Knowledge, Attitudes, and Practices (KAP) of healthcare professionals at this facility regarding biological health hazards. Without detailed understanding of these factors at the local level, hospital administrators and policymakers lack the evidence necessary to design effective, tailored interventions that address not only infrastructure gaps but also behavioral and cultural barriers to occupational safety. This study seeks to fill that gap by systematically examining the KAP profile of health professionals at Ho Teaching Hospital.

1.3 Rationale of the Study

Occupational exposure to biological hazards remains a persistent challenge in healthcare delivery, particularly among frontline professionals. While most interventions have emphasized structural components such as ensuring personal protective equipment (PPE) availability, vaccination coverage, and facility safety standards, the behavioral dimensions that influence compliance and risk perception have received comparatively less attention. In Ghana's ongoing efforts to strengthen infection prevention and control (IPC) frameworks, a comprehensive understanding of how healthcare workers internalize, perceive, and respond to biological risks is essential. Such insights are critical for designing interventions that are not only effective but also contextually appropriate and sustainable.

Teaching hospitals, including Ho Teaching Hospital, present unique occupational risk environments due to their dual functions in patient care and clinical education. These settings require a workforce that is both knowledgeable and behaviorally aligned with safety protocols. However, there is limited empirical evidence on how doctors and nurses in these institutions understand biological hazards, assess personal vulnerability, and translate knowledge into consistent preventive practices. Addressing this knowledge gap has significant implications for both institutional and national public health priorities.

This study is therefore timely and necessary. By applying the Knowledge, Attitude, and Practice (KAP) model, it shifts attention from general prevalence data to the cognitive and behavioral factors that shape safety outcomes in high exposure environments. The findings are directly relevant to public health practice as they can inform tailored IPC training and behavioral change interventions; to research by establishing baseline evidence for longitudinal monitoring and further behavioral studies; and to policy by guiding the development of context specific occupational health policies and strengthening national IPC strategies. Ultimately, this research contributes to safeguarding the health workforce, a foundational pillar for achieving universal health coverage and building resilient health systems in Ghana and beyond.

1.4 Conceptual Framework

The conceptual framework guiding this study is based on the Knowledge, Attitude, and Practice (KAP) model, widely used in public health to understand how awareness and beliefs influence behavior (*Lartey et al. 2023*). The framework includes three constructs: knowledge of biological hazards, attitudes toward infection prevention, and self-reported infection control practices. The model posits that knowledge influences attitudes, which in turn shape practices. This structure has informed questionnaire design and data analysis, enabling the identification of gaps and potential leverage points for improving occupational health and safety behaviors among healthcare workers. The framework is grounded in existing literature (*Mansour-Ghanaei et al., 2013; Lartey et al., 2023*).

The proposed framework was structured around four key constructs:

1. **Knowledge of biological hazards** – This included health professionals’ understanding of the modes of transmission, symptoms, prevention, and risk factors of biological agents such as HIV, Hepatitis B, tuberculosis, and SARS-CoV-2. Prior research has demonstrated that higher knowledge levels are associated with better preparedness and safer behaviors (*Mansour-Ghanaei et al., 2013*).

2. **Attitude toward safety practices** – This captured individual beliefs, perceptions of risk, motivation, and willingness to comply with infection prevention protocols. Studies have shown that even when knowledge is high, negative or indifferent attitudes can limit behavioral compliance (Lartey *et al.*, 2023).
3. **Practice of infection control measures** – This variable represents the actual implementation of safety procedures such as hand hygiene, use of personal protective equipment (PPE), reporting of exposure incidents, vaccination, and correct disposal of sharps. Poor compliance with safety protocols despite adequate knowledge has been documented in Ghana and similar contexts (Mansour-Ghanaei *et al.*, 2013).

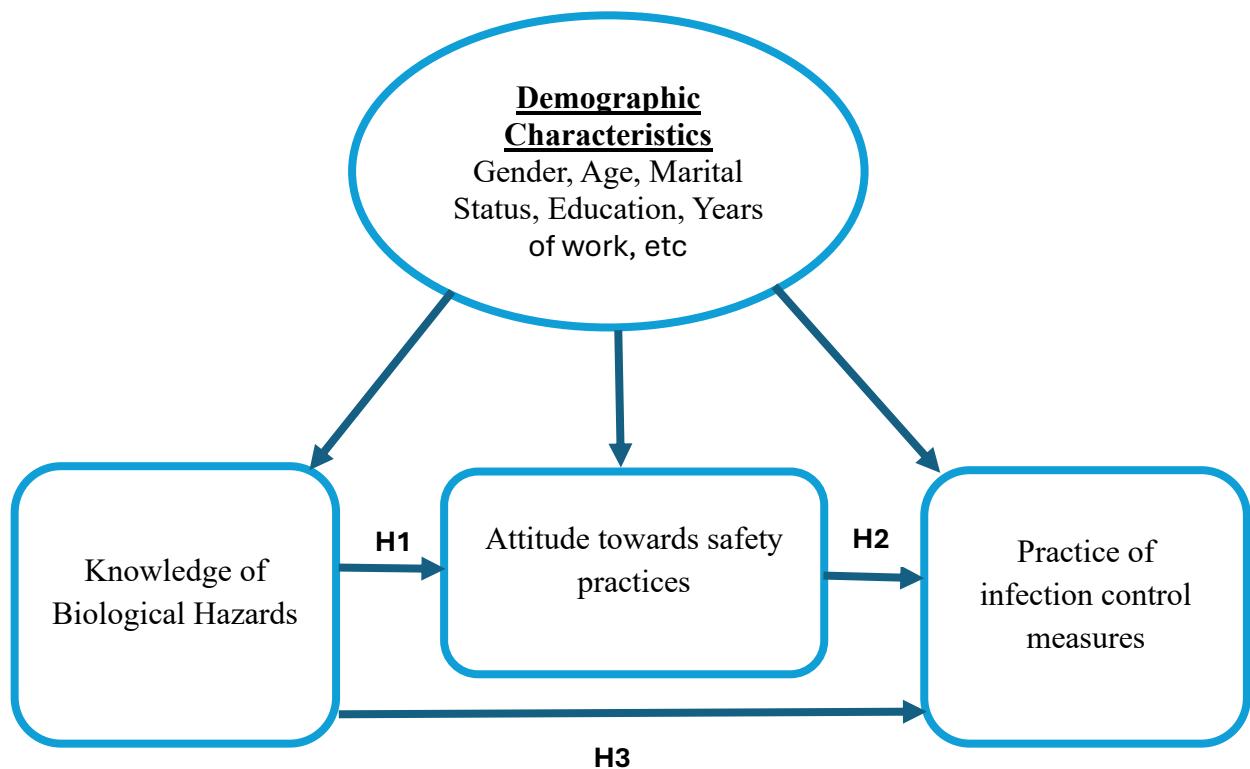


Figure 1.1 Conceptual framework based on the Knowledge, Attitude, and Practice (KAP).

Source: Adapted from Mansour-Ghanaei *et al.* (2013), and Lartey *et al.* (2023).

1.5 Research Questions

1. What is the level of knowledge of doctors and nurses regarding biological health hazards?

2. What are the attitudes of doctors and nurses toward biological health hazards?
3. What infection prevention and control practices are adopted by doctors and nurses in handling biological health hazards in clinical settings?
4. What is the relationship between knowledge, attitudes, and practices regarding biological health hazards among doctors and nurses?

1.6 General Objective

The study assessed the knowledge, attitudes, and practices of doctors and nurses regarding biological health hazards at Ho Teaching Hospital in the Volta Region of Ghana.

1.7 Specific Objectives

1. To assess the level of knowledge of doctors and nurses regarding biological health hazards.
2. To evaluate the attitudes of doctors and nurses toward biological health hazards and occupational risk prevention.
3. To examine the infection prevention and control practices adopted by doctors and nurses when handling biological health hazards in clinical settings.
4. To analyze the relationship between knowledge, attitudes, and practices regarding biological health hazards among doctors and nurses.

1.8 Profile of Study Area

The study was conducted at Ho Teaching Hospital (HTH), a major tertiary healthcare facility located in the Volta Region of Ghana. Originally established as the Volta Regional Hospital, the facility commenced operations in 1999, following its construction by Kaevener Construction International, United Kingdom. In 2019, the hospital was elevated to teaching hospital status, becoming the primary clinical training site for the University of Health and Allied Sciences (UHAS), also located in Ho.

Ho Teaching Hospital currently has a bed capacity of approximately 300, with ongoing expansion plans to develop into a 600-bed tertiary-level hospital. It serves as the principal referral center for the Volta Region and parts of the Oti Region, offering both general and specialized services. Key units within the hospital include the Accident and Emergency Centre, Intensive Care Unit (ICU), Maternal and Child Health Centre, ART (Antiretroviral Therapy) Unit, Renal Dialysis Unit, Radiology Department, Cardiology Unit, and Surgical Services including general and orthopedic surgery.

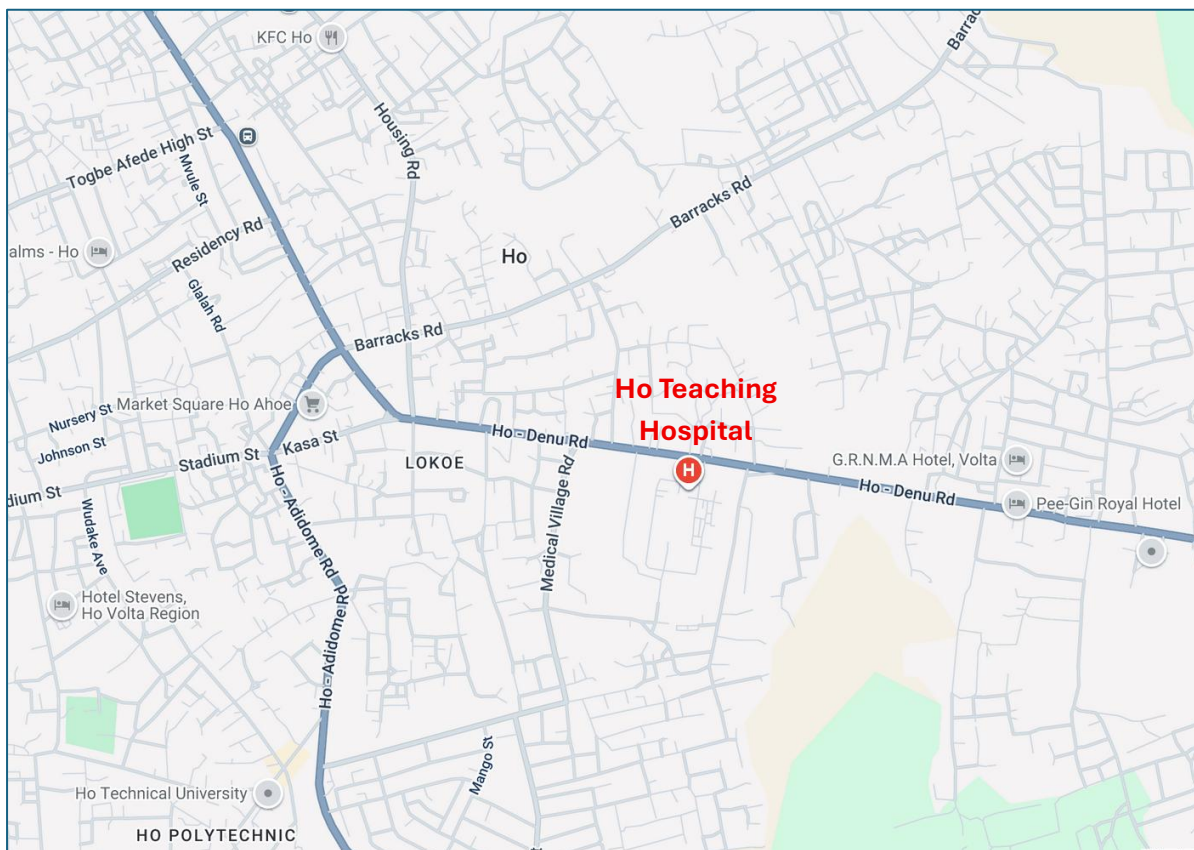


Figure 1.2 Map of Ho Teaching Hospital.

1.9 Scope of Study

This study was limited to the assessment of knowledge, attitudes, and practices of healthcare professionals regarding biological health hazards at the Ho Teaching Hospital in the Volta

Region of Ghana. The focus was on registered nurses and licensed medical doctors who had worked at the facility for at least six months, as this period ensured sufficient workplace exposure to occupational risks. The study focused on four major biological hazards of public health importance: Hepatitis B, HIV, Tuberculosis, and COVID-19, due to their prevalence, potential for hospital-based transmission, and implications for both healthcare worker safety and patient outcomes. The investigation examined the extent of knowledge and awareness among healthcare professionals, their preventive attitudes, and the degree to which recommended infection prevention and control measures were practiced.

Geographically, the study was confined to Ho Teaching Hospital, which serves as the main referral and teaching hospital in the Volta Region. The findings were therefore not generalized to all healthcare institutions in Ghana, particularly smaller facilities with different resource capacities and patient loads. The study excluded other categories of hospital staff such as laboratory scientists, pharmacists, administrative personnel, cleaners, and students, since their roles and exposures differ significantly from those of doctors and nurses. In addition, the study did not aim to establish causal relationships but was restricted to describing existing patterns and associations between knowledge, attitudes, and practices within the study population.

1.10 Organization of Report

This thesis is presented in six chapters, each dealing with a specific aspect of the study.

Chapter One outlines the introduction to the research. It presents the background to the study, the statement of the problem, the purpose and objectives, and the research questions. The chapter also highlights the significance of the study, the scope, the profile of the study setting, and concludes with the organization of the report.

Chapter Two reviews relevant literature. It discusses the key variables of the study and synthesizes findings from previous research, theoretical perspectives, and conceptual frameworks that provide the foundation for the current work.

Chapter Three explains the methodology adopted for the study. It describes the research design, target population, sampling strategy, and data collection methods and tools. The chapter also addresses the study variables, pretesting of instruments, data handling procedures, methods of analysis, ethical considerations, as well as the limitations and assumptions underlying the study.

Chapter Four presents the results of the study. It begins with an overview of the demographic and professional characteristics of respondents, followed by findings related to the main study variables. Results are displayed in tables, charts, and figures for clarity.

Chapter Five discusses the findings in relation to the research objectives and questions. It compares the results with evidence from previous studies and theoretical perspectives, providing interpretations and insights within the broader academic context.

Chapter Six concludes the thesis. It summarizes the major findings of the research and provides practical recommendations aimed at healthcare institutions, policymakers, and future researchers.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Biological health hazards remain the most significant occupational risks faced by healthcare workers (HCWs), particularly doctors and nurses, due to their frequent and close contact with patients, blood, and other potentially infectious materials (WHO, 2020). The World Health Organization (WHO, 2016, 2019, 2020) and UNAIDS (2017) emphasize that universal adherence to standard precautions, including vaccination, consistent use of personal protective equipment (PPE), hand hygiene, prompt reporting of exposures, and immediate initiation of post-exposure prophylaxis (PEP), are non-negotiable strategies for reducing the transmission of occupational infections. Empirical evidence, however, reveals a recurring gap between knowledge, attitudes, and practices (KAP) among HCWs globally and in Africa. This review synthesizes findings on four major biological hazards: Hepatitis B, HIV, Tuberculosis (TB), and COVID-19, followed by a cross-cutting analysis of the KAP relationship.

2.2 Level of Knowledge of Doctors and Nurses Regarding Biological Health Hazards.

Globally, doctors and nurses generally demonstrate a strong theoretical understanding of biological hazards, yet significant discrepancies persist between awareness and practical application. Across diverse contexts, studies reveal a consistent pattern of high knowledge of general infection control principles but limited mastery of technical procedures and post exposure protocols. For instance, research from the UK, Bangladesh, and Malaysia indicates that although most healthcare workers (HCWs) are aware of infection prevention guidelines, fewer than two thirds accurately apply critical practices such as hand hygiene and sharps disposal, suggesting that cognitive understanding often fails to translate into behavioral compliance (Ackah *et al.*, 2022; Rahman *et al.*, 2024; Subramanian *et al.*, 2017). Comparable trends emerge across low and middle income countries such as Egypt, Saudi Arabia, and

Zimbabwe, where knowledge of occupational risks is high, but recall of protective measures and institutional protocols remains suboptimal (El Mohamady and Ahmed, 2018; Alam, 2002; Gono and Matsa, 2019). Collectively, this evidence underscores a structural gap between awareness and procedural competence, reflecting inadequate institutional reinforcement and fragmented infection prevention training.

When examined by hazard type, the depth of knowledge varies substantially. Regarding bloodborne pathogens, particularly Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV), studies consistently show that recognition of transmission risks is nearly universal, but understanding of asymptomatic carriage, vaccination, and post exposure prophylaxis (PEP) remains limited. Meta analyses across Africa and Asia demonstrate that average HBV knowledge scores remain below 60 percent, with nurses often less informed than physicians (Auta *et al.*, 2018; Ogoina *et al.*, 2014). Ghanaian studies mirror these global trends: despite over 80 percent of HCWs acknowledging HBV as an occupational risk, fewer than half comprehend asymptomatic infection or complete vaccination schedules (Tagbor *et al.*, 2025; Senoo Dogbey *et al.*, 2024).

