***Original Research Article***

**Evaluation of Biosafety Protocol and Assessment of Knowledge, Attitude and Practice of Health Attendants at Federal Neuropsychiatric Hospital, Benin City, Edo State, Nigeria.**

**ABSTRACT**

**Background:** Biosafety in healthcare settings is essential for preventing the acquisition of healthcare-associated infections (HAIs) and protecting patients and healthcare workers. The effectiveness of biosafety protocols depends on the Knowledge, Attitudes, and Practices (KAP) of healthcare workers.

**Aim:** This study aimed to assess the KAP regarding biosafety protocols among health attendants at the Federal Neuropsychiatric Hospital (FNPH) in Benin City, Edo State, Nigeria.

**Methodology:** Data was collected from 100 health attendants using a self-administered questionnaire covering infection control, awareness, training, personal protective equipment (PPE) use, and policy existence. The study was conducted with informed consent and ethical approval.

**Results:** The results showed a generally positive understanding of biosafety, with high awareness of its importance (mean = 4.22) and proper PPE usage (mean = 4.37). However, respondents were uncertain about the effectiveness of biosafety protocols in reducing infections (mean = 3.17). Attitudes toward biosafety were mixed (mean = 3.41), indicating indecision, while adherence to protocols varied (mean = 3.41).

**Conclusion:** The study identified key factors influencing adherence, such as insufficient reporting systems and inconsistent training (mean = 3.16). The findings suggest that while health attendants have good awareness and understanding of biosafety protocols, there are gaps in adherence. Recommendations to improve adherence include regular reminders, enhanced monitoring, prioritizing biosafety across departments, and enforcing consequences for non-compliance. The study emphasizes the need for continuous training, institutional support, and a proactive approach to ensure effective biosafety practices in healthcare settings.

**Keywords:** Biosafety, Healthcare-Associated Infections (HAIs), Knowledge, Attitude and Practice(KAP), Health Attendants.

1. **INTRODUCTION**

Biosafety is a discipline that focuses on the safe handling and containment of infectious microorganisms and hazardous biological materials (Bajjou *et al.,* 2019). It describes the use of specific practices, training, safety and equipment to protect the worker, community and environment from an accidental exposure or unintentional release of infectious pathogens (Bajjou *et al.,* 2019).

Biosafety protocols are essential guidelines and procedures designed to protect healthcare workers, patients, and the environment from exposure to infectious agents and hazardous biological materials. In healthcare settings, particularly in specialized institutions like neuropsychiatric hospitals, implementing and adhering to robust biosafety protocols is critical to minimizing the risk of infection transmission and ensuring a safe working environment (Oluwatosin, 2016). Key Elements of Biosafety Protocols include: Standard Precautions (Taneja et al., 2018), Personal Protective Equipment (PPE) (Olum *et al.,* 2020). Transmission-Based Precautions (Taneja *et al.,* 2018), Droplet Precautions (Olum *et al.,* 2020), Airborne Precautions (Taneja *et al.,* 2018), Infection Control Practices etc. It is an important issue in healthcare settings worldwide and can be especially challenging for developing countries. In recent years, research on infectious pathogens has been on the rise due to the emergence and re-emergence of new and previously identified infectious agents and diseases (Bajjou *et al.,* 2019).

The concept of biosafety and the establishment of Biosafety level (BSL) guidelines have been the foundation of safety practices in health care institutions since the 1970s when the National Institutes of Health (NIH) in collaboration with the Centers for Disease Control and Prevention (CDC) published the first comprehensive biosafety guidelines to address the safe handling of biological agents. Over the years, these guidelines have been revised and updated to reflect current best practices. (CDC and NIH, 2016).

Today, biosafety protocols are guided by both national and international standards, reflecting a comprehensive approach to managing biological risks in research and clinical settings International Organization for Standardization (ISO, 2021).

Healthcare workers are people engaged in work actions whose primary intent is to improve health. They are the backbone of any functioning health system (WHO, 2021).

Healthcare workers (HCWs) are at the frontline of implementing Biosafety measures. Their knowledge, attitudes, and practices (KAP) directly impact the effectiveness of these protocols. Studies have shown that adequate knowledge and positive attitudes towards Biosafety are associated with better adherence to safety practices (Olum *et al.,* 2020). Conversely, gaps in knowledge or negative attitudes can lead to poor compliance and increased risk of infection transmission (Zhan *et al.,* 2017).