In contrast, HIV related knowledge among HCWs is generally higher in terms of transmission awareness but remains uneven in clinical and occupational application. While over 90 percent of healthcare workers globally can identify major transmission routes, far fewer understand the correct use and timing of antiretroviral therapy (ART) and PEP protocols. Studies in South Africa and Nigeria revealed that although clinicians correctly recognized sexual and bloodborne transmission routes, less than half knew ART initiation criteria or accurate PEP regimens (Harland, 2024; Adebayo *et al.*, 2020). Similarly, in Ghana, Boakye and Konadu (2023) found that while most nurses were well informed about HIV transmission, only about one third could describe the complete PEP process. These findings suggest that HIV knowledge is strongest at the theoretical level but insufficiently translated into occupational safety

practices, underscoring a persistent gap in professional training and post exposure preparedness.

For airborne infections such as tuberculosis (TB) and COVID 19, knowledge disparities are even more pronounced. Studies across Africa and Asia indicate that while most HCWs identify airborne transmission routes, misconceptions about etiology, prevention, and treatment remain widespread (Ismail *et al.*, 2021; Umoh *et al.*, 2020). Ghanaian data reveal similar inconsistencies—although 88 percent of healthcare workers recognize TB’s airborne nature, fewer than two thirds identify its bacterial cause, and over one quarter misclassify it as viral (Kumi *et al.*, 2025). These gaps extend to practice, with low adherence to infection prevention and control (IPC) protocols and underreporting of occupational exposures (Osei Yeboah, 2019). During the COVID 19 pandemic, awareness rose sharply across countries, yet persistent weaknesses in vaccination literacy, PPE use, and the interpretation of evolving clinical guidelines limited effective response (Ackah *et al.*, 2022; Mbele *et al.*, 2024).

Taken together, these studies demonstrate that while awareness of biological hazards among doctors and nurses is consistently high, substantial deficiencies persist in deeper biomedical understanding, preventive strategies, and the application of safety protocols. Knowledge levels are generally strongest for HIV and HBV but weaker for TB and COVID 19, reflecting uneven training emphasis. Ghanaian studies follow this global pattern, where high awareness coexists with low vaccination completion, poor PEP utilization, and inconsistent IPC compliance.

2.3 Attitudes of Doctors and Nurses Toward Biological Health Hazards

2.3.1 General Attitude Toward Biological Hazards

Empirical evidence indicates that healthcare workers generally exhibit positive attitudes toward biological hazards, although these attitudes are significantly shaped by institutional context, resource availability, and workplace culture. In Egypt, El Mohamady and Ahmed (2018)

reported that nurses valued infection prevention practices such as hand hygiene and use of personal protective equipment (PPE), but adherence declined under heavy workloads and limited supply of protective gear. Similarly, Gono and Matsa (2019) found that healthcare workers in Zimbabwe maintained favorable attitudes toward infection control despite systemic shortages, reflecting a sense of professional duty even in resource constrained environments. Studies in Pakistan and Ecuador also show that while healthcare professionals recognize biosafety as essential, discomfort with PPE, high workloads, and stress frequently erode compliance (Ahmad *et al.*, 2014; Urgilés *et al.*, 2020). Aluko *et al.* (2016) confirmed these trends in Nigeria, where most healthcare workers reported positive orientations toward occupational safety but noted that inadequate training and irregular supervision undermined consistent preventive behavior. Collectively, these findings suggest that attitudes toward biological hazards are generally positive yet remain fragile and heavily dependent on institutional support and resource adequacy.

2.3.2 Bloodborne Hazards: HBV and HIV

With respect to bloodborne infections, particularly Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV), healthcare workers consistently acknowledge these as major occupational risks, yet their attitudes toward prevention, vaccination, and patient care remain influenced by fear, stigma, and limited institutional trust. Globally, more than 80 percent of healthcare workers endorse vaccination as essential, yet fewer than half express confidence in enforcement of vaccination policies or feel fully protected in their work environments (Brnović *et al.*, 2023). Persistent misconceptions about transmission continue to shape attitudes; for example, in Vietnam, 28 percent of healthcare professionals reported discomfort treating HBV positive patients, while a third believed casual contact could result in infection (Pham *et al.*, 2019). In African settings, similar patterns are evident. Studies in Ethiopia and the Democratic Republic of Congo revealed that although most healthcare workers viewed HBV as a serious

occupational threat, many hesitated to fully adopt preventive measures or maintained inaccurate beliefs about transmission (Hebo and Gameda, 2019; Shindano *et al.*, 2017). In Ghana, Adjei *et al.* (2019, 2022) found that despite high awareness of HBV risks, stigma and fear of contagion influenced avoidance behaviors, while only about half of respondents had undergone HBV testing. These findings point to a dissonance between professional knowledge and personal attitudes, where fear and institutional mistrust hinder prevention, screening, and patient centered care.

Regarding HIV, studies reveal both persistent stigma and gradual attitudinal improvement over time. Although some healthcare workers continue to express reluctance to provide routine care to people living with HIV (PLHIV), exposure to patients and professional training have been shown to reduce discrimination and improve empathy. In Laos, Vorasane *et al.* (2017) found that over one third of doctors and nurses displayed stigmatizing beliefs, with nurses more likely than doctors to express discomfort in caring for PLHIV. However, those who had received HIV specific training demonstrated significantly more positive attitudes. Similar results were reported in Indonesia, where Hidayat *et al.* (2023) identified fear of infection and misinformation as predictors of stigma, while younger professionals with greater patient contact exhibited more supportive orientations. In Africa, Senbeta *et al.* (2025) observed that collaboration and education improved professional acceptance of PLHIV, and Topp and Chipukuma (2016) found that the scale up of HIV services in Zambia strengthened trust between healthcare workers and patients, even as residual stigma persisted. Ghanaian research echoes these findings: Dako Gyeke *et al.* (2015) and Anokye *et al.* (2019) documented that while moral judgments about patients' lifestyles sometimes persisted, most doctors and nurses expressed empathy and a strong ethical commitment to equitable care. Taken together, global and regional evidence suggests that HIV related stigma among healthcare workers is declining

but remains influenced by fear, misinformation, and moral attitudes, all of which can be mitigated through continuous professional education and direct patient interaction.

2.3.3 Airborne Hazards: Tuberculosis and COVID 19

Attitudes toward airborne infections such as tuberculosis and COVID 19 are often characterized by fear, avoidance, and ambivalence. Studies across multiple regions demonstrate that while healthcare workers recognize the seriousness of these diseases, their professional behavior frequently reflects anxiety about personal safety. In Iraq, Hashim *et al.* (2013) found that more than half of respondents held negative attitudes toward TB patients, often maintaining physical distance despite adequate knowledge of transmission. Similar findings from Turkey show that nurses who understood treatment protocols still struggled to engage patients empathetically (Yükseltürk and Dinç, 2013). South African studies highlight the role of training: Van Rensburg and Engelbrecht (2018) observed that structured education improved preventive behavior, though stigma remained. Ghanaian evidence deepens this picture. Dodor and Kelly (2010) and Dodor *et al.* (2009) revealed that fear of infection among healthcare workers reinforced stigma and avoidance, eroding community trust in health services. Tabong *et al.* (2021) and Der *et al.* (2022) further noted that anxiety about infection risk led to reduced case finding and diagnostic vigilance, while Osei Yeboah (2019) found poor compliance with basic IPC measures such as mask use. These findings demonstrate that professional fear, institutional weakness, and inadequate protection combine to shape negative or defensive attitudes toward TB patients.

In the context of COVID 19, attitudes among healthcare workers globally have evolved from uncertainty to cautious acceptance. Systematic reviews indicate that vaccine acceptance among healthcare workers ranges from 60 to 80 percent, with hesitancy driven by safety concerns, misinformation, and mistrust of government communication (Li *et al.*, 2023; Hajure *et al.*, 2021). Psychological distress has also played a significant role in shaping professional

attitudes; studies in China documented that over half of healthcare workers experienced depressive or anxious symptoms during the pandemic, leading to more defensive clinical behaviors (Liu *et al.*, 2020; Ning *et al.*, 2020). In Europe and the Middle East, evidence shows high levels of occupational stress and skepticism toward institutional preparedness, yet many professionals demonstrated resilience through adaptive behaviors such as teleconsultation (Kramer *et al.*, 2021; Al Dossary *et al.*, 2020). In Africa, evidence from Nigeria, Libya, and Ghana underscores similar complexities. While most healthcare workers endorsed preventive practices, trust in institutional preparedness and vaccine safety remained moderate (Ejeh *et al.*, 2020; Elhadi *et al.*, 2021). Ghanaian studies highlight significant progress over time: Agyekum *et al.* (2021) initially reported low vaccine acceptance rates, particularly among nurses, but later surveys showed improved uptake and positive attitudes following enhanced public communication and training (Mbele *et al.*, 2024; Balegha *et al.*, 2023; Atongu *et al.*, 2024). Collectively, these findings suggest that although healthcare workers' attitudes toward COVID 19 have become increasingly positive, they remain influenced by personal fears, misinformation, and institutional trust, underscoring the need for sustained mental health support, transparent communication, and continuous training.

2.4 Infection Prevention and Control Practices Adopted By Doctors And Nurses When Handling Biological Health Hazards In Clinical Settings

2.4.1 General Infection Prevention and Control Practices

Effective infection prevention and control (IPC) depends not only on policy and infrastructure but also on consistent compliance by doctors and nurses with established protocols. Ackah *et al.* (2022) emphasize that adherence to standard precautions—such as hand hygiene, sterilization, and appropriate use of personal protective equipment (PPE)—is essential in preventing hospital acquired infections. However, evidence from multiple contexts shows that awareness often exceeds compliance. In Italy, Kawuki *et al.* (2023) observed irregularities in

aseptic practices, with staff overlooking protocols for sharps handling and isolation, highlighting gaps in accountability and enforcement. Akkajit *et al.* (2020) similarly found that while healthcare professionals in Canada and Europe acknowledged biological hazards and expressed strong commitment to safety, IPC compliance was inconsistent, particularly regarding waste management and barrier protection. Across low resource settings, these challenges are exacerbated by shortages of PPE, insufficient training, and weak institutional monitoring systems (Malotle *et al.*, 2017). Collectively, these studies underscore that knowledge alone does not guarantee compliance; sustained adherence depends on adequate resources, supportive supervision, and organizational culture.

2.4.2 Bloodborne Hazards

Hepatitis B Virus (HBV)

Evidence across low and middle income countries consistently reveals that despite high awareness of HBV risks, preventive practices remain inadequate. In Nigeria, Ogoina *et al.* (2014) reported that only 36 percent of healthcare workers had completed the full HBV vaccination series, while fewer than half practiced safe sharps disposal. A meta analysis by Auta *et al.* (2018) covering fifteen African countries confirmed that although over 70 percent of healthcare workers recognized major transmission routes, vaccination coverage and PPE use were poor, with only one in four fully vaccinated. In Ethiopia, Bayissa *et al.* (2024) and Awoke *et al.* (2020) found similar patterns: despite high awareness of infection risks, fewer than 40 percent were fully vaccinated, and less than half practiced proper hand hygiene or safe injection techniques, citing low wages and limited institutional support as barriers.

In Ghana, empirical evidence mirrors these global patterns. Afihene and Duduyemi (2015) found that although more than 80 percent of healthcare workers knew HBV could be transmitted through blood and sharps, only 30 percent consistently practiced safe disposal. Konlan *et al.* (2017) reported that fewer than half of nurses had received even one vaccine

dose, and completion rates were lower still. Tawiah *et al.* (2022) and Balegha *et al.* (2021) observed similarly low vaccination rates and PPE adherence, while Senoo Dogbey *et al.* (2024) and Cofie *et al.* (2025) confirmed that even where preventive intentions were high, translation into practice was limited by cost, weak enforcement, and inadequate occupational health policies. Overall, vaccination completion rarely exceeds 55 percent, PPE adherence averages below 50 percent, and PEP knowledge remains low, reflecting systemic rather than individual barriers to effective HBV control.

Human Immunodeficiency Virus (HIV)

Global guidance from the World Health Organization (2020) and UNAIDS (2017) identifies consistent use of PPE, timely reporting of occupational exposures, and immediate initiation of post exposure prophylaxis (PEP) as essential components of HIV prevention among healthcare workers. Despite this, practice remains inconsistent across settings. Studies show that while knowledge of universal precautions is widespread, adherence varies sharply by resource level. Yavorovsky *et al.* (2020) and Prasad and Katiyar (2021) noted that glove use often exceeds 80 percent in high income countries but drops below 50 percent in low resource contexts. In Nigeria, Akinboro *et al.* (2012) and Ajibola *et al.* (2014) reported that although most healthcare workers recognized their occupational risk, fewer than 20 percent consistently used goggles or gowns, and only a small proportion of those exposed to blood accessed PEP due to stigma, lack of reporting systems, and weak supervision. Umoh *et al.* (2020) similarly found that fewer than 30 percent of doctors who sustained occupational exposures completed PEP, while Amoran and Onwube (2013) documented widespread recapping of needles and poor hand hygiene practices. In Ghana, these same gaps persist. Boakye and Mavhandu Mudzusi (2019) observed that while nurses held positive attitudes toward patients with HIV, misconceptions about casual transmission persisted, and only about 60 percent used gloves consistently. Babanawo *et al.* (2018) found that although nearly 80 percent of healthcare workers were aware of PEP, fewer

than half knew the correct initiation window, and fewer than one in five exposed workers received prophylaxis. Akagbo *et al.* (2017) and Suglo *et al.* (2021) further highlighted that despite widespread awareness of universal precautions, compliance remained low, especially among nurses and junior staff. These findings point to systemic weaknesses—limited access to PPE, unclear reporting channels, and inadequate enforcement—that continue to compromise occupational safety and infection control in HIV care.

2.4.3 Airborne Hazards: Tuberculosis and COVID 19

Tuberculosis

Tuberculosis infection prevention and control (TB IPC) requires early case identification, patient separation, use of respirators, proper ventilation, and continuous staff training (World Health Organization, 2019). However, global compliance remains uneven. In Nepal, Baral and Koirala (2022) found that while most nurses possessed adequate knowledge of TB IPC, fewer than half consistently used N95 masks, and adherence to triage protocols was inconsistent. Similar findings from Shrestha *et al.* (2017) revealed that only one third of healthcare workers regularly used masks or ensured adequate ventilation. African studies report even lower compliance. In Mozambique, Brouwer *et al.* (2014) found that less than one fifth of healthcare workers had access to N95 respirators, while Engelbrecht *et al.* (2016) in South Africa reported that only half of nurses maintained consistent IPC practices. In Ghana, Osei Yeboah (2019) observed that although most healthcare workers were aware of TB IPC protocols, fewer than half consistently applied them, especially with regard to mask use and isolation procedures. These findings suggest that the persistence of fear, stigma, and weak institutional accountability undermine adherence, exposing healthcare workers and patients alike to preventable infection risks.

COVID 19

The COVID 19 pandemic exposed critical gaps in IPC systems worldwide. The World Health Organization (2020) and the Centers for Disease Control and Prevention (2021) emphasize that effective control requires consistent PPE use, hand hygiene, environmental cleaning, and patient triage. Yet studies indicate that compliance has been highly variable. In China, Lai *et al.* (2020) found that over 85 percent of healthcare workers adhered to proper mask use, but compliance declined during long shifts and high workload periods. In Qatar and Malaysia, Abed Alah *et al.* (2021) and Mohamad *et al.* (2022) found that while adherence to mask use exceeded 80 percent, compliance with eye protection, gowning, and isolation measures was considerably lower due to discomfort, fatigue, and limited supply. African research paints a similar picture. In Nigeria, Ilesanmi *et al.* (2021) reported that although most healthcare workers were aware of COVID 19 IPC measures, fewer than half consistently used PPE. In Ghana, Ashinyo *et al.* (2021) found high awareness but variable adherence: about 77 percent consistently wore masks, 62 percent practiced hand hygiene, and fewer than 40 percent used full PPE during high risk procedures. These trends underscore a persistent challenge—while healthcare workers generally recognize infection control protocols, their ability to sustain compliance depends on training, adequate supplies, and institutional trust.

2.5 Relationship between knowledge, attitudes, and practices regarding biological health hazards among doctors and nurses

The relationship between healthcare workers' knowledge, attitudes, and practices (KAP) regarding biological health hazards has been widely studied, and the evidence consistently highlights a gap between awareness and actual compliance. In Ethiopia, Hebo and Gameda (2019) reported that while 73% of doctors and nurses at Gondar University Hospital demonstrated good knowledge of infection prevention, only 56% adhered consistently to standard practices such as hand hygiene and glove use, with attitudes significantly predicting

practice quality. Similarly, a systematic review by Ayalew *et al.* (2016) covering multiple Ethiopian hospitals showed that although 82% of healthcare providers had favorable attitudes toward infection prevention, actual compliance remained low, with only 45% demonstrating satisfactory practice, underscoring the knowledge–practice disconnect.