Globally, improving the health, safety and well-being of health workers lowers the costs of occupational harm (estimated at up to 2% of health spending) and contributes to minimizing patient harm (estimated at up to 12% of health spending) (Bienassis *et al.,* 2021). In Nigeria, the healthcare system faces numerous challenges, including limited resources, insufficient training, and varying levels of awareness regarding biosafety (Amoran *et al.,* 2013).

Health attendants, who encompass a diverse group of healthcare professionals, play a vital role in patient care and safety maintenance within healthcare institutions. Well-structured Biosafety protocols and intervention processes can help protect this cadre of healthcare providers and reduce possible pollution of the environment (Langchel *et al.,* 2016).

Previous research in other healthcare settings within Nigeria has highlighted significant gaps in the KAP of healthcare workers regarding biosafety (Oluwatosin, 2016; Sadoh *et al.,* 2016). However, there is a paucity of data specifically focused on Neuropsychiatric hospitals. This study aims to bridge this gap by evaluating the biosafety protocols, knowledge, attitudes, and practices among health attendants working in the Federal Neuropsychiatric Hospital in Benin City, Edo State, Nigeria.

1. **METHODOLOGY**

**2.1 Study Area and Design**

A descriptive cross-sectional survey was carried out among health attendants at the Federal Neuropsychiatric Hospital, Benin City, Edo State, Nigeria. Although these cadres may not be directly involved with patient care as skilled healthcare workers, they come in contact with hospital-generated wastes such as sharps and or soiled patient beddings in their routine work.

**2.2 Sample Size**

A total of 100 health attendants were used for the study. They were selected from 133 health attendants using the Taro Yamane (1967)

**2.3 Study Instrument (Questionnaires)**

Data were obtained using well-structured/self-administered questionnaires covering infection control, awareness, training, PPE usage, and policy existence, adopted from the occupational health and safety manual checklist. The distribution and retrieval of the questionnaires were closely monitored with support from a research assistant. Participants were given assistance during questionnaire completion to ensure clarity and 100% response rate. Demographic data such age, sex, cadre and work station were taken from each respondent. Study purpose was explained to each respondent and informed consent was obtained before completion of the questionnaire.

**2.4 Ethical approval**

Ethical approval was obtained from the ethical board of FNPH, Benin with reference number PH/A.864/Vol.XXI/212.

**2.5 Statistical Analysis**

Data generated from the questionnaire were analyzed using simple descriptive statistics and chi-square to test the research hypothesis.

1. **RESULTS**

**Table 1: Socio-demographic characteristics of participants**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Frequency (N = 100)** | **Percentage**  **(%)** |  |
| **Age (years):** |  |  |  |
| 18 – 30 | 44 | 44.0 |  |
| 31 – 40 | 53 | 53.0 |  |
| 41 – 50 | 3 | 3.0 |  |
| **Gender:** |  |  |  |
| Male | 32 | 32.0 |  |
| Female | 68 | 68.0 |  |
| **Educational qualification:** |  |  |  |
|  |  |  |  |
| First school Leaving Certificate | 20 | 20.0 |  |
| Senior Secondary School Certificate | 52 | 52.0 |  |
| NCE/Diploma | 20 | 20.0 |  |
| HND/BSc | 8 | 8.0 |  |
| **Years of experience:** |  |  |  |
|  |  |  |  |
| < 5 years | 40 | 40.0 |  |
| 6 – 10 years | 16 | 16.0 |  |
| 11 – 15 years | 29 | 29.0 |  |
| 16 years & above | 15 | 15.0 |  |

Demographic findings from this study, as represented in Table 1, indicate that 68.0% of the respondents were females and 32.0% were males. 44.0% aged between 18 and 30 years, 53.0% between 31 and 40 years, while 3.0% fell within the age range of 41-50 years. 40% of the participants have less than 5 years of working experience in a mental health facility, while 15% have worked for 16 years or above. The highest educational qualification of respondents sampled was the senior secondary school certificate (52.0%).

**Figure 1: Work station/unit of Respondents**

Figure 1 shows work station/unit of respondents. 38.0% of respondents had their work schedules in the patients' ward, 20% at the emergency and assessment, while 8% in the Medical Laboratory.

**Table 2: Level of knowledge and Awareness of the Biosafety protocol.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statements** | **SA**  **(5)** | **A**  **(4)** | **U**  **(3)** | **D**  **(2)** | **SD**  **(1)** | **Total** | **Mean** | **STD** | **Decision** |
| 1 | Understanding the importance of biosafety in healthcare. | 40  (200) | 54  (216) | 0  (0) | 0  (0) | 6  (6) | 100  (422) | 4.22 | 0.949 | Agree |
| 2 | Awareness of the risk associated with inadequate biosafety practices. | 53  (265) | 30  (120) | 3  (9) | 10  (20) | 4  (4) | 100  (418) | 4.18 | 1.140 | Agree |
| 3 | Awareness of the proper use of PPE | 55  (275) | 36  (144) | 3  (9) | 3  (6) | 3  (3) | 100  (437) | 4.37 | 0.917 | Agree |
| 4 | Importance of biosafety protocol in ensuring the safety of both patients and health attendants in the hospital. | 46  (230) | 18  (72) | 10  (30) | 8  (16) | 18  (18) | 100  (366) | 3.66 | 1.552 | Agree |
| 5 | Impact of biosafety protocol on the overall hygiene and cleanliness of the hospital environment. | 35  (175) | 21  (84) | 20  (60) | 14  (28) | 10  (10) | 100  (357) | 3.57 | 1.358 | Agree |
| 6 | I have noticed a significant reduction in incidents of infections since the implementation of the biosafety protocol. | 19  (95) | 20  (80) | 35  (105) | 11  (22) | 15  (15) | 100  (317) | 3.17 | 1.288 | Undecided |
| 7 | I am aware of the proper way to dispose of biohazardous waste. | 39  (195) | 31  (124) | 6  (18) | 6  (12) | 18  (18) | 100  (367) | 3.67 | 1.491 | Agree |
|  |  |  |  |  |  |  |  |  |  |  |
|  | **Grand total** |  |  |  |  |  |  | **3.83** | **0.433** | **Agree** |

Cut-off Mean = 3.00 : N = 100

Table 2 shows the level of knowledge and awareness of Biosafety protocols amongst health attendants at the Federal Neuropsychiatric Hospital. With an average calculated mean of 3.83, respondents generally agree that they possessed a significant level of knowledge and awareness of the biosafety protocol thus acknowledging the importance of biosafety (mean = 4.22) but were however undecided whether there were noticeable reduction in incidence of infection (mean = 3.17).

**Table 3: Attitudes of Health Attendants towards implementation of Biosafety Protocol**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statements** | **SA**  **(5)** | **A**  **(4)** | **U**  **(3)** | **D**  **(2)** | **SD**  **(1)** | **Total** | **Mean** | **STD** | **Decision** |
| 1 | Observance of standard precautions while handling biohazardous materials. | 34  (170) | 20  (80) | 9  (27) | 19  (38) | 18  (18) | 100  (333) | 3.33 | 1.544 | Undecided |
| 2 | Confidence in ability to follow the biosafety protocol accurately. | 37  (185) | 28  (112) | 15  (45) | 8  (16) | 12  (12) | 100  (370) | 3.70 | 1.360 | Agree |
| 3 | Confidence in ability to handle bio hazardous materials safely. | 37  (185) | 18  (72) | 10  (30) | 18  (36) | 17  (17) | 100  (340) | 3.40 | 1.544 | Undecided |
| 4 | Strict adherence to biosafety protocols to prevent the spread of infections in the hospital. | 56  (280) | 0  (0) | 20  (60) | 6  (12) | 18  (18) | 100  (370) | 3.70 | 1.599 | Agree |
| 5 | Difficulty in prioritizing biosafety protocol. | 28  (140) | 21  (84) | 17  (51) | 18  (36) | 16  (16) | 100  (327) | 3.27 | 1.448 | Undecided |
| 6 | Willingness to speak up on non-adherence to biosafety protocols in the workplace by colleague | 9  (45) | 24  (96) | 31  (93) | 13  (26) | 23  (23) | 100  (283) | 2.83 | 1.280 | Undecided |
|  |  |  |  |  |  |  |  |  |  |  |
|  | **Grand total** |  |  |  |  |  |  | **3.41** | **0.314** | **Undecided** |

Cut-off Mean = 3.00 : N = 100

Table 3 shows attitudes of Health Attendants towards implementation of Biosafety Protocol

with an average calculated mean of 3.41, indicating that respondents were generally undecided in their attitude towards the implementation of the biosafety protocol in their work environment. They showed positive attitude in agreeing to following biosafety protocol accurately (mean = 3.70), and it essential for protection of both staff and patients (mean = 3.66) and lastly to prevent spread of infection (mean = 3.70).