Evidence from outside Africa confirms these patterns. In Birmingham, UK, Ackah *et al.* (2022) found that although over 90% of doctors and nurses were aware of infection control guidelines, only 62% consistently complied with hand hygiene, and just 43% adhered to safe sharps disposal protocols, with nurses performing slightly better than doctors. In Kuwait, Alwutaib and Abdulghafour (2012) reported that while 88% of physicians and nurses had good knowledge of blood-borne infections, negative attitudes (e.g., perceiving low personal risk) were linked to poor compliance, with fewer than 50% practicing correct needle-stick injury prevention measures. Likewise, Alam (2002) in Saudi Arabia observed that although more than 70% of nurses and paramedics reported good knowledge of needle-stick risks, only 41% adhered to recommended post-exposure protocols, suggesting that knowledge alone does not ensure compliance.

In Nigeria, Aluko *et al.* (2016) found that while 79% of healthcare workers across multiple hospitals recognized occupational hazards, only 46% adhered to safety practices, with poor institutional enforcement and lack of PPE cited as barriers. In Egypt, El-Mohamady and Ahmed (2018) reported that although 85% of nurses acknowledged the importance of protective measures against biological hazards, only 58% consistently used gloves, and less than 30% complied with mask use in high-risk situations, highlighting attitudinal and infrastructural obstacles. In Zimbabwe, Gono and Matsa (2019) found that despite 80% of doctors and nurses recognizing biological hazards as major occupational risks, only 52% regularly practiced safe disposal of sharps, and just 48% reported consistent use of protective equipment.

2.6 Summary of the Literature Review

The review of existing studies highlights that healthcare workers generally possess high awareness of biological health hazards, yet significant gaps remain in their technical knowledge, preventive attitudes, and practical behaviors. While many professionals are aware of infection risks and protocols, their understanding of post-exposure management, vaccination schedules, and infection prevention procedures is often incomplete. This mismatch between awareness and detailed technical knowledge leaves healthcare workers vulnerable to occupational exposure.

Attitudes toward biological hazards are shaped by a mixture of professional commitment and personal fear. Many healthcare workers acknowledge the seriousness of infections and the importance of prevention, but stigma, fear of contagion, and mistrust in institutional support frequently undermine positive attitudes. This is particularly evident with conditions such as hepatitis and HIV, where avoidance of infected patients has been reported, as well as tuberculosis, where fear of infection remains a persistent challenge. More recently, COVID-19 presented a unique situation where initial vaccine hesitancy gradually gave way to higher acceptance, although concerns about safety and systemic preparedness continued to influence perceptions.

Infection prevention and control practices present the most striking gaps. Although guidelines emphasize the consistent use of protective equipment, safe sharps disposal, hand hygiene, and vaccination, compliance remains low in many healthcare settings. Vaccination rates for hepatitis B, for example, are often below 55 percent, while use of personal protective equipment such as gloves and masks is inconsistent. Similarly, occupational exposures are frequently underreported, and the uptake of post-exposure prophylaxis remains limited. For airborne infections such as tuberculosis and COVID-19, adherence to mask use, patient

isolation, and ventilation protocols has been irregular, often constrained by shortages of equipment and weak institutional enforcement.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Design

The study employed an analytical cross-sectional quantitative design to assess the knowledge, attitudes, and practices of doctors and nurses regarding biological health hazards at Ho Teaching Hospital in the Volta Region of Ghana. This design was appropriate because it not only allowed for the assessment of prevalence and distribution of knowledge, attitudes, and practices at a specific point in time but also enabled the analysis of associations between variables such as profession, years of experience, and compliance with safety measures (Setia, 2016). The analytical approach made it possible to identify significant relationships and differences in knowledge levels and preventive behaviors between doctors and nurses, thereby providing evidence-based insights for improving occupational health and safety interventions. According to Creswell and Creswell (2018), cross-sectional analytical designs are particularly useful in identifying patterns and correlations within defined populations, offering valuable information for policy formulation and targeted institutional strategies.

3.2 Data Collection Techniques and Tools

The primary data collection technique for this study was the use of a structured questionnaire developed by the researchers, based on insights from a comprehensive review of relevant literature on biological health hazards and infection prevention practices among healthcare workers. The questionnaire was designed to capture detailed information on the knowledge, attitudes, and practices (KAP) of doctors and nurses with regard to biological hazards.

To ensure accuracy and efficiency, the questionnaire was administered digitally through the KoBoCollect platform, a mobile-based data collection tool that supports real-time data entry, minimizes entry errors, and guarantees data security. The use of KoBoCollect was particularly advantageous in a clinical setting as it allowed for paperless data collection, faster responses,

and direct synchronization to a secure cloud server. Compared to paper-based methods, KoBoCollect reduced the risk of data loss, eliminated the need for secondary data entry, and improved monitoring of fieldwork in real time. These advantages have been widely documented in healthcare research, where electronic systems such as KoBoCollect and Open Data Kit have been found to enhance efficiency, reduce transcription errors, and improve data management and quality (Umoh, *et al.*, 2020; Creswell and Creswell (2018).

The questionnaire used in this study was developed by the researcher and adapted from previously validated Knowledge, Attitude, and Practice (KAP) instruments on infection prevention and control among healthcare workers. Its design was informed by established guidelines from the World Health Organization (WHO, 2020) and the Centers for Disease Control and Prevention (CDC, 2021) regarding occupational safety and management of biological hazards. In addition, several empirical studies served as references for item development and structuring, including those by Auta *et al.* (2018), Ogoina *et al.* (2014), El-Mohamady and Ahmed (2018), Ackah *et al.* (2022), and Aluko *et al.* (2016), which provided guidance on measuring healthcare workers' knowledge, attitudes, and practices related to infection prevention, hepatitis B vaccination, and post-exposure prophylaxis.

The instrument consisted entirely of closed-ended questions organized into four main sections containing a total of ninety-one (91) items. The first section (Section A) focused on demographic information and included nine (9) items that captured respondents' age, gender, marital status, professional cadre, educational qualification, years of experience, department or unit, and prior training or experience related to infection prevention and control. Responses in this section were recorded using multiple-choice and dichotomous options such as "Yes" or "No."

The second section (Section B) assessed participants' knowledge of biological health hazards and comprised thirty-two (32) multiple-choice questions. These covered general biological hazards as well as specific topics on Hepatitis B Virus (HBV), Human Immunodeficiency Virus (HIV), Tuberculosis (TB), and COVID-19. The knowledge component was modeled after prior studies that assessed healthcare workers' awareness and comprehension of infectious risks and preventive strategies (Auta *et al.*, 2018; Ogoina *et al.*, 2014; Rahman *et al.*, 2024). Each question had one correct answer, and scores were assigned based on accuracy.

The third section (Section C) examined respondents' attitudes toward biological hazards, including perceptions of risk, prevention, and patient care. This section contained twenty-five (25) items adapted from previous KAP studies exploring healthcare workers' attitudes toward infection control and vaccination programs (El-Mohamady and Ahmed, 2018; Gono and Matsa, 2019; Brnović *et al.*, 2023). Responses were rated on a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1).

The fourth and final section (Section D) assessed infection prevention and control practices through twenty-five (25) statements measuring the frequency of preventive behaviors such as hand hygiene, use of personal protective equipment (PPE), vaccination, and exposure reporting. The structure and scoring were aligned with previous instruments examining IPC compliance and occupational exposure practices among healthcare workers (Aluko *et al.*, 2016; Osei Yeboah, 2019; Kawuki *et al.*, 2023). Responses were measured on a five-point Likert scale ranging from Always (5) to Never (1).

Prior to data collection, the study obtained ethical approval from both Ensign Global University's Institutional Review Board and the Ho Teaching Hospital Research Review Committee. This approval ensured compliance with all ethical requirements for research involving human participants. In line with ethical principles outlined in the Belmont Report

(1979): respect for persons, beneficence, and justice, potential participants were provided with detailed information about the study's purpose, objectives, procedures, risks, and benefits. Participation was strictly voluntary, and participants were informed that they could withdraw at any time without penalty.

Data collection took place in a private and quiet setting within the hospital to minimize distractions and protect confidentiality. The questionnaire was preloaded on tablet devices, and participants completed it digitally through the KoBoCollect application. An informed consent form appeared at the beginning of the questionnaire, and only those who actively selected the "I agree to participate" option were permitted to proceed. This ensured documented consent in accordance with ethical standards.

The questionnaire required approximately 35 to 40 minutes to complete. During administration, the researchers were present to clarify questions and assist participants when needed. Data collection was carried out over a two-month period, allowing adequate time for consistency, accuracy, and full coverage of the sample.

All collected data were automatically uploaded to the KoBoCollect system, where they were securely stored and protected against unauthorized access or data loss. This digital approach minimized manual entry errors, enhanced efficiency, and improved the overall quality and reliability of the dataset for subsequent analysis.

3.3 Study Population

The target population for the study consisted of all registered nurses and licensed medical doctors who had been employed at Ho Teaching Hospital for a minimum of six months. Data obtained from the hospital's Human Resource Department indicated that the institution had 855 nurses and 127 doctors, making a total of 982 healthcare professionals. Only staff members who had completed at least six months of continuous service were included as eligible

participants. This criterion was adopted to ensure that respondents had adequate workplace exposure and practical experience to provide meaningful insights into occupational health hazards.

3.4 Inclusion and Exclusion Criteria

To ensure relevance and uniformity in the study sample, the following criteria guided participant selection:

3.4.1 Inclusion Criteria

Participants who met all the following conditions were included in the study:

1. Must be a registered nurse or licensed medical doctor currently working at Ho Teaching Hospital.
2. Must have worked at the hospital continuously for at least six (6) months prior to the study.
3. Must consent voluntarily to participate in the research.

3.4.2 Exclusion Criteria

The following categories of individuals were excluded from the study:

1. Intern doctors, house officers, student nurses, and temporary staff such as locum professionals.
2. Healthcare staff who are on extended leave (e.g., study leave, maternity leave, or medical leave) during the period of data collection.
3. Non-clinical staff such as administrators, cleaners, security, and other support personnel.

3.5 Study Variable

Dependent Variables: The dependent variables of the study were the levels of knowledge, attitude, and practices (KAP) concerning biological health hazards among nurses and doctors.

1. Knowledge was measured using questionnaire items on awareness of biological hazards, modes of transmission, preventive measures, and reporting requirements. Responses were scored, and overall knowledge levels were categorized as *adequate* or *inadequate* based on predetermined cut-off points from the literature.
2. Attitude was assessed through Likert-scale items that explored perceptions of risk, willingness to adhere to infection prevention protocols, and views on institutional safety measures. Attitude scores were grouped as *positive* or *negative*.
3. Practices were evaluated using self-reported behaviors such as the use of personal protective equipment (PPE), compliance with hand hygiene protocols, and reporting of exposure incidents. Practice scores were categorized as *good* or *poor*.

Independent Variables: The independent variables were the demographic and professional characteristics of participants that could influence their KAP levels. These included:

1. Age
2. Gender
3. Professional cadre (nurse or doctor)
4. Educational qualification
5. Years of work experience
6. Department or unit of practice
7. Previous training in occupational health and safety
8. History of exposure to biological hazards

3.6 Sampling

The sample size for this study was determined using Yamane's (1967) formula, which is a method commonly utilized to calculate sample sizes in research studies where the total

population is known. This formula is particularly useful when dealing with large populations and when a specific level of precision in the sample is required.

The formula is denoted as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = required sample size

N = total population size (982 Nurses and Doctors)

e = margin of error (0.05 or 5%)

$$n = \frac{982}{1 + 982(0.05)^2}$$

$$n \approx 284.2$$

Therefore, the sample size was approximately 285 participants.

Proportional Allocation: Based on the population distribution of 855 nurses and 127 doctors, the sample was proportionally divided as follows:

$$\text{Nurses: } (855 / 982) \times 285 \approx 248$$

$$\text{Doctors: } (127 / 982) \times 285 \approx 37$$

This proportional allocation ensures representation across both professional groups in line with their population size.

The study employed a stratified random sampling technique to ensure proportional and representative participation from the two professional categories of interest: nurses and medical doctors. Stratification was based on professional cadre, as the two groups differed in size and potentially in their level of exposure and response to occupational health hazards. This method was deemed appropriate because it improved the representativeness of each subgroup and enhanced the statistical efficiency of comparative analyses across strata (Setia, 2016).

Following stratification, simple random sampling was applied within each stratum to select the final participants. The Human Resource Department provided a verified list of all eligible nurses and doctors who met the inclusion criteria. Each eligible participant was assigned a unique identification code, and random selection was performed using the RAND function in Microsoft Excel. The random number generator produced values for each individual, after which the list was sorted in ascending order. The first 248 nurses and 37 doctors were then selected for inclusion in the study. This procedure ensured that every eligible healthcare professional had an equal chance of being chosen within their group while maintaining proportional representation across cadres (Setia, 2016).

3.7 Pretesting

Prior to the main data collection, the structured questionnaire was pretested at Ho Municipal Hospital, a secondary-level facility located within the same municipality but not part of the actual study site. This hospital shared similar characteristics with Ho Teaching Hospital in terms of staffing and service delivery, which made it an appropriate setting for pilot testing. A total of 12 healthcare professionals were selected for the pretest, comprising 8 nurses and 4 medical doctors who met the inclusion criteria. The purpose of the pretest was to evaluate the clarity, relevance, and sequencing of questions, as well as to estimate the average time required to complete the instrument.

Feedback obtained from the pretest was analyzed to identify ambiguities and inconsistencies in the questionnaire. Necessary revisions were made to improve wording, formatting, and overall coherence of the instrument before it was deployed for the main study at Ho Teaching Hospital. This process ensured the validity and reliability of the final data collection tool.

3.8 Data Handling

Data collection was carried out using the KoBoCollect digital platform, which ensured real-time encryption of all responses at the point of entry. The data were automatically uploaded to KoBo's secure cloud-based server and were accessible only to authorized members of the research team through password-protected accounts. To maintain anonymity, each participant was assigned a unique identifier within the system, and no personally identifiable information was collected or stored alongside the responses.

Upon completion of data collection, the dataset was exported in CSV format from KoBoToolbox into Microsoft Excel for initial cleaning. This stage involved identifying and correcting errors, addressing missing values, and removing duplicate entries. The cleaned dataset was then imported into SPSS Version 28.0 for detailed statistical analysis.

All digital files, including exported datasets and analysis outputs, were stored on password-protected computers and encrypted external drives. To ensure redundancy and prevent data loss, the files were also backed up regularly using a secure cloud storage solution with restricted access.

Participants' digital consent was documented at the beginning of the KoBo form through a mandatory consent screen, and no separate physical consent forms were used. In compliance with the Data Protection Act of Ghana (2012), all research data were retained securely for a period of five years and then permanently deleted using certified digital data destruction tools. These digital safeguards ensured the accuracy, confidentiality, and integrity of the data throughout the research process.

3.9 Data Analysis

The cleaned dataset was imported into SPSS Version 28.0 for statistical analysis. Both descriptive and inferential statistical methods were employed to address the study's objectives.

Descriptive statistics were first used to summarize respondents' demographic and professional characteristics, as well as their knowledge, attitudes, and practices (KAP) regarding biological health hazards. Categorical variables such as gender, cadre, and department were summarized using frequencies and percentages, while continuous variables such as age and years of professional experience were summarized using means and standard deviations.

Knowledge, attitude, and practice scores were computed from the questionnaire responses according to standardized KAP scoring procedures. For the knowledge section, each correct response was awarded one point, while incorrect or "don't know" responses were scored zero. The total possible score was 25 points. Following the scoring approach used by Yosef (2023) in assessing infection prevention among healthcare professionals in Southwest Ethiopia, a 70% cut-off point was adopted to classify knowledge levels. Thus, respondents who scored 18 points and above ($\geq 70\%$) were categorized as having adequate knowledge, while those who scored 17 points or below ($< 70\%$) were considered to have inadequate knowledge of biological health hazards.

For the attitude section, responses were rated on a five-point Likert scale, where *Strongly Agree* = 5, *Agree* = 4, *Neutral* = 3, *Disagree* = 2, and *Strongly Disagree* = 1. The total possible score ranged from 25 to 125. Respondents scoring 76 to 125 were classified as having a positive attitude, while those scoring 25 to 75 were considered to have a negative attitude toward infection prevention and control. This categorization was based on the methodology adopted in previous KAP studies conducted among healthcare workers in similar contexts (El-Mohamady and Ahmed, 2018; Yosef, 2023).

For the practice section, responses were also measured on a five-point Likert scale, where *Always* = 5, *Often* = 4, *Sometimes* = 3, *Rarely* = 2, and *Never* = 1. The total practice score similarly ranged from 25 to 125. In line with the same analytical framework, respondents with

scores between 76 and 125 were categorized as demonstrating good infection prevention and control (IPC) practices, whereas those scoring between 25 and 75 were classified as having poor IPC practices (Yosef, 2023).

Following the scoring and classification, inferential statistics were applied to examine associations between independent variables (such as age, gender, professional cadre, work experience, training history, and exposure experience) and the dependent variables (knowledge, attitude, and practice levels). The Chi-square test of independence was used to assess relationships between categorical variables.

To explore the relationships among knowledge, attitudes, and practices, both bivariate and multivariate analyses were conducted. Cross-tabulations with Chi-square tests were used to evaluate associations between knowledge and attitude, knowledge and practice, and attitude and practice. In addition, Spearman's rank correlation coefficient (ρ) was employed to assess the strength and direction of relationships among the three KAP variables.

Finally, binary logistic regression models were fitted to identify predictors of good practice. Knowledge and attitude were entered as explanatory variables, while good IPC practice (coded as 1) and poor IPC practice (coded as 0) served as the dependent variable. The models generated Adjusted Odds Ratios (AORs) and 95% Confidence Intervals (CIs) to determine whether adequate knowledge and positive attitudes significantly increased the likelihood of adopting good infection prevention practices. This analytical approach ensured a comprehensive understanding of the interplay between healthcare workers' knowledge, attitudes, and practices toward biological health hazards.

3.10 Ethical Considerations

The study adhered strictly to established ethical guidelines for research involving human participants. Prior to the commencement of data collection, ethical approval was sought and

obtained from the Institutional Review Board (IRB) of Ensign Global University and the Research Ethics Committee of Ho Teaching Hospital. These approvals ensured that the study complied with both national and international ethical standards.

All participants were provided with detailed information regarding the purpose, objectives, procedures, potential risks, and benefits of the study. They were informed of their right to participate voluntarily and their freedom to withdraw from the study at any point without penalty or consequence. Written informed consent was obtained digitally through the KoBoCollect platform before participation began. The consent form contained an option for participants to indicate their agreement to participate, and only those who provided consent were allowed to proceed.

Confidentiality and anonymity were strictly maintained throughout the study. All collected data were stored securely on password-protected devices and encrypted servers within the KoBoCollect system. Identifiers such as names or staff identification numbers were not collected, and all results were presented in aggregate form to prevent individual identification.

Furthermore, the data were used solely for academic and policy purposes and were not shared with unauthorized parties. The research team also ensured that participation in the study did not interfere with the normal clinical duties of nurses and doctors.

3.11 Limitation of the study

This study had some limitations that must be acknowledged. Being a cross-sectional design, the findings reflected knowledge, attitudes, and practices (KAP) at a single point in time and therefore did not establish causal relationships. The reliance on self-reported data introduced the possibility of recall bias and social desirability bias, as some participants may have over-reported good practices or positive attitudes. Furthermore, the study was conducted at a single teaching hospital, which may limit the generalizability of the findings to other healthcare

facilities in Ghana or beyond. Despite these limitations, the use of a validated instrument and a robust sampling approach enhanced the reliability and representativeness of the results.

3.12 Assumption

The study was conducted on the basis of several assumptions. It was assumed that participants responded to the questionnaire items truthfully and accurately, reflecting their actual knowledge, attitudes, and practices. It was also assumed that the selected sample of nurses and doctors was representative of the broader staff population at Ho Teaching Hospital. Finally, it was assumed that the respondents' knowledge, attitudes, and practices during the period of the study were stable and reflective of their usual behavior, rather than being unduly influenced by temporary circumstances.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter presents the study's findings. The conclusions are mostly based on the study's objectives, and the data collected from the structured questionnaire was analyzed using SPSS version 28.

4.2 Demographic Characteristics of Respondents

A total of 285 healthcare workers participated in the study, comprising 248 nurses (87.0%) and 37 doctors (13.0%), which yielded a 100% study response rate. The respondents' ages ranged from 23 to 59 years, with a mean age of 42.4 years (SD = 9.8). About a third (31.6%) were within 50 to 59 years, twenty-six percent (26.7%) were 40 to 49 years, and few (19.7%) were within the ages of 20 to 29. The majority of participants were female, constituting about 61.1% of the total respondents.

The mean years of professional experience was 15.3 (SD = 7.9), with a range from 1 to 29 years, and most (36.1%) had 1 to 10 years of working experience. More than two-thirds of the respondents (68.1%) reported having received formal training in infection prevention and control, while 31.9% indicated they had not. Approximately half of the respondents (49.8%) reported a history of occupational exposure to biological hazards such as needlestick injuries or body fluid splashes.

With respect to Departmental distribution, participants were drawn from a wide range of units in the hospital: Emergency (18.9%), ICU (14.4%), Medical (18.2%), Surgical (16.5%), Maternity (17.2%), and Other units (14.7%). See Table 1 below.

Table 4. 1: Demographic Characteristics of Respondents

Variable	Frequency (n=285)	Percentage (%)
Age (years)		
20–29	56	19.7
30–39	63	22.1
40–49	76	26.7
50–59	90	31.6
Gender		
Male	111	38.9
Female	174	61.1
Cadre		
Nurse	248	87
Doctor	37	13
Years of Experience		
Mean (SD)		15.3 (\pm 7.9)
1–10 years	103	36.1
11–20 years	89	31.2
21–29 years	93	32.6
Training in Infection Prevention		
Yes	194	68.1
No	91	31.9
Occupational Exposure		
Yes	142	49.8
No	143	50.2
Department/Unit		
Emergency	54	18.9
ICU	41	14.4
Medical	52	18.2
Surgical	47	16.5
Maternity	49	17.2
Other	42	14.7

Source: *Field Data (2025)*

4.3 Knowledge of Biological Hazards

Table 4.2 illustrates respondents' general knowledge of biological hazards. The majority of the respondents correctly defined biological hazards (89.8%) and identified needle-stick injuries as the most common occupational exposure (86.7%). A similarly high proportion recognized that gloves are the appropriate PPE for bloodborne exposures (88.4%) and that Hepatitis B is preventable through vaccination (90.9%). Recognition that recapping needles is not part of standard precautions was also high (82.8%), though slightly lower than other items, suggesting that safe sharps handling may require further reinforcement.

Table 4. 2: Responses to General Biological Hazard Knowledge Items (N = 285)

Knowledge Statement	Correct n (%)	Incorrect n (%)
Definition of biological hazards	256 (89.8)	29 (10.2)
Common occupational route (needle-stick)	247 (86.7)	38 (13.3)
Recapping not part of standard precautions	236 (82.8)	49 (17.2)
PPE for bloodborne exposure (gloves)	252 (88.4)	33 (11.6)
Infection preventable through vaccination	259 (90.9)	26 (9.1)

Source: *Field Data (2025)*

Table 4.3 presents respondents' knowledge of Hepatitis B (HBV) and Human Immunodeficiency Virus (HIV), the two major bloodborne biological hazards among healthcare workers. Knowledge of Hepatitis B was generally adequate, with most participants correctly identifying that three doses of the vaccine are required for full protection (90.9%) and that the infection can lead to chronic complications, such as liver cirrhosis (87.0%). A large majority (91.6%) also recognized that HBV is transmitted through blood and body fluids. However, knowledge of more technical details showed relatively lower performance. Only 81.4% correctly indicated that the protective antibody titer following vaccination is ≥ 10 mIU/mL, and 84.2% knew the appropriate immediate action following a sharps injury

involving possible HBV exposure. These results suggest that while overall knowledge of HBV is strong, specific technical aspects and post-exposure protocols may require reinforcement.

With regards to HIV, a strong majority recognized that HIV can be transmitted through needlestick injuries (90.2%) and that post-exposure prophylaxis (PEP) significantly reduces the risk of infection (87.7%). Similarly, 85.3% knew that PEP should be initiated within 72 hours of exposure, while 91.9% acknowledged that consistent condom use reduces the risk of transmission. However, fewer participants correctly identified the existence of an asymptomatic window period (80.4%), which is critical for understanding HIV testing and diagnosis. This gap suggests the need for additional emphasis on HIV pathophysiology and diagnostic principles during training.

Table 4. 3: Responses to Knowledge Items on Bloodborne Biological Hazards

Knowledge Statement	Correct n (%)	Incorrect n (%)
Hepatitis B (HBV)		
Number of vaccine doses required for full protection (3)	259 (90.9)	26 (9.1)
Chronic infection can cause liver cirrhosis	248 (87.0)	37 (13.0)
HBV is transmitted through blood and body fluids	261 (91.6)	24 (8.4)
Protective antibody titer after vaccination (≥ 10 mIU/mL)	232 (81.4)	53 (18.6)
Correct action after HBV-related sharps injury	240 (84.2)	45 (15.8)
Human Immunodeficiency Virus (HIV)		
HIV can be transmitted through needlestick injuries	257 (90.2)	28 (9.8)
Post-exposure prophylaxis (PEP) reduces infection risk	250 (87.7)	35 (12.3)
PEP should be started within 72 hours of exposure	243 (85.3)	42 (14.7)
HIV has an asymptomatic window period	229 (80.4)	56 (19.6)
Correct use of condoms reduces HIV transmission risk	262 (91.9)	23 (8.1)

Source: Field Data (2025)

Table 4.4 summarizes respondents' knowledge of Tuberculosis (TB) and COVID-19, the two major airborne biological hazards faced by healthcare workers. Most participants correctly identified airborne droplets as the main mode of transmission (88.8%) and recognized persistent cough lasting more than two weeks as a key clinical symptom (86.3%). Awareness that TB is curable with appropriate drug therapy was also strong (90.5%). However, relatively fewer respondents (81.1%) correctly identified that latent TB infection is not infectious, suggesting a knowledge gap regarding the distinction between latent and active disease. Additionally, while 85.6% knew that an N95 mask is recommended for TB patient care, this still leaves a notable minority unfamiliar with correct protective measures.

With regards to COVID-19, over 90% correctly identified SARS-CoV-2 as the causative agent (92.3%) and recognized the role of hand hygiene in preventing transmission (91.2%). Similarly, 89.1% were aware of the common symptoms, and 88.1% understood droplet transmission as a key route of spread. Awareness of recommended protective equipment was slightly lower, with 86.0% correctly identifying the use of medical or N95 masks for COVID-19 patient care. Although still a strong majority, this result indicates that PPE guidance requires continuous reinforcement to ensure optimal protection in clinical settings.

Table 4. 4: Responses to Knowledge Items on Airborne Biological Hazards (N = 285)

Knowledge Statement	Correct n (%)	Incorrect n (%)
Tuberculosis (TB)		
TB is primarily transmitted through airborne droplets	253 (88.8)	32 (11.2)
Persistent cough > 2 weeks is a common symptom	246 (86.3)	39 (13.7)
Latent TB infection is non-infectious	231 (81.1)	54 (18.9)
N95 mask is recommended for TB patient care	244 (85.6)	41 (14.4)
TB is curable with appropriate drug treatment	258 (90.5)	27 (9.5)
COVID-19		
COVID-19 is caused by a novel coronavirus (<i>SARS-CoV-2</i>)	263 (92.3)	22 (7.7)
Fever, cough, and shortness of breath are common symptoms	254 (89.1)	31 (10.9)
COVID-19 can spread through respiratory droplets	251 (88.1)	34 (11.9)
Hand hygiene helps prevent COVID-19 transmission	260 (91.2)	25 (8.8)
N95 or medical mask is recommended for COVID-19 patient care	245 (86.0)	40 (14.0)

Source: Field Data (2025)

Knowledge Levels of Respondents on Biological Hazards

Knowledge of biological hazards was assessed using 25 multiple-choice questions, each carrying one point, giving a maximum possible score of 25. In accordance with established practices in Knowledge, Attitude, and Practice (KAP) studies, a 70% cut-off point was adopted to classify respondents' knowledge levels. Respondents scoring 18 points or higher ($\geq 70\%$) were considered to have adequate knowledge, while those scoring 17 points or lower ($< 70\%$) were categorized as having inadequate knowledge. The 70% threshold was selected based on its frequent application in similar KAP studies assessing infection prevention and biological hazard awareness among healthcare workers. For instance, Yosef (2023) employed a 70% cut-off to differentiate between adequate and inadequate infection prevention knowledge among healthcare professionals in Ethiopia. This approach has been widely used to ensure

comparability of knowledge classifications across healthcare-based KAP studies (Auta *et al.*, 2018; Ogoina *et al.*, 2014; Yosef, 2023).

The results showed that the majority of respondents, 243 (85.3%) had adequate knowledge, while 42 (14.7%) had inadequate knowledge.

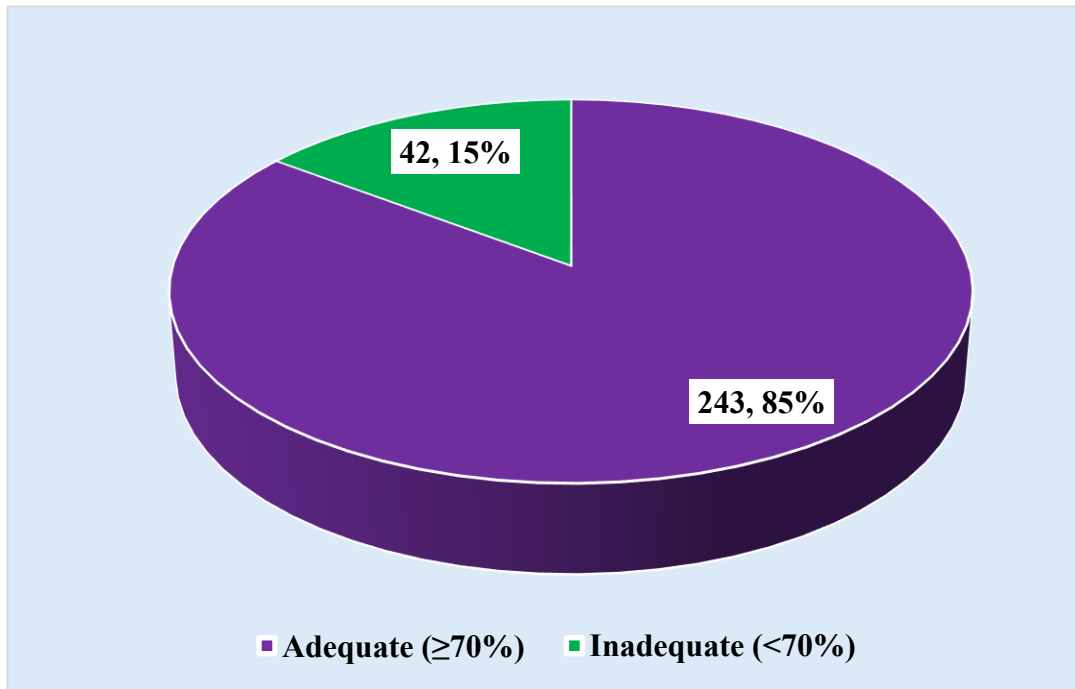


Figure 4. 1: Knowledge Levels of Respondents on Biological Hazards

Table 4.6 illustrates the association between the level of knowledge of biological hazards and the socio-demographic data among respondents using binary logistic regression analysis with a p-value significant at < 0.05 . The table showed that respondents who had 21 to 29 years of working experience were 1.73 times more likely to have adequate knowledge on biological hazards [AOR = 1.73; 95% CI = 1.01–3.00]. Moreover, respondents who had training in infection prevention were 2.68 times more likely to have adequate knowledge on biological hazards [AOR = 2.68; 95% CI = 1.42–5.06]. Lastly, respondents who had occupational exposure to biological hazards were 1.38 times more likely to have adequate knowledge on biological hazards [AOR = 1.38; 95% CI = 0.88–2.17].