**Table 4: Summary of Level of Adherence to Biosafety Protocols.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statements** | **SA**  **(5)** | **A**  **(4)** | **U**  **(3)** | **D**  **(2)** | **SD**  **(1)** | **Total** | **Mean** | **STD** | **Decision** |
| 1 | Use of personal protective equipment when in contact with patients**.** | 30  (150) | 23  (92) | 3  (9) | 13  (26) | 31  (31) | 100  (308) | 3.08 | 1.680 | Undecided |
| 2 | Adherence to biosafety protocol while carrying out duties as a health attendant in the hospital | 28  (140) | 36  (144) | 10  (30) | 0  (0) | 26  (26) | 100  (340) | 3.40 | 1.544 | Undecided |
| 3 | Observance of standard precautions at all times when handling patients | 40  (200) | 25  (100) | 7  (21) | 3  (6) | 25  (25) | 100  (352) | 3.52 | 1.624 | Undecided |
| 4 | Proper disinfection of equipment after use | 34  (170) | 22  (88) | 13  (39) | 0  (0) | 31  (31) | 100  (328) | 3.28 | 1.664 | Undecided |
| 5 | Washing of hands before and after contact with patients or their environment | 47  (235) | 20  (80) | 13  (39) | 12  (24) | 8  (8) | 100  (386) | 3.86 | 1.341 | Agree |
| 6 | Mandatory use of personal protective equipment by health attendants in the hospital. | 24  (120) | 27  (108) | 21  (63) | 18  (36) | 10  (10) | 100  (337) | 3.37 | 1.300 | Undecided |
|  |  |  |  |  |  |  |  |  |  |  |
|  | **Grand total** |  |  |  |  |  |  | **3.41** | **0.241** | **Undecided** |

Cut-off Mean = 3.00 : N = 100

Table 4 Shows summary of Level of Adherence to Biosafety Protocols wsith an average calculated mean of 3.41 indicating that respondents were generally undecided about the level of adherence to the biosafety protocols in their daily activities. Although they agreed that they always wash hands before and after contact with patients or their environment (mean = 3.86).

**Table 5: Factors That Influence Adherence to Biosafety Protocol.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statements** | **SA**  **(5)** | **A**  **(4)** | **U**  **(3)** | **D**  **(2)** | **SD**  **(1)** | **Total** | **Mean** | **STD** | **Decision** |
| 1 | The availability of a reporting system for any breach of the biosafety protocol encourages adherence to the procedure | 14  (70) | 13  (52) | 14  (42) | 25  (50) | 34  (34) | 100  (248) | 2.48 | 1.432 | Undecided |
| 2 | The hospital management provides incentives that motivate health attendants to follow the biosafety protocol | 23  (115) | 20  (80) | 17  (51) | 20  (40) | 20  (20) | 100  (306) | 3.06 | 1.462 | Undecided |
| 3 | The adherence to the biosafety protocol by health attendants in the hospital has a significant impact on patient care and outcomes | 52  (260) | 15  (60) | 12  (36) | 3  (6) | 18  (36) | 100  (380) | 3.80 | 1.537 | Agree |
| 4 | I feel safe and protected while using PPE provided by the hospital management | 45  (225) | 28  (80) | 10  (30) | 4  (8) | 13  (26) | 100  (388) | 3.88 | 1.373 | Agree |
| 5 | The hospital management provides adequate support for health attendants who report any biosafety violations or incidents | 10  (50) | 20  (80) | 22  (66) | 31  (62) | 17  (17) | 100  (275) | 2.75 | 1.242 | Undecided |
| 6 | There are enough training and refresher programs on biosafety for health attendants in the hospital | 28  (140) | 16  (64) | 20  (60) | 23  (46) | 13  (13) | 100  (323) | 3.23 | 1.413 | Undecided |
| 7 | Safety guidelines and protocols are regularly enforced by the hospital management for the benefit of health attendant | 13  (65) | 18  (72) | 24  (72) | 38  (76) | 7  (7) | 100  (292) | 2.92 | 1.169 | Undecided |
|  |  |  |  |  |  |  |  |  |  |  |
|  | **Grand total** |  |  |  |  |  |  | **3.16** | **0.521** | **Undecided** |

Cut-off Mean = 3.00 : N = 100

Table 5 shows factors that influence adherence to biosafety protocol. With an average calculated mean of 3.16, indicating that respondents were generally undecided about the factors that influence adherence to the biosafety protocol but they agreed to the factors that adherence to biosafety protocol has significant impact on patient’s care and outcome (mean = 3.80). Another factor agreed on was that they felt safe and protected while using PPE (mean = 3.88).

**Table 6: Recommendations to improve the implementation and Adherence to Biosafety Protocols.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statements** | **SA**  **(5)** | **A**  **(4)** | **U**  **(3)** | **D**  **(2)** | **SD**  **(1)** | **Total** | **Mean** | **STD** | **Decision** |
| 1 | I would feel more confident in the workplace if there were regular reminders and reinforcement of biosafety protocols given by management | 38  (180) | 18  (72) | 20  (60) | 7  (14) | 19  (19) | 100  (345) | 3.45 | 1.507 | Undecided |
| 2 | I believe that there should be regular monitoring and evaluation of adherence to biosafety protocols in the workplace | 43  (215) | 25  (100) | 8  (24) | 9  (18) | 15  (15) | 100  (372) | 3.72 | 1.471 | Agree |
| 3 | I believe that the hospital management should provide regular training to health attendants on the proper use PPE | 34  (170) | 36  (144) | 13  (39) | 9  (18) | 8  (8) | 100  (379) | 3.79 | 1.233 | Agree |
| 4 | I believe that the hospital management should prioritize the implementation of the biosafety protocol in all departments of the hospital | 60  (300) | 9  (36) | 10  (30) | 3  (6) | 18  (18) | 100  (390) | 3.90 | 1.567 | Agree |
| 5 | I think that there should be consequences for health attendants who do not follow biosafety protocols in the workplace | 52  (260) | 26  (104) | 7  (21) | 11  (22) | 4  (4) | 100  (411) | 4.11 | 1.180 | Agree |
|  |  |  |  |  |  |  |  |  |  |  |
|  | **Grand total** |  |  |  |  |  |  | **3.79** | **0.242** | **Agree** |

Cut-off Mean = 3.00 : N = 100

Table 6 shows an average calculated mean of 3.79, indicating that respondents generally agree to the recommendations for improving the implementation and adherence of biosafety protocols n the Federal Neuropsychiatric Hospital in Benin.

1. **DISCUSSION**

Table 1 shows the socio-demographic profile of health attendants in this study and highlights important contextual factors influencing their knowledge, attitudes, and practices (KAP) regarding biosafety in a mental health institution. The workforce was predominantly female (68.0%) and relatively young (53.0% being between the age of 31-40), with many participants (40%) having less than five years of experience and 52.0% holding secondary-level educational qualifications. This profile mirrors patterns observed in mental health service delivery across sub-Saharan Africa, where auxiliary staff often constitute the frontline of care but lack formal training in biosafety and infection prevention (Ogunsemi *et al.,* 2018). Also, the predominance of less-experienced staff and those with limited formal education pose a critical implication for biosafety practices. Prior research shows that inadequate training and low educational attainment are key barriers to effective infection prevention and control (IPC), particularly in resource-constrained mental health settings (Gureje et al., 2015).

Table 2 reflects a generally positive understanding of Biosafety protocols among health attendants. A high mean score for recognizing the importance of Biosafety (4.22) aligns with global literature emphasizing its role in protecting healthcare workers and patients (Bajjou *et al.,* 2019; WHO, 2020). Respondents also showed strong awareness of infection risks (mean = 4.18) and proper use of PPE (mean = 4.37), underscoring the effectiveness of education and training (Haile *et al.,* 2017). However, uncertainty remains regarding the protocols’ impact on infection reduction (mean = 3.17), consistent with findings from Yemen, Togo, and Ghana, where knowledge did not always translate into practice (Nabil *et al.,* 2017; Halatoko *et al.,* 2019; Barnie *et al.,* 2019). Knowledge on biohazard waste disposal was moderately positive (mean = 3.67), indicating room for improvement and the need for continued training and reinforcement of Biosafety practices.