Table 4. 5: Binary Logistic Regression Analysis for Knowledge Levels on Biological Hazards and the Socio-Demographic Data

Variables	OR	95% CI	p-value	AOR	95% CI	p-value
Age (years)						
20–29 (ref)	1	-	-	1	-	-
30–39	1.42	(0.88-2.31)	0.211	1.38	(0.82-2.31)	0.146
40–49	1.89	(1.07-4.35)	1.379	1.72	(1.02-3.01)	1.127
50–59	1.26	(0.80-0.15)	0.699	1.18	(0.70-2.00)	0.319
Gender						
Male (ref)	1	-	-	1	-	-
Female	1.48	(0.99-3.44)	0.864	1.36	(0.90-2.16)	0.056
Cadre						
Doctor (ref)	1	-	-	1	-	-
Nurse	2.31	(1.19-6.54)	2.289	2.04	(1.08-4.03)	1.31
Years of Experience						
1–10 years (ref)	1	-	-	1	-	-
11–20 years	1.28	(0.81-1.05)	0.812	1.22	(0.74-2.01)	0.289
21–29 years	1.86	(1.08-5.20)	0.046	1.73	(1.01-3.00)	0.025
Training in Infection Prevention						
No (ref)	1	-	-	1	-	-
Yes	2.92	(1.53-1.154)	0.023	2.68	(1.42-5.06)	0.001
Occupational Exposure						
No (ref)	1	-	-	1	-	-
Yes	1.44	(0.93-2.23)	0.847	1.38	(0.88-2.17)	0.035
Department/Unit						
Emergency (ref)	1	-	-	1	-	-
ICU	1.52	(0.89-2.73)	0.234	1.46	(0.84-2.62)	0.126
Medical	1.23	(0.75-0.13)	0.378	1.18	(0.70-2.01)	0.411
Surgical	1.28	(0.76-0.22)	0.891	1.24	(0.72-2.14)	0.34
Maternity	1.64	(0.98-3.92)	0.466	1.58	(0.94-2.81)	0.056
Other	1.12	(0.66-0.10)	0.242	1.08	(0.63-2.02)	0.518

OR: Adjusted odds ratio; AOR: Adjusted odds ratio; CI: confidence interval; and *Significant with P <0.05

4.4 Attitudes Toward Biological Hazards

Table 4.7 presents the distribution of responses for the five items measuring attitudes toward general biological hazards. Across all items, the majority of participants reported either *Disagree* or *Strongly Disagree*. For example, 62.4% of respondents disagreed or strongly disagreed that healthcare workers are at high risk of biological hazards, while only 14.8% expressed agreement. Similarly, fewer than 15% of respondents agreed or strongly agreed that proper use of PPE or hand hygiene effectively prevents biological hazard transmission. Reporting occupational exposures received the lowest endorsement, with 67.7% of participants disagreeing or strongly disagreeing. Finally, although slightly higher, agreement with institutional support for managing biological hazards remained low, with only 17.5% selecting *Agree* or *Strongly Agree*.

Overall, mean scores for the five items ranged between 2.17 and 2.39, suggesting a general tendency toward disagreement. Standard deviations near one indicate modest variability around these negative attitudes.

Table 4. 6: Attitudes Toward General Biological Hazards among Respondents (n = 285)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean (SD)
Healthcare workers are at high risk of biological hazards	73 (25.6%)	105 (36.8%)	65 (22.8%)	29 (10.2%)	13 (4.6%)	2.31 (1.10)
Proper use of PPE protects against most biological hazards	63 (22.1%)	103 (36.1%)	77 (27.0%)	29 (10.2%)	13 (4.6%)	2.39 (1.08)
Hand hygiene is essential in preventing transmission	75 (26.3%)	101 (35.4%)	72 (25.3%)	26 (9.1%)	11 (3.9%)	2.29 (1.07)
Reporting exposures improves worker safety	85 (29.8%)	108 (37.9%)	59 (20.7%)	24 (8.4%)	9 (3.2%)	2.17 (1.05)
Hospital provides adequate support for hazards	73 (25.6%)	95 (33.3%)	67 (23.5%)	34 (11.9%)	16 (5.6%)	2.39 (1.15)

Source: Field Data (2025)

Table 4.8 presents the distribution of responses to the five items assessing attitudes toward Hepatitis B. Overall, the results suggest mixed and generally negative attitudes, with disagreement being the most common response across all items.

Perceptions of personal risk were modest, as only 15.5% of respondents agreed or strongly agreed that they were at high risk of Hepatitis B infection, compared to 54.1% who disagreed or strongly disagreed. Attitudes toward vaccination were also weaker than expected: although vaccination is widely recommended for healthcare workers, two-thirds of participants disagreed or strongly disagreed that it is essential, and only 10.2% endorsed agreement. Similarly, support for mandatory vaccination among doctors and nurses was limited, with just 17.2% agreement. Institutional protection was also questioned, as most respondents did not feel adequately protected by vaccination programs. Comfort in providing care to patients with Hepatitis B showed low endorsement, with more participants disagreeing than agreeing.

Table 4. 7: Attitudes Toward Hepatitis B among Respondents (n = 285)

Item	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean (SD)
I am at high risk of Hepatitis B infection due to my work	62 (21.8%)	92 (32.3%)	87 (30.5%)	27 (9.5%)	17 (6.0%)	2.46 (1.11)
Hepatitis B vaccination is essential for all healthcare workers	74 (26.0%)	122 (42.8%)	60 (21.1%)	23 (8.1%)	6 (2.1%)	2.18 (0.98)
HBV vaccination should be mandatory for doctors and nurses	68 (23.9%)	100 (35.1%)	68 (23.9%)	35 (12.3%)	14 (4.9%)	2.39 (1.12)
I feel adequately protected from HBV because of vaccination programs	78 (27.4%)	89 (31.2%)	60 (21.1%)	45 (15.8%)	13 (4.6%)	2.39 (1.17)
I am comfortable providing care to patients with Hepatitis B	69 (24.2%)	96 (33.7%)	69 (24.2%)	35 (12.3%)	16 (5.6%)	2.41 (1.15)

Source: *Field Data (2025)*

Table 4.9 presents the distribution of responses to the five items assessing attitudes toward HIV. Perceived occupational risk was modest: only 15.4% of respondents agreed or strongly agreed that they were at high risk of contracting HIV at work, while 63.5% disagreed or strongly disagreed. Knowledge of post-exposure prophylaxis (PEP) was not strongly endorsed, with just 21.7% recognizing its importance in reducing infection risk, compared to 61.4% who disagreed or strongly disagreed.

Perceptions of patient-related occupational risk were similarly low, as fewer than 16% agreed that HIV-positive patients posed a high risk. Confidence in universal precautions was limited, with 63.5% expressing disagreement and only 10.2% agreement. Comfort in caring for patients living with HIV showed slightly better but still modest endorsement, with fewer than 15% agreeing.

Table 4. 8: Attitudes Toward HIV among Respondents (n = 285)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean (SD)
I am at high risk of contracting HIV at work	79 (27.7%)	102 (35.8%)	60 (21.1%)	32 (11.2%)	12 (4.2%)	2.28 (1.11)
Immediate initiation of PEP reduces the risk of HIV infection	77 (27.0%)	98 (34.4%)	48 (16.8%)	38 (13.3%)	24 (8.4%)	2.42 (1.25)
HIV-positive patients pose a high occupational risk to healthcare workers	74 (26.0%)	112 (39.3%)	54 (18.9%)	33 (11.6%)	12 (4.2%)	2.29 (1.10)
I feel confident that universal precautions protect me from HIV	70 (24.6%)	111 (38.9%)	75 (26.3%)	21 (7.4%)	8 (2.8%)	2.25 (1.00)
I am comfortable caring for patients living with HIV	75 (26.3%)	91 (31.9%)	78 (27.4%)	27 (9.5%)	14 (4.9%)	2.35 (1.11)

Source: *Field Data (2025)*

Table 4.10 presents the distribution of responses to the five items assessing attitude towards TB. A majority of respondents expressed strong agreement that they were at occupational risk, with more than a third (39.3%) agreeing. Agreement was even higher regarding preventive measures, with over 80% endorsing consistent N95 use and patient isolation. However, perceived protection from hospital policies was weaker, with only 57.2% expressing confidence, and nearly 20% disagreed. Comfort in caring for TB patients was moderately endorsed (62.8%).

Table 4. 9: Attitudes Toward TB among Respondents (n = 285)

Item	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean (SD)
I am at high risk of TB infection at work	8 (2.8%)	22 (7.7%)	50 (17.5%)	95 (33.3%)	110 (38.6%)	4.00 (0.98)
Consistent use of N95 masks reduces TB transmission	8 (2.8%)	12 (4.2%)	25 (8.8%)	88 (30.9%)	152 (53.3%)	4.28 (0.89)
TB patients should always be isolated in well-ventilated rooms	6 (2.1%)	15 (5.3%)	22 (7.7%)	72 (25.3%)	168 (58.9%)	4.34 (0.93)
I feel adequately protected by my hospital's TB infection control policies	16 (5.6%)	42 (14.7%)	64 (22.5%)	91 (31.9%)	72 (25.3%)	3.57 (1.12)
I am comfortable caring for patients with TB	15 (5.3%)	30 (10.5%)	61 (21.4%)	97 (34.0%)	82 (28.8%)	3.70 (1.09)

Source: *Field Data (2025)*

Table 4.11 presents the distribution of responses to the five items assessing attitude towards COVID-19. Majority (75%) of respondents acknowledged high occupational risk, and nearly 90% agreed that vaccination and PPE are essential. Still, only 61.4% felt adequately protected by hospital measures, with 18% expressing disagreement. Comfort in caring for COVID-19 patients was moderately high (66.7%).

Table 4. 10: Attitudes Toward COVID-19 among Respondents (n = 285)

Item	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean (SD)
I am at high risk of COVID-19 infection at work	128 (44.9%)	90 (31.6%)	40 (14.0%)	18 (6.3%)	9 (3.2%)	4.09 (0.97)
COVID-19 vaccination protects against severe illness	162 (56.8%)	77 (27.0%)	29 (10.2%)	11 (3.9%)	6 (2.1%)	4.33 (0.88)
PPE is essential when managing COVID-19 patients	174 (61.1%)	72 (25.3%)	20 (7.0%)	12 (4.2%)	7 (2.5%)	4.38 (0.91)
I feel adequately protected by hospital measures against COVID-19	80 (28.1%)	95 (33.3%)	59 (20.7%)	36 (12.6%)	15 (5.3%)	3.67 (1.10)
I am comfortable caring for patients with COVID-19	88 (30.9%)	102 (35.8%)	52 (18.2%)	29 (10.2%)	14 (4.9%)	3.77 (1.08)

Source: *Field Data (2025)*

Overview of Attitudes Toward Biological Hazards

Figure 4.2 summarizes respondents' attitudes towards biological hazards. Attitude statements were rated on a 5-point Likert-scale (5-1), thus, strongly agree, agree, strongly disagree, disagree and do not know. The attitude scores ranged from 25 to 125. The results of respondents' attitude towards biological hazards were categorized into positive and negative due to the answers provided. All respondents who scored 25 to 75 were classified to have a negative attitude and respondents who scored 76 to 125 were classified to have a positive attitude towards biological hazards. This method ensures the classification is anchored to the scale's midpoint, which is common in KAP. Hence, the majority, 208 (73%), had a positive attitude towards biological hazards, and 77 (27%) had a negative attitude towards biological hazards.

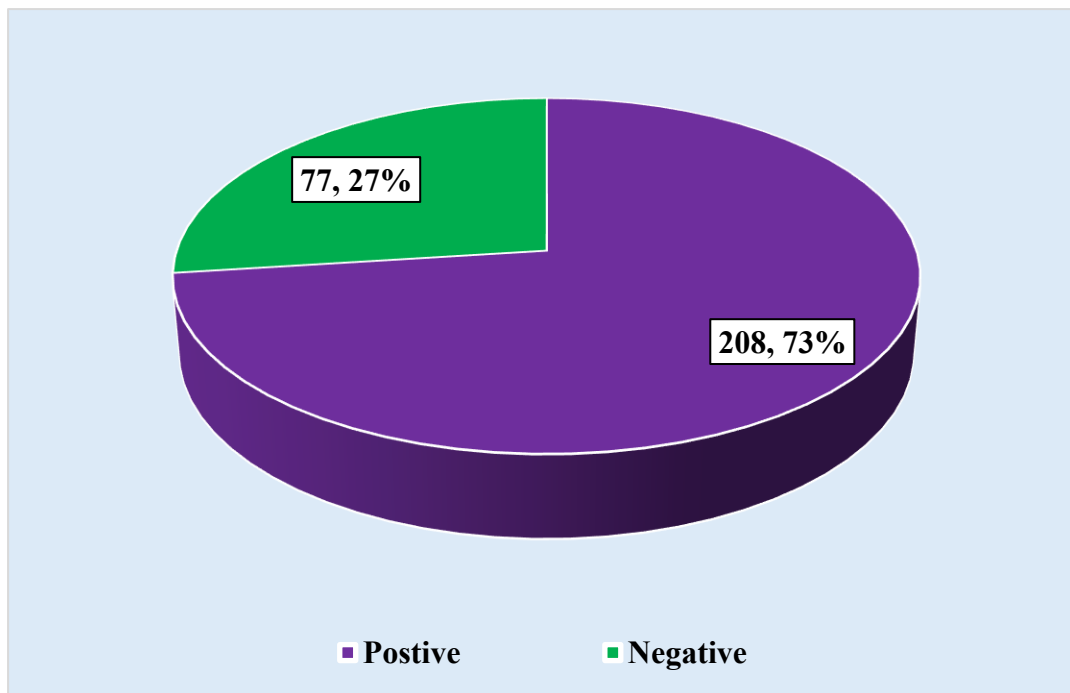


Figure 4. 2: Overview of Attitude Toward Biological Hazards among Respondents

Table 4.12 illustrates the association between the attitude toward biological hazards and the socio-demographic data among respondents using binary logistic regression analysis with a p-value significant at <0.05 . From the table, respondents who had 21 to 29 years of working experience were 1.71 times more likely to show a positive attitude towards biological hazards [AOR = 1.71; 95% CI = 1.00–3.02]. Moreover, respondents who had training in infection prevention were 2.52 times more likely to have a positive attitude towards biological hazards [AOR = 2.52; 95% CI = 1.32–4.81]. Lastly, respondents who had occupational exposure to biological hazards were 2.23 times more likely to exhibit a positive attitude toward biological hazards [AOR = 2.23; 95% CI = 0.82-3.02].

Table 4. 11: Binary Logistic Regression Analysis for the Association Between Attitude Toward Biological Hazards and the Socio-Demographic Data Among Respondents

Variables	OR	95% CI	p-value	AOR	95% CI	p-value
Age (years)						
20–29 (ref)	1	-	-	1	-	-
30–39	1.31	(0.70-2.34)	0.122	1.26	(0.66-2.38)	0.269
40–49	1.92	(1.01-3.46)	1.106	1.79	(1.00-3.21)	0.440
50–59	1.21	(0.76-2.50)	0.181	1.15	(0.70-1.91)	0.368
Gender						
Male (ref)	1	-	-	1	-	-
Female	1.37	(0.93-2.28)	0.154	1.31	(0.86-2.18)	0.111
Cadre						
Doctor (ref)	1	-	-	1	-	-
Nurse	2.21	(1.15-4.32)	1.273	1.98	(1.03-3.82)	1.047
Years of Experience						
1–10 years (ref)	1	-	-	1	-	-
11–20 years	1.27	(0.78-2.11)	0.117	1.21	(0.73-2.08)	0.28
21–29 years	1.85	(1.07-3.23)	0.017	1.71	(1.00-3.02)	0.029
Training in Infection Prevention						
No (ref)	1	-	-	1	-	-
Yes	2.74	(1.44-5.21)	0.02	2.52	(1.32-4.81)	0.002
Occupational Exposure						
No (ref)	1	-	-	1	-	-
Yes	1.29	(0.88-2.10)	0.031	2.23	(0.82-3.02)	0.015
Department/Unit						
Emergency (ref)	1	-	-	1	-	-
ICU	1.42	(0.80-2.63)	0.148	1.35	(0.74-2.48)	0.223
Medical	1.19	(0.72-2.03)	0.165	1.15	(0.68-1.95)	0.420
Surgical	1.24	(0.73-2.13)	0.181	1.20	(0.69-2.11)	0.367
Maternity	1.57	(0.92-2.85)	0.101	1.51	(0.88-2.71)	0.083
Other	1.08	(0.62-1.95)	0.127	1.04	(0.59-1.87)	0.602

OR: Adjusted odds ratio; AOR: Adjusted odds ratio; CI: confidence interval; and *Significant with P <0.05

4.5 Practices in Infection Prevention and Control

Table 4.13 presents the distribution of responses regarding practices in the prevention and control of general biological hazards. The data indicate generally suboptimal adherence to infection prevention standards. Hand hygiene before and after every patient contact was inconsistently practiced, with the largest proportion of respondents reporting they rarely performed this measure (35.1%), followed closely by those who never did so (30.5%). Similarly, the use of gloves when handling blood or body fluids was most often reported as never (36.8%), while just over a quarter admitted to rarely using gloves (26.7%).

Safe disposal of sharps in designated boxes was also inadequate, as one-third of respondents indicated they never practiced this (33.7%), and a similar proportion reported rarely doing so (34.7%). Reporting of occupational exposures was low, with never (34.4%) and rarely (30.9%) being the most frequent responses. Participation in hospital infection prevention trainings was also limited, with over a third stating they never attended such trainings (35.4%), and nearly another third indicating they rarely did (33.0%).