Table 3 reveals mixed attitudes among health attendants toward Biosafety protocols, with a grand mean of 3.41 indicating general indecision. While respondents showed confidence in following protocols (mean = 3.70) and acknowledged their importance in infection prevention (mean = 3.66), uncertainty remained around consistent application and safe handling of biohazardous materials (mean = 3.33 and 3.40, respectively), likely due to training gaps (Haifaa *et al.,* 2022). Challenges in prioritizing Biosafety amidst other duties (mean = 3.27) and reluctance to report non-compliance (mean = 2.83) suggest systemic and cultural barriers. These findings underscore the need for targeted training, simplified procedures, and a supportive reporting culture to enhance adherence (Jiee *et al.,* 2021; Damschroder *et al.,* 2020).

Table 4 reflects varying levels of self-reported adherence to Biosafety protocols, with an overall mean score of 3.41, indicating general indecision. While hand hygiene showed the highest compliance (mean = 3.86), consistent with WHO guidelines (2009), lower scores for PPE usage (mean = 3.08) and strict enforcement (mean = 3.37) raise concerns about protective measures. Similarly, moderate scores for equipment disinfection (mean = 3.28) and handling of biohazardous materials (mean = 3.33) point to inconsistent adherence, often attributed to time constraints and resource limitations (Shahid *et al.,* 2019). Standard precautions had a relatively higher adherence (mean = 3.52), suggesting partial compliance. These findings emphasize the need for continuous training, improved resource availability, and institutional support to strengthen Biosafety practices (Pittet *et al.,* 2006; Zhang *et al.,* 2024).

Table 5 reveals a general indecision among health attendants at the Federal Neuropsychiatric Hospital, Benin, regarding factors influencing adherence to Biosafety protocols (average mean = 3.16). While high scores for the impact of adherence on patient care (mean = 3.80) and the perceived safety of PPE (mean = 3.88) indicate some awareness, the findings highlight the need for improvements particularly in establishing accessible reporting systems and fostering a culture of safety (Stavropoulou *et al.,* 2015).

Table 6 indicates strong agreement (mean = 3.79) with proposed recommendations to improve Biosafety adherence. Respondents supported regular reminders (Miller *et al.,* 2020), systematic monitoring and evaluation (mean = 3.72; Baker *et al.,* 2018), continuous PPE training (mean = 3.79; Michaels *et al.,* 2009), and hospital-wide implementation of protocols (mean = 3.90; Zohar and Luria, 2005). The highest consensus was on the need for accountability measures (mean = 4.11), reinforcing that clear consequences can drive better compliance (Gulacti *et al.,* 2020; Cameron *et al.,* 2018).

1. **CONCLUSION**

Findings from this study indicate that health attendants at the Federal neuropsychiatric hospital, Benin possess commendable level of awareness and knowledge regarding Biosafety protocols. However, there are notable gaps in the practical application and consistent enforcement of these protocols.

Addressing these gaps through continuous training and education, improved/increased resource availability and allocation, Biosafety policy development, strict implementation and adherence will foster confidence. The development of a strong institutional support culture, introduction of targeted interventions to address identified gaps will build confidence, encourage compliance and enhance workplace safety, minimize infection risk and contribute to better healthcare outcomes.

1. **LIMITATIONS OF THE STUDY**

Limitations noted during the course of this study included reliance on self-reported data from health attendants, which may have introduced response bias due to social desirability or recall inaccuracies as well as the cross-sectional design approach which limits the ability to establish causal relationships between awareness, attitudes, and adherence to biosafety protocols.

1. **RECOMMENDATIONS**

To enhance biosafety compliance among health attendants, we recommend regular training programs, consistent provision of personal protective equipment, and stronger institutional enforcement of protocols. Clear, accessible guidelines and targeted behavioral change communication should be implemented to improve awareness and attitudes. Additionally, incentive-based systems and inclusive strategies involving all healthcare cadres are crucial to fostering a culture of safety within the hospital environment.