Table 4. 12: Practices in the Prevention and Control of General Biological Hazards (n = 285)

Statement	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Always (%)
I wash my hands before and after every patient contact.	87 (30.5%)	100 (35.1%)	54 (18.9%)	27 (9.5%)	17 (6.0%)
I use gloves when handling blood or body fluids.	105 (36.8%)	76 (26.7%)	69 (24.2%)	23 (8.1%)	12 (4.2%)
I dispose of sharps in safety boxes immediately after use.	96 (33.7%)	99 (34.7%)	53 (18.6%)	24 (8.4%)	13 (4.6%)
I report all occupational exposures (sharps, splashes).	98 (34.4%)	88 (30.9%)	55 (19.3%)	31 (10.9%)	13 (4.6%)
I participate in hospital infection prevention trainings.	101 (35.4%)	94 (33.0%)	46 (16.1%)	31 (10.9%)	13 (4.6%)

Source: *Field Data (2025)*

Table 4.14 outlines the practices of healthcare workers in the prevention and control of Hepatitis B. Vaccination uptake was limited, with the largest group reporting they had rarely received even a single dose of the Hepatitis B vaccine (37.9%), and a comparable proportion indicating never having received it (28.4%). Completion of the full 3-dose schedule was similarly poor, with 38.6% stating they rarely completed it, and 28.1% reporting never. Post-vaccination antibody testing was notably neglected, as one-third of respondents never checked their Hepatitis B antibody status (32.3%) and another 32.6% reported doing so rarely. Regarding protective practices, glove use when handling blood to reduce HBV risk was suboptimal, with 33.3% practicing it rarely and 28.1% indicating they never used gloves consistently. Finally, encouragement of colleagues to get vaccinated was also uncommon, with the highest percentage of respondents reporting they rarely engaged in this practice (40.0%), and more than a quarter admitting they never did so (27.7%).

Table 4. 13: Practices in the Prevention and Control of Hepatitis B (n = 285)

Statement	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Always (%)
I have received at least one dose of the Hepatitis B vaccine.	81 (28.4%)	108 (37.9%)	55 (19.3%)	25 (8.8%)	16 (5.6%)
I have completed the full 3-dose HBV vaccination schedule.	80 (28.1%)	110 (38.6%)	58 (20.4%)	19 (6.7%)	18 (6.3%)
I check my Hepatitis B antibody status (anti-HBs) after vaccination.	92 (32.3%)	93 (32.6%)	65 (22.8%)	26 (9.1%)	9 (3.2%)
I use gloves when handling blood to reduce HBV risk.	80 (28.1%)	95 (33.3%)	62 (21.8%)	34 (11.9%)	14 (4.9%)
I encourage colleagues to get vaccinated against HBV.	79 (27.7%)	114 (40.0%)	54 (18.9%)	27 (9.5%)	11 (3.9%)

Source: *Field Data (2025)*

Table 4.15 presents the practices of healthcare workers in the prevention and control of HIV. Adherence to universal precautions was weak, with the largest proportion of respondents

reporting they rarely observed them (32.6%), and almost as many admitting they never did (30.9%). Initiation of HIV post-exposure prophylaxis (PEP) following occupational exposure was also inadequate, as 33.7% said they rarely initiated PEP, while 29.8% never initiated it. Consistent use of personal protective equipment (PPE) when managing patients with suspected HIV was low, with 37.2% indicating rarely and 30.5% stating never. Needle recapping, which increases HIV exposure risk, was still practiced despite guidelines, with 39.6% reporting they rarely avoided it and 27.0% indicating they never avoided it. Finally, participation in HIV infection prevention training was limited, as the highest share of respondents reported they rarely attended (36.1%), while 31.9% admitted to never participating.

Table 4. 14: Practices in the Prevention and Control of HIV (n = 285)

Statement	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Always (%)
I follow universal precautions when caring for patients with HIV.	88 (30.9%)	93 (32.6%)	59 (20.7%)	28 (9.8%)	17 (6.0%)
I initiate HIV PEP promptly after occupational exposure.	85 (29.8%)	96 (33.7%)	51 (17.9%)	38 (13.3%)	15 (5.3%)
I consistently use PPE when managing patients with suspected HIV.	87 (30.5%)	106 (37.2%)	46 (16.1%)	30 (10.5%)	16 (5.6%)
I avoid needle recapping to reduce HIV exposure risk.	77 (27.0%)	113 (39.6%)	49 (17.2%)	26 (9.1%)	20 (7.0%)
I participate in regular HIV infection prevention training.	91 (31.9%)	103 (36.1%)	54 (18.9%)	25 (8.8%)	12 (4.2%)

Source: *Field Data (2025)*

Table 4.16 highlights healthcare workers' practices in the prevention and control of tuberculosis (TB). Use of N95 respirators when attending to TB patients was limited, with a third of respondents stating they never used them (33.3%) and another third reporting rarely doing so (33.0%). Similarly, isolation or masking of coughing patients was poorly practiced, with 33.0% never applying this measure and 31.9% reporting they rarely did. Ensuring good ventilation

during TB care was suboptimal, as the largest proportion of respondents reported practicing it rarely (38.2%), while a quarter indicated they never ensured ventilation (25.3%). TB screening following exposure was also inadequate, with 36.1% stating they rarely completed it and 29.5% saying they never did so. Patient and family education on cough etiquette showed similar patterns, with 38.9% indicating they rarely engaged in this practice and 30.9% reporting they never did.

Table 4. 15: Practices in the Prevention and Control of TB (n = 285)

Statement	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Always (%)
I use N95 respirators when attending to TB patients.	95 (33.3%)	94 (33.0%)	55 (19.3%)	27 (9.5%)	14 (4.9%)
I isolate or mask coughing patients suspected of TB.	94 (33.0%)	91 (31.9%)	65 (22.8%)	20 (7.0%)	15 (5.3%)
I ensure good ventilation when caring for TB patients.	72 (25.3%)	109 (38.2%)	66 (23.2%)	26 (9.1%)	12 (4.2%)
I complete TB screening when exposed to a TB patient.	84 (29.5%)	103 (36.1%)	52 (18.2%)	27 (9.5%)	19 (6.7%)
I educate patients and families on cough etiquette to prevent TB spread.	88 (30.9%)	111 (38.9%)	45 (15.8%)	28 (9.8%)	13 (4.6%)

Source: *Field Data (2025)*

Table 4.17 presents healthcare workers' practices in the prevention and control of COVID-19. Mask use during patient care in COVID-19 wards was inconsistent, with the majority reporting either rarely (36.1%) or never (25.3%) wearing a medical mask. Physical distancing was similarly weak, with 32.3% rarely observing it and 29.1% indicating they never practiced it. Adherence to ventilation protocols was particularly poor, with the largest proportion stating they never followed them (36.5%), while another 29.8% reported doing so rarely. Vaccination uptake was low, as more than a third of respondents rarely reported receiving at least one dose (35.1%), and one-third stated they never received it (33.3%). Finally, use of appropriate PPE

when caring for suspected COVID-19 patients was suboptimal, with 35.4% reporting rarely and 28.4% never practicing it consistently.

Table 4. 16: Practices in the Prevention and Control of COVID-19 (n = 285)

Statement	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Always (%)
I wear a medical mask during patient care in COVID-19 wards.	72 (25.3%)	103 (36.1%)	62 (21.8%)	33 (11.6%)	15 (5.3%)
I practice physical distancing where possible at work.	83 (29.1%)	92 (32.3%)	54 (18.9%)	36 (12.6%)	20 (7.0%)
I follow ventilation protocols in COVID-19 wards.	104 (36.5%)	85 (29.8%)	50 (17.5%)	29 (10.2%)	17 (6.0%)
I have received at least one dose of a COVID-19 vaccine.	95 (33.3%)	100 (35.1%)	51 (17.9%)	27 (9.5%)	12 (4.2%)
I use appropriate PPE when caring for suspected COVID-19 patients.	81 (28.4%)	101 (35.4%)	60 (21.1%)	29 (10.2%)	14 (4.9%)

Source: *Field Data (2025)*

General Overview of Practices in Infection Prevention and Control

Figure 4.5 summarizes practices in infection prevention and control among respondents. Prevention statements were rated on a 5-point Likert-scale (5-1), thus, Always, Often, Sometimes, Rarely, and Never. The prevention scores ranged from 25 to 125. The results were categorized into good practice and poor practice due to the answers provided. All respondents who scored 25 to 75 were classified to have shown poor practice in infection prevention and controls, and respondents who scored 76 to 125 were classified to have good practice in infection prevention and controls. This method ensures the classification is anchored to the scale's midpoint, which is common in KAP. Therefore, 64 (22%) showed good practice in infection prevention and controls, and 221 (78%) showed poor practice in infection prevention and controls.

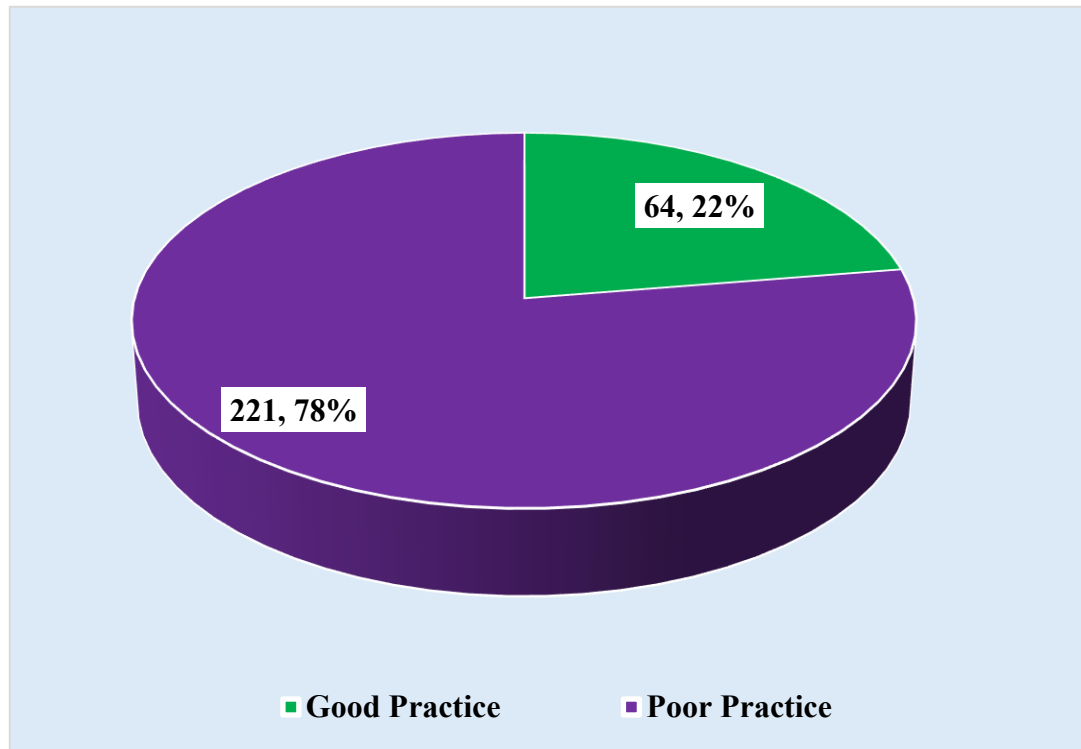


Figure 4. 3: Overview of Practices in Infection Prevention and Control among Respondents

Table 4.18 illustrates the association between the practice in infection prevention and control and the socio-demographic data among respondents using binary logistic regression analysis with a p-value significant at <0.05 . According to the table, respondents who had received training on infection prevention were 2.67 times more likely to exhibit good practice in infection prevention and control [AOR = 2.67; 95% CI = 1.54–4.74] compared to their counterparts who had not, controlling for all other variables. Additionally, respondents who had occupational exposure to biological hazards were 1.54 times more likely to show good practice in prevention and control [AOR = 1.54; 95% CI = 1.01-2.46]. Finally, respondents who were working in the ICU were 1.87 times more likely to exhibit good practice in infection prevention and control [AOR = 1.87; 95% CI = 1.05-3.41].

Table 4. 17: Binary Logistic Regression Analysis On Attitude Toward Biological Hazards and the Socio-Demographic Data

Variables	OR	95% CI	p-value	AOR	95% CI	p-value
Age (years)						
20–29 (ref)		1			1	
30–39	1.42	(0.90-2.23)	0.231	1.38	(0.85-2.26)	0.128
40–49	1.76	(1.06-2.94)	1.941	1.61	(1.01-2.79)	0.127
50–59	1.95	(1.15-3.29)	1.291	1.82	(1.09-3.22)	0.13
Gender						
Male (ref)		1			1	
Female	1.28	(0.89-1.84)	0.841	1.21	(0.83-1.79)	0.177
Cadre						
Doctor (ref)		1			1	
Nurse	2.02	(1.15-3.57)	1.572	1.88	(1.09-3.44)	0.305
Years of Experience						
1–10 years (ref)		1			1	
11–20 years	1.39	(0.91-2.12)	0.121	1.31	(0.84-2.05)	0.118
21–29 years	1.11	(0.81-1.59)	0.591	1.09	(0.76-1.62)	0.517
Training in Infection Prevention						
No (ref)		1			1	
Yes	2.94	(1.71-5.04)	0.222	2.67	(1.54-4.74)	0.001
Occupational Exposure						
No (ref)		1			1	
Yes	1.61	(1.00-2.58)	0.345	1.54	(1.01-2.46)	0.049
Department/Unit						
Emergency (ref)		(0.96-2.57)	0.571	1.48	(0.91-2.52)	0.077
ICU	1.94	(1.11-3.45)	0.031	1.87	(1.05-3.41)	0.02
Medical	1.48	(0.91-2.64)	0.641	1.42	(0.86-2.59)	0.089
Surgical	1.28	(0.87-2.27)	0.271	1.21	(0.83-2.18)	0.185
Maternity	1.15	(0.81-1.95)	0.951	1.11	(0.79-1.89)	0.337
Other		1			1	

OR: Adjusted odds ratio; AOR: Adjusted odds ratio; CI: confidence interval; and *Significant with P <0.05

4.6 Relationship Between Knowledge, Attitudes, And Practices Regarding Biological Health Hazards Among Doctors and Nurses

Table 4.19 illustrates a Chi-square analysis to examine the relationship between respondents' knowledge of biological hazards and their attitude towards them. The results showed no statistically significant association between knowledge level and attitude ($\chi^2 = 0.06$, $df = 1$, $p = 0.806$).

Table 4. 18: Chi-square analysis for the relationship between respondents' knowledge of biological hazards and their attitude towards biological hazards

Knowledge	Attitude Towards Biological Hazards		df	χ^2	p-value
	Positive (n=208)	Negative (n=77)			
Adequate	178 (73.3%)	65 (26.7%)			
Inadequate	30 (71.4%)	12 (28.6%)	1	0.06	0.806

p-value < 0.05 denotes statistical significance

Table 4.21 presents a Chi-square analysis that was conducted to assess the association between knowledge of biological hazards and practices in infection prevention and control. The results revealed no statistically significant relationship between knowledge and practice ($\chi^2 = 0.394$, $df = 1$, $p = 0.530$).

Table 4. 19: Chi-square analysis for the relationship between respondents' knowledge of biological hazards and their practice in infection prevention and control

Knowledge	Practice in Infection Prevention and Control		df	χ^2	p-value
	Good (n=64)	Poor (n=221)			
Adequate	53 (21.8%)	190 (78.2%)			
Inadequate	11(26.2%)	31(73.8)	1	0.394	0.53

p-value < 0.05 denotes statistical significance

Table 4.21 presents the Chi-square analysis of the relationship between respondents' attitude towards biological hazards and their practice in infection prevention and control. The results showed a statistically significant association between attitude and practice ($\chi^2 = 0.17$, $df = 1$, $p = 0.036$). This indicates that respondents' attitudes significantly influenced their infection prevention and control practices.

Table 4. 20: Chi-square analysis for the relationship between respondents' attitude towards biological hazards and their practice in infection prevention and control

Attitude	Practice in Infection Prevention and Control		df	χ^2	p-value
	Good (n=64)	Poor (n=221)			
Positive	48 (23.1%)	160 (76.9%)			
Negative	16 (20.8%)	61 (79.2%)	1	0.17	0.036

p-value < 0.05 denotes statistical significance

CHAPTER FIVE

5.0 DISCUSSION

5.1 Introduction

This chapter discusses the findings of the study in relation to the four specific objectives and situates them within the context of existing literature. The discussion integrates the key results from the analysis with insights from prior studies, highlighting areas of alignment, divergence, and implication for healthcare practice and policy.

5.2 Level of Knowledge of Doctors and Nurses Regarding Biological Health Hazards

The present study demonstrated that healthcare workers at Ho Teaching Hospital possessed a generally adequate level of knowledge regarding biological hazards, with 85.3% of respondents attaining adequate knowledge scores. This suggests that both doctors and nurses were well sensitized to the risks posed by infectious agents and to the core principles of infection prevention. The relatively adequate level of knowledge may be attributed to the fact that more than two-thirds (68.1%) of respondents had received formal training in infection prevention and control, coupled with the experiential learning that accompanies clinical practice in high-risk units such as emergency, surgical, and medical wards. Such a knowledge base is an important prerequisite for reducing occupational exposure, as awareness constitutes the first step in the Knowledge, Attitude, Practice (KAP) continuum that underpins safe behavior.

Adequate levels of knowledge were evident across the specific hazards examined. Almost nine out of ten respondents (89.8%) correctly defined biological hazards, 86.7% identified needle-stick injuries as the primary occupational route of exposure, and 90.9% knew that Hepatitis B is preventable through vaccination. Strong knowledge was also demonstrated for HIV, with 90.2% acknowledging its transmission through needle-stick injuries and 87.7% recognizing the protective role of post-exposure prophylaxis (PEP), as well as for tuberculosis, with 88.8%

citing airborne droplets as the main transmission route and 90.5% acknowledging its curability. Similarly, 92.3% of respondents correctly identified SARS-CoV-2 as the causative agent of COVID-19 and 91.2% emphasized hand hygiene as a preventive measure. This finding is consistent with a study by Subramanian *et al.* (2017) in Malaysia, where over 90% of healthcare workers demonstrated strong knowledge of PPE use and Hepatitis B vaccination, and with Macharia (2018) in Kenya, who also reported high awareness of occupational hazards and preventive measures. A similar pattern was observed in Ghana, where Akagbo *et al.*, (2017) documented good knowledge of standard precautions, though noted barriers to compliance, and in the United Kingdom, where Trim *et al.*, (2003) reported high awareness of inoculation risks and glove use among nurses. In contrast, Soares *et al.* (2020) in Brazil found that sharps injuries remained frequent despite good awareness, and Ojo (2021) in Namibia observed continued recapping practices among trained staff. Tenna *et al.*, (2013) in Ethiopia also reported uneven knowledge, particularly regarding sharps handling and post-exposure management. These variations across contexts may be explained by differences in institutional enforcement of infection prevention measures, the strength of national occupational health policies, and the consistency of refresher training, with stronger systems more able to sustain knowledge and reinforce safe practices than those constrained by limited resources.

Although most respondents demonstrated correct knowledge on disease-specific technical items, the proportions were lower than those observed for general knowledge indicators, highlighting important gaps. Only 81.4% correctly indicated that the protective antibody titer following Hepatitis B vaccination is ≥ 10 mIU/mL, and 84.2% knew the appropriate immediate action after a sharps injury involving possible HBV exposure. Knowledge of HIV was also weaker in specific domains, with just 80.4% recognizing the existence of the asymptomatic window period. Similarly, for tuberculosis, only 81.1% distinguished between latent and active infection, and for COVID-19, 86.0% identified the correct use of medical or N95 masks during

patient care. While these proportions still represent majority awareness, they are notably lower than the >90% observed for general items, suggesting that technical and procedural knowledge is less well internalized. Comparable findings have been reported elsewhere: Al-Abhar *et al.* (2020) in Yemen observed that healthcare workers had strong knowledge of HBV transmission but poor awareness of antibody testing and post-vaccination monitoring; Somasundaram (2024) in Oman found that nurses were familiar with HIV transmission but often lacked understanding of the asymptomatic window period; and Ismail *et al.* (2021) showed that many healthcare workers worldwide struggled to differentiate latent from active TB. Similarly, van Wyk-Heath (2022) in South Africa and Harland (2024) in the United States noted persistent gaps in knowledge and compliance regarding PPE use during the COVID-19 pandemic. These results indicate that while training programs effectively instill broad infection prevention principles, less emphasis is placed on specialized technical competencies, underscoring the need for targeted refresher training, practical simulations, and stronger institutional monitoring.

5.3 Attitude of doctors and nurses toward biological health hazards prevention

The findings of this study indicate that although the majority of healthcare workers (73%) demonstrated positive attitudes toward biological hazards, a substantial proportion (27%) still held negative attitudes. Interpreted through the lens of the Knowledge–Attitude–Practice (KAP) framework, this distribution reinforces the theoretical proposition that attitudes serve as the vital bridge between knowledge and practice (Macharia, 2018). The study further revealed that while knowledge levels were generally adequate, knowledge alone did not significantly predict good infection prevention behaviours ($p = 0.34$). In contrast, attitudes were a strong determinant, with healthcare workers who expressed positive attitudes being more than twice as likely to engage in proper preventive practices ($OR = 2.45, p = 0.002$). This finding is congruent with global evidence suggesting that attitudinal dispositions, rather than knowledge

per se, frequently dictate compliance with occupational health and safety protocols (Ackah *et al.*, 2022).

A deeper analysis reveals significant variations across specific hazards. Respondents expressed more favourable attitudes toward tuberculosis and COVID-19 prevention, particularly endorsing the use of N95 masks, isolation of infectious patients, and vaccination. These stronger attitudes may reflect the heightened institutional and global emphasis on these diseases in recent years, which amplified both perceived severity and perceived benefits—two core constructs in the KAP model (Malotle *et al.*, 2017). By contrast, weaker attitudinal orientations were recorded with regard to hepatitis B and HIV. Despite adequate knowledge scores, many respondents were ambivalent about hepatitis B vaccination, doubted the effectiveness of institutional vaccination programmes, or expressed limited confidence in post-exposure prophylaxis. Such findings echo those of international studies that report persistently low hepatitis B vaccination uptake among healthcare workers, often linked to vaccine hesitancy, cost, and inconsistent institutional enforcement (Atakro *et al.*, 2019). Likewise, underreporting of occupational exposures despite widespread awareness has been attributed to negative attitudes toward institutional support mechanisms, fear of stigma, or a sense of futility (Macharia, 2018; Rahman *et al.*, 2024).

These attitudinal gaps highlight a crucial principle of the KAP framework: that knowledge, while necessary, is insufficient in the absence of attitudinal conviction. Healthcare workers may possess biomedical knowledge of risks and preventive measures, but unless they perceive themselves as personally vulnerable and believe in the effectiveness of interventions, their behaviour is unlikely to change (Hebo and Gameda, 2019). The more positive attitudes toward COVID-19 and TB prevention observed in this study can therefore be explained not simply by knowledge, but by the alignment of knowledge with institutional reinforcement and public health campaigns. This interpretation finds support in Kawuki *et al.* (2023), who demonstrated

that medical students' willingness to adhere to infection control protocols was strongly influenced by the adequacy of institutional training and reinforcement of positive attitudes.

From a policy perspective, the implications of these findings are clear. Strategies to strengthen infection prevention and control must extend beyond knowledge dissemination through guidelines or training. They must focus on actively shaping attitudes. This could involve institutionalising mandatory hepatitis B vaccination, ensuring non-punitive and supportive mechanisms for exposure reporting, and embedding role modelling of safe practices by senior staff. As (Atakro *et al.* (2019) argue, the sustainability of infection prevention among healthcare personnel depends on systemic reinforcement of positive attitudinal orientations as much as on knowledge provision. Thus, in line with the KAP model, this study confirms that while knowledge informs, it is attitudes that transform serving as the linchpin in converting awareness into consistent preventive behaviours.

5.4 Infection Prevention and Control Practices Adopted by Doctors and Nurses When Handling Biological Health Hazards in Clinical Settings

The present study revealed a striking deficit in healthcare workers' practices toward biological hazards, with only 22 percent demonstrating good practice and the majority 78 percent exhibiting poor practice. Within the Knowledge, Attitude and Practice framework, practice reflects the behavioural translation of knowledge and beliefs (Auta *et al.*, 2017). The predominance of poor practice, despite generally adequate knowledge and moderately positive attitudes, highlights a persistent knowledge to practice gap in occupational health. This gap indicates that structural, cultural, and institutional factors such as inadequate supervision, insufficient resources, and weak enforcement of safety protocols significantly limit healthcare workers' ability to implement protective behaviours. Comparatively, the 22 percent compliance rate in this study is lower than figures reported elsewhere. In Bangladesh, Rahman *et al.* (2024) found 32 percent of nurses demonstrated adequate preventive practices against hepatitis B,

while Macharia (2018) reported 35 percent adherence to sharps safety protocols among Kenyan healthcare workers. Even within low and middle-income countries, compliance can be higher. Adebimpe (2018) observed over 50 percent of Nigerian healthcare workers correctly using personal protective equipment and disposing of sharps safely. In high income settings, adherence is markedly higher, with hand hygiene rates above 70 percent (Akkajit, Romin and Assawadithalerd, 2020) and over 60 percent of Italian medical students consistently applying universal precautions (Almutairi *et al.*, 2020). These findings underscore that poor practice is context dependent, and the low compliance in this study points to systemic and institutional shortcomings that prevent healthcare workers from translating knowledge and attitudes into protective practices.

A closer examination of practice patterns revealed worrying inconsistencies. More than two-thirds of respondents reported rarely or never washing their hands before and after patient contact, and over 60% admitted to irregular glove use and unsafe sharps disposal. Almost 70% continued the unsafe practice of needle recapping, while exposure reporting was neglected by a similar proportion. Participation in routine infection prevention training was also minimal. These findings resonate with studies from other low and middle-income countries, which similarly highlight systemic deficiencies as barriers to safe practice. Ackah *et al.* (2022) reported that fewer than half of healthcare workers in South Asia complied with hand hygiene, attributing this to poor supervision and inadequate infrastructure. Rahman *et al.* (2024) found that in Bangladesh, although awareness of Hepatitis B risks was high, fewer than one-third of nurses had received full vaccination or consistently used gloves. Macharia (2018) in Kenya also documented widespread underreporting of exposures and unsafe sharps handling, closely mirroring the trends observed in the present study. In contrast, Kawuki *et al.* (2023) observed that more than 60% of Italian medical students consistently adhered to universal precautions, though gaps in vaccination and sharps management persisted. A systematic review by Akkajit,

Romin and Assawadithalerd (2020) similarly showed that in European hospitals, hand hygiene compliance frequently exceeded 70% when training, infrastructure and supervisory reinforcement were present. Even within resource-constrained environments, variation is evident. Adebimpe (2018) reported that over half of Nigerian healthcare workers demonstrated satisfactory PPE use and sharps disposal practices, suggesting that leadership and targeted training can substantially improve behaviours despite systemic challenges. These differences indicate that poor practice in the present study cannot be attributed solely to individual negligence, but rather to institutional shortcomings that limit healthcare workers' ability to translate knowledge and attitudes into safe behaviours.

The disease-specific practices reported in this study reinforce this interpretation. Hepatitis B vaccination uptake was low, with most respondents failing to complete the three-dose series and few undergoing post vaccination antibody testing. HIV related practices were equally concerning: although knowledge of transmission risks was high, post exposure prophylaxis was rarely initiated, and needle recapping remained common. Tuberculosis precautions were also weak, with low adherence to N95 mask use, patient isolation and ventilation. By comparison, compliance with COVID-19 preventive measures was relatively stronger, particularly with respect to mask use and distancing, although still inadequate overall. This suggests that healthcare workers are more likely to adopt protective behaviours when risk is reinforced by global visibility, institutional emphasis and strong public health messaging. Where preventive measures rely primarily on individual initiative, as in the case of hepatitis B vaccination or HIV post-exposure prophylaxis, practice falters.

Viewed through the KAP framework, these results affirm that practice cannot be explained by knowledge alone. While knowledge provides the necessary foundation and attitudes shape intentions, practice is actualised only when supported by enabling environments. In this study, attitudes were a significant predictor of practice, whereas knowledge was not. This finding is

consistent with international evidence that attitudinal conviction, reinforced by systemic supports, is the critical determinant of compliance (Aluko *et al.*, 2016; Almutairi *et al.*, 2020). The stronger COVID-19 practices observed illustrate this point. They were not simply a product of biomedical knowledge but were driven by heightened perceived risk, institutional reinforcement and widespread public health campaigns that aligned attitudes with behaviour. Interventions must move beyond knowledge dissemination to embed structural reinforcements such as mandatory hepatitis B vaccination, routine TB screening and guaranteed access to PPE and post-exposure prophylaxis. Institutional systems must be strengthened to provide reliable supplies, accessible reporting mechanisms and supportive supervision. Workplace culture also plays a central role: role modelling by senior staff, peer accountability and non-punitive reporting systems are critical in normalising safe behaviours. This study therefore affirms the KAP model's central proposition that while knowledge informs and attitudes motivate, consistent and safe practices toward biological hazards emerge only when systemic reinforcements are firmly in place.

5.5 Relationship Between Knowledge, Attitudes, And Practices Regarding Biological Health Hazards Among Doctors and Nurses

The findings of this study reveal a complex relationship between knowledge, attitudes, and practices regarding biological health hazards among doctors and nurses. Although the majority of respondents demonstrated adequate knowledge, logistic regression analysis showed that knowledge alone was not a statistically significant predictor of good practice (OR = 1.25, 95% CI: 0.78–2.01, $p = 0.34$). This suggests that although healthcare workers are well informed about biological hazards, such knowledge does not automatically translate into consistent adoption of preventive practices. This outcome reflects a common knowledge-to-practice gap in healthcare settings, where workers may be familiar with correct procedures but fail to apply them due to systemic, cultural, or behavioral barriers (Aluko *et al.*, 2016; Ejeh *et al.*, 2020).

In contrast, attitudes were found to be a strong and significant predictor of safe practices. Healthcare workers who held positive attitudes were 2.45 times more likely to engage in proper infection prevention behaviors compared to those with negative attitudes (OR = 2.45, 95% CI: 1.40–4.28, $p = 0.002$). This finding aligns with studies conducted in Egypt and other countries, which demonstrate that positive attitudes toward infection prevention and occupational safety strongly influence compliance with standard precautions and protective practices (El-Mohamady and Ahmed, 2018). Similarly, a systematic review of healthcare workers' preparedness for biological threats emphasized that while knowledge is necessary, attitudes are the key drivers of behavioral outcomes, shaping whether or not safe practices are consistently adopted (Li *et al.*, 2023).

The mediation model tested in this study further reinforces this perspective. The results showed that knowledge significantly predicted attitudes, and in turn, attitudes significantly predicted practices, with both together accounting for 29 percent of the variance in preventive behaviors. These findings demonstrate that attitudes mediate the pathway from knowledge to practice, supporting the view that without positive attitudinal reinforcement, knowledge may remain theoretical rather than practical. Comparable results have been reported in studies of laboratory workers and other healthcare professionals, where attitudes were identified as the behavioral link between awareness and action (Almutairi *et al.*, 2020).

However, this study also revealed that despite 73 percent of respondents demonstrating positive attitudes, only 22 percent translated these attitudes into good practice. This apparent discrepancy may be explained by two key factors. First, the strength of positive attitudes was uneven across different hazards. Respondents were more favorable toward preventive measures for high profile infections such as TB and COVID-19 but expressed weaker attitudes toward Hepatitis B vaccination, HIV post exposure prophylaxis, and reporting of occupational exposures. Since these latter risks are more common in daily clinical work, the weaker attitudes

in these areas limited overall preventive practices. Second, structural and institutional barriers such as inconsistent supply of PPE, lack of enforcement of infection control guidelines, and inadequate post exposure support constrained healthcare workers from acting on their attitudes, even when these attitudes were positive. This study therefore highlights a persistent KAP gap: healthcare workers may know what to do, and may even agree that such practices are important, but their ability to implement them depends on both the strength of their attitudes across different risks and the presence of supportive institutional systems. Improving infection prevention and control therefore requires interventions that not only strengthen knowledge but also deepen attitudinal conviction and provide the institutional resources, policies, and supervision necessary to enable safe practices.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the summary of the study, the main conclusions drawn from the findings, and recommendations for practice, policy, and future research.

6.2 Summary of the Study

This study assessed the knowledge, attitudes, and practices (KAP) of doctors and nurses regarding biological health hazards at Ho Teaching Hospital in the Volta Region of Ghana. A total of 285 healthcare workers participated, including 248 nurses and 37 doctors.

The findings revealed that most respondents (85.3%) had adequate knowledge of biological hazards. However, technical knowledge gaps remained, particularly in areas such as HBV antibody titers, HIV window period, and differentiation between latent and active TB.

In terms of attitudes, majority of the respondents (73%) exhibited positive attitudes, especially toward TB and COVID-19 prevention, while more negative attitudes were observed regarding HBV and HIV. Factors such as years of experience, prior occupational exposure, and infection prevention training significantly predicted positive attitudes.

Regarding practices, only 22% of respondents demonstrated good infection prevention practices, while 78% reported poor compliance. Hand hygiene, glove use, safe sharps disposal, HBV vaccination uptake, and PPE use were suboptimal. Unsafe behaviors such as needle recapping and underreporting of exposures were common. Better compliance was noted with COVID-19 measures, reflecting heightened institutional emphasis.

6.3 Conclusions

This study set out to assess the knowledge, attitudes, and practices of doctors and nurses regarding biological health hazards at Ho Teaching Hospital. The findings demonstrated that

while healthcare workers possessed generally adequate knowledge and a majority expressed positive attitudes, their actual infection prevention and control practices were predominantly poor. This outcome reflects a persistent knowledge-to-practice gap, which has been documented in similar contexts.

The analysis revealed that knowledge alone did not significantly predict safe practices, while attitudes emerged as a strong determinant. However, the presence of overall positive attitudes did not translate directly into good practices. This apparent paradox can be explained by two interrelated factors. First, the strength of positive attitudes varied across hazards. Respondents expressed more favorable attitudes toward high-profile infections such as TB and COVID-19, but exhibited weaker attitudes toward Hepatitis B vaccination, HIV post-exposure prophylaxis, and exposure reporting. Since these latter hazards form a large part of everyday occupational risk, the weaker attitudinal orientations in these domains contributed to the poor overall practice scores. Second, structural and institutional barriers such as inconsistent PPE supply, inadequate enforcement of infection prevention protocols, underreporting of exposures, and limited supervisory support likely constrained healthcare workers from acting on their attitudes, regardless of their knowledge.

Thus, the study concludes that attitudes are indeed the critical mediator between knowledge and practice, but their influence is contingent upon supportive institutional systems. Knowledge provides the foundation, and attitudes shape intentions, but consistent safe practices emerge only when positive attitudes are reinforced by enabling environments. This finding underscores the need for a shift from knowledge-focused interventions toward integrated strategies that simultaneously enhance attitudes, strengthen institutional policies, and address systemic barriers. By highlighting the centrality of attitudes and the contextual limitations on their translation into practice, this study contributes to a more nuanced understanding of the KAP framework in occupational health and safety.

Recommendations

1. Hospital management and health authorities should strengthen institutional systems by ensuring consistent supply of PPE, strict enforcement of infection prevention and control protocols, and robust supervisory support to enable healthcare workers to act on their knowledge and positive attitudes.
2. Policy makers and the Ministry of Health (MOH) should design interventions that go beyond knowledge dissemination and actively foster sustained positive attitudes, particularly in everyday occupational risks such as Hepatitis B vaccination, HIV post-exposure prophylaxis, and exposure reporting.
3. Professional training institutions and medical educators should incorporate attitude-shaping modules and practical behavioral reinforcement strategies into curricula and in-service training, to bridge the gap between knowledge and practice.
4. Hospital Administrators, in corporation with regulatory bodies should integrate systemic reforms, including institutional accountability mechanisms, exposure reporting systems, and supportive workplace culture, to ensure that positive attitudes are translated into consistent safe practices.

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APPENDIX A: INTRODUCTORY LETTER

In case of reply the number
And the date of this
Letter should be quoted
My Ref. No. HTH/RPPME/
Your Ref. No....

Our Core Values:

- ☛ Commitment
- ☛ Accountability
- ☛ Dedication
- ☛ Integrity
- ☛ Professionalism
- ☛ Innovation
- ☛ Teamwork
- ☛ Safe Care



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30th July, 2025

Michael Boateng Darko
Assistant Registrar
Ensign Global University

RE: LETTER OF INTRODUCTION

In response to your letter seeking permission for **ChristLove Kafui Ganu** to conduct research titled: **"Assessment of Knowledge, Attitude and Practices in Biological Health Hazards among Nurses and Doctors in the Ho Teaching Hospital in the Volta Region of Ghana."** I hereby wish to inform you that the management of the hospital has granted the permission with the hope that she will abide by the following ethical guidelines and administrative requirements of the Hospital:

- Acquire an Ethical Clearance and submitted the same to the Research Department for an introduction letter to your research participants.
- Complete the HTH Research Coordination form.
- Provide proof of payment for Data collection and facility user fee when the study is about to begin.
- Submit a report to the Research Department when you complete your study.

The hospital hopes the study will help improve the quality of care and contribute to the knowledge and practice of healthcare in general.

Thank You.


[Simon Dzokoto]
Director, RPPME

APPENDIX B: INFORMED CONSENT FORM

Title of Study: Assessment of Knowledge, Attitudes, and Practices of Doctors and Nurses Regarding Biological Health Hazards at Ho Teaching Hospital, Volta Region, Ghana

Principal Investigator: Christ-Love Kafui Ganu

Institution: Ensign Global University

General Information about study

You are being invited to take part in a research study that seeks to understand how healthcare professionals perceive and practice safety precautions in relation to biological health hazards. This study is to assess the knowledge, attitudes, and practices (KAP) of healthcare providers regarding biological risks at Ho Teaching Hospital in the Volta Region of Ghana. The findings are expected to help identify gaps in behavior and inform future interventions that enhance infection prevention and occupational safety.

If you agree to participate, you will be asked to complete a structured questionnaire. This questionnaire has been pre-tested and will be administered digitally through the KoBoCollect platform. It will take approximately 15 to 20 minutes to complete. Your participation is entirely voluntary, and you may choose not to answer any question or to withdraw from the study at any point without any consequence to your employment or professional standing.

Risks/ Benefits of the study

There are no physical risks associated with participating in this study. However, you may skip any question you find uncomfortable. While you may not receive any direct benefit from participating, the knowledge gained from this research will contribute to improving workplace safety and infection control measures for all healthcare workers at the hospital.

Confidentiality

Your responses will remain strictly confidential and anonymous. No personal identifiers will be used in reporting the results, and all data will be securely stored and accessed only by the research team.

Compensation

There is no monetary compensation for participating. However, your time and input are deeply appreciated.

Voluntary Participation/ Withdrawal

Participation in this study is entirely voluntary. You may withdraw at any point without giving a reason, and without any consequences to your care or services received.

Additional Information

By signing this consent form, you affirm that you have read and understood the information provided above. You understand that your participation is voluntary and that you may withdraw at any time without penalty. You also understand that your responses will be used only for academic and public health research purposes, with full respect for your privacy and confidentiality.

Contact for Additional Information

If you have any questions regarding this study, you may contact:

Principal Investigator: Christ-Love Kauai Ganu

Phone: 0244996624

Participant's Details

Participant's Signature/Thumbprint: _____

Date: _____

Researcher's Details

Researcher's Name: _____

Researcher's Signature: _____

Date: _____

APPENDIX C: DATA COLLECTION FORM

Questionnaire for Data Collection

Title: Assessment of Knowledge, Attitudes, and Practices in Biological Health Hazards among Nurses and Doctors at Ho Teaching Hospital, Volta Region, Ghana

Section A: Demographic Information

1. Age: ___ years
2. Gender: Male Female Other
3. Marital Status: Single Married Divorced Widowed
4. Professional Cadre: Nurse Doctor
5. Highest Qualification: Diploma Bachelor's Master's Other: ____
6. Years of Professional Experience: <1 1–5 6–10 >10
7. Department/Unit: Emergency ICU Medical Surgical Maternity Other:

8. Have you received formal training in infection prevention and control? Yes No
9. Have you experienced an occupational exposure (e.g., sharps injury, splash)? Yes
 No

Section B: Knowledge of Biological Hazards

B1: General Biological Hazards (12 Questions)

(Choose one correct answer)

1. Which of the following best describes “biological hazards” in healthcare?
 - a) Chemical substances []
 - b) Infectious agents (e.g., viruses, bacteria) []
 - c) Radiation []
 - d) Sharp instruments []

2. Which is the most common occupational route of infection for doctors and nurses?
 - a) Handshakes []
 - b) Needle-stick injuries []
 - c) Air-conditioning systems []
 - d) Food consumption in wards []
3. Which is NOT a standard precaution in infection prevention and control?
 - a) Hand hygiene []
 - b) Consistent use of PPE []
 - c) Safe waste disposal []
 - d) Recapping used needles []
4. Which PPE is MOST appropriate for preventing bloodborne exposure?
 - a) Gloves []
 - b) Hairnet []
 - c) Apron only []
 - d) Surgical mask []
5. Which biological hazard requires vaccination for protection?
 - a) HIV []
 - b) Hepatitis B []
 - c) Tuberculosis []
 - d) Malaria []
6. How soon should a healthcare worker report an occupational exposure?
 - a) Immediately []
 - b) Within 24 hours []
 - c) Within 1 week []
 - d) After symptoms develop []

7. Which environmental factor increases the risk of airborne transmission (TB, COVID-19)?
- a) Poor ventilation []
 - b) Bright lighting []
 - c) Wide corridors []
 - d) Closed doors []
8. Universal precautions should be applied:
- a) Only to known infected patients []
 - b) Only in surgical units []
 - c) To all patients regardless of diagnosis []
 - d) Only when PPE is available []
9. Which of these is the correct method for sharps disposal?
- a) Recapping before disposal []
 - b) Burning in open pits []
 - c) Discarding in safety boxes []
 - d) Placing in household bins []
10. Post-exposure prophylaxis (PEP) is available for:
- a) Malaria []
 - b) HIV and Hepatitis B []
 - c) COVID-19 []
 - d) Tuberculosis []
11. Standard infection prevention and control measures include:
- a) Relying on immunity []
 - b) Vaccination, PPE, waste management, hand hygiene []
 - c) Cleaning only after visible contamination []

- d) Delegating safety to infection officers []
12. Healthcare workers with open wounds should:
- a) Continue duties without protection []
 - b) Cover wound with waterproof dressing []
 - c) Avoid hand hygiene []
 - d) Wear a mask only []

B2: Hepatitis B

13. How many doses of the Hepatitis B vaccine provide full protection?
- a) One []
 - b) Two []
 - c) Three []
 - d) Four []
14. Which of the following is a serious complication of chronic HBV infection?
- a) Hypertension []
 - b) Liver cirrhosis []
 - c) Pneumonia []
 - d) Malaria []
15. The minimum protective antibody level (anti-HBs) after HBV vaccination is:
- a) 1 mIU/mL []
 - b) 10 mIU/mL []
 - c) 100 mIU/mL []
 - d) 500 mIU/mL []
16. Which is the correct action after an HBV-related sharps injury?
- a) Wash wound, report immediately, consider PEP []
 - b) Wait for symptoms []

c) Ignore if vaccinated []

d) Use antibiotics []

17. HBV can be transmitted through:

a) Blood and body fluids []

b) Airborne droplets []

c) Sharing food []

d) Mosquito bites []

B3: HIV (5 Questions)

18. The recommended time frame for initiating PEP after HIV exposure is:

a) Within 1 week []

b) Within 72 hours []

c) After symptoms develop []

d) Within 30 days []

19. Which of the following is NOT a transmission route for HIV?

a) Sharing needles []

b) Blood transfusion []

c) Casual contact (e.g., handshakes) []

d) Unprotected sexual contact []

20. Which drug regimen is typically used for HIV PEP?

a) Antibiotics []

b) Antiretroviral therapy (ART) []

c) Antimalarials []

d) Vitamins []

21. HIV can be prevented through:

a) Vaccination []

b) Consistent condom use []

c) Eating well []

d) Using herbal remedies []

22. The HIV window period refers to:

a) The period after exposure when tests may not detect infection []

b) The time HIV survives in the air []

c) The period of symptoms []

d) The time ART is most effective []

B4: Tuberculosis (5 Questions)

23. TB is caused by:

a) Virus []

b) Fungus []

c) Bacterium (*Mycobacterium tuberculosis*) []

d) Parasite []

24. The primary mode of TB transmission is:

a) Droplet nuclei in the air []

b) Casual contact []

c) Blood transfusion []

d) Food []

25. Which PPE is recommended for TB prevention?

a) Gloves []

b) Surgical mask []

c) N95 respirator []

d) Apron []

26. A patient with suspected TB should be:

- a) Discharged home []
- b) Isolated in a well-ventilated room []
- c) Placed in general wards []
- d) Treated without precautions []

27. Latent TB differs from active TB because:

- a) Latent TB is not infectious []
- b) Active TB has no symptoms []
- c) Latent TB requires no follow-up []
- d) Active TB cannot be treated []

B5: COVID-19 (5 Questions)

28. COVID-19 is primarily transmitted via:

- a) Blood []
- b) Respiratory droplets []
- c) Mosquitoes []
- d) Food []

29. Which of the following is a common symptom of COVID-19?

- a) Cough and fever []
- b) Skin rash []
- c) Jaundice []
- d) Red eyes []

30. The main purpose of COVID-19 vaccination is to:

- a) Prevent all infections completely []
- b) Reduce severity and complications []
- c) Replace PPE use []
- d) Cure already infected patients []

31. Effective COVID-19 prevention includes:

- a) Hand hygiene, masking, ventilation []
- b) Eating herbs []
- c) Only antibiotics []
- d) Avoiding vaccination []

32. Healthcare workers should wear which mask type during COVID-19 patient care?

- a) Cloth mask []
- b) Medical mask or N95 []
- c) No mask needed []
- d) Surgical cap []

Section C: Attitudes Toward Biological Hazards

(5-point Likert scale: Strongly Agree = 5 → Strongly Disagree = 1)

👉 For **Attitudes**, the same applies but with **agreement** instead of frequency:

5-point Likert scale: Strongly Agree = 5 → Strongly Disagree = 1

Response option	Score
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

C1: General Biological Hazards

1. Healthcare workers are at high risk of biological hazards in the hospital.
2. Proper use of PPE protects against most biological hazards.
3. Hand hygiene is essential in preventing biological hazard transmission.

4. Reporting occupational exposures improves healthcare worker safety.
5. My hospital provides adequate support for managing biological hazards.

C2: Hepatitis B

6. I am at high risk of Hepatitis B infection due to my work.
7. Hepatitis B vaccination is essential for all healthcare workers.
8. HBV vaccination should be mandatory for doctors and nurses.
9. I feel adequately protected from HBV because of vaccination programs.
10. I am comfortable providing care to patients with Hepatitis B.

C3: HIV

11. I am at high risk of contracting HIV at work.
12. Immediate initiation of PEP reduces the risk of HIV infection.
13. HIV-positive patients pose a high occupational risk to healthcare workers.
14. I feel confident that universal precautions protect me from HIV.
15. I am comfortable caring for patients living with HIV.

C4: Tuberculosis (TB)

16. I am at high risk of TB infection at work.
17. Consistent use of N95 masks reduces TB transmission.
18. TB patients should always be isolated in well-ventilated rooms.
19. I feel adequately protected by my hospital's TB infection control policies.
20. I am comfortable caring for patients with TB.

C5: COVID-19

21. I am at high risk of COVID-19 infection at work.
22. COVID-19 vaccination protects against severe illness.
23. PPE is essential when managing COVID-19 patients.
24. I feel adequately protected by hospital measures against COVID-19.

25. I am comfortable caring for patients with COVID-19.

Section D: Practices in Infection Prevention and Control

(5-point Likert scale: Always = 5 → Never = 1)

Here's the exact coding:

Response option	Score
Always	5
Often	4
Sometimes	3
Rarely	2
Never	1

D1: General Biological Hazards

26. I wash my hands before and after every patient contact.

27. I use gloves when handling blood or body fluids.

28. I dispose of sharps in safety boxes immediately after use.

29. I report all occupational exposures (sharps, splashes).

30. I participate in hospital infection prevention trainings.

D2: Hepatitis B

31. I have received at least one dose of the Hepatitis B vaccine.

32. I have completed the full 3-dose HBV vaccination schedule.

33. I check my Hepatitis B antibody status (anti-HBs) after vaccination.

34. I use gloves when handling blood to reduce HBV risk.

35. I encourage colleagues to get vaccinated against HBV.

D3: HIV

36. I follow universal precautions when caring for patients with HIV.

- 37. I initiate HIV PEP promptly after occupational exposure.
- 38. I consistently use PPE when managing patients with suspected HIV.
- 39. I avoid needle recapping to reduce HIV exposure risk.
- 40. I participate in regular HIV infection prevention training.

D4: Tuberculosis (TB)

- 41. I use N95 respirators when attending to TB patients.
- 42. I isolate or mask coughing patients suspected of TB.
- 43. I ensure good ventilation when caring for TB patients.
- 44. I complete TB screening when exposed to a TB patient.
- 45. I educate patients and families on cough etiquette to prevent TB spread.

D5: COVID-19

- 46. I wear a medical mask during patient care in COVID-19 wards.
- 47. I practice physical distancing where possible at work.
- 48. I follow ventilation protocols in COVID-19 wards.
- 49. I have received at least one dose of a COVID-19 vaccine.
- 50. I use appropriate PPE when caring for suspected COVID-19 patients.

APPENDIX D: ETHICAL CLEARANCE



OUR REF: ENSIGN/IRB/EL/SN-295/03
YOUR REF:

August 4, 2025

INSTITUTIONAL REVIEW BOARD SECRETARIAT

Christ-Love Kafui Ganu
Ensign Global University
Kpong.

Dear Christ-Love,

ETHICAL CLEARANCE TO UNDERTAKE POSTGRADUATE RESEARCH

At the General Research Proposals Review Meeting of the *INSTITUTIONAL REVIEW BOARD (IRB)* of Ensign Global University held on Friday, August 1, 2025, your research proposal entitled "**Assessment of Knowledge, Attitude, and Practices in Biological Health Hazards Among Nurses and Doctors in the Ho Teaching Hospital in the Volta Region of Ghana**" was considered.

You have been granted Ethical Clearance to collect data for the said research under academic supervision within the IRB's specified frameworks and guidelines.

We wish you all the best.

Sincerely,

A handwritten signature in black ink, appearing to read 'Rebecca Acquah-Arhin', with a flourish at the end.

Dr. (Mrs.) Rebecca Acquah-Arhin
IRB Chairperson

APPENDIX E: PLAGIARISM SCORE

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