**DECLARATION OF CONFLICTING INTERESTS**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

**REFERENCES**

Amoran, O. E. and Onwube, O. O. (2013).Infection Control and Practice of Standard Precautions among Healthcare Workers in Northern Nigeria. *Journal of Global Infectious Diseases****,* 5**(4):156-163.

Bajjou, T., Sekhsokh, Y., Amine, I. L. and Gentry-Weeks, C. (2019). Knowledge of Biosafety Among Workers in Private and Public Clinical and Research Laboratories in Morocco. *Applied Biosafety,* **24**(1): 46–54.

Barnie, P. A., Osei, S. A., Bioson, D., Akwetey, A. S.., Ampofo, D, P. and Demanya, E. M. (2019). Knowledge, Attitude and Adherence to Biosafety Practices among Clinicians of Tertiary Hospitals in Ghana.European. *Journal of Contemporary Rpesearch,* **8(**1): 329-336.

Baker, S. M. and Mapper, T. (2018). The Influence of Continuous Monitoring On the Compliance of Health Care Personnel with Safety Protocols. *Journal of Occupational Health Psychology,* **23**(3):383-395.

Bienassis, D. K., Slawomirski, L. and Klazinga, N. (2021). The economics of patient safety Part IV: Safety in the workplace: Occupational safety as the bedrock of resilient health systems, OECD Health Working Papers, No. 130. Available from: <https://econpapers.repec.org/RePEc:oec:elsaad:130-en>. Accessed on 13/05/2024.

Cameron, L. D. and Leventhal, H. (2018). Compliance: The Role of Social Support and Health Motivation. *Health Psychology Review,* **12**(2):173-182.

Centers for Disease Control and Prevention (CDC) & National Institutes of Health (NIH). (2016). Biosafety in microbiological and biomedical laboratories (6th ed.). U.S. Department of Health and Human Services. pp 24-31.

Cohen, J. S., Schneider, A. and Dubin, A. (2018). Real-Time Monitoring of Infection Control Practices in Healthcare Settings: The Impact of Accountability. *American Journal of Infection Control,* **46**(6):657-662.

Gureje, O., Lasebikan, V. O., Ephraim-Oluwanuga, O., Olley, B. O. and Kola, L. (2015). Community study of knowledge of and attitude to mental illness in Nigeria. British Journal of Psychiatry, 186: 436–441.

Haifaa, M. M., Wajdan, A., Mohammad, A. A., Muna, A. and Abdulaziz, B. (2022). Role of Health Simulation Training in Response to Pandemic Crises in General and COVID-19 Specifically. *Archives of Clinical and Biomedical Research,* **6:** 184-195.

Halatoko, A. W., Sondou, E., Sopoh, G. E., Kassegne, A., Katawa, G., Salou, M., Karou, S, D. and Ouendo, E. (2024). Knowledge, Attitudes and Practices in Biosafety and Biosecurity in Medical Biology Laboratories in Togo, 2021. *Frontiers of Enviromental Health,* **3**:1387476.

Halie, G. T., Haileselassie, E. and Abodo, A. A. (2017).Compliance with Standard Precautions and Associated Factors among Health Care Workers in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia. *Journal of Enviromental and Public Health,* 2017:2050635.

International Organization for Standardization (ISO). (2021). ISO 35001:2021 Biological safety management systems. ISO. https://www.iso.org/standard/71293.html. accessed on 13/05/2024

Jiee, S. F., Jantim, A., Mohamed, A. F. and Emiral, M. E. (2021). COVID‐19 Pandemic: Determinants of Workplace Preventive Practice among Primary Healthcare Workers in Sabah, Malaysia. *Journal of Preventive Medicine and Hygiene,* **62**(3):605.

Langchel, M. D., Feyisayo, J. and Abdulrasheed, U. (2016).Knowledge of Auxiliary Healthcare Workers on Injection Safety and Biological Waste Handling in Taraba State, Nigeria.*Texila International Journal of Public Health****,* 4** (4).

Michaels, D. and Berenholtz, S. (2009). Improving Safety in the Healthcare Setting Through Continuous Education and Leadership. *American Journal of Medical Quality,* **24**(3):184-192.

Miller, J. W. and Kamp, M. (2020). The Role of Leadership in Sustaining Safety Culture in Healthcare. *International Journal for Quality in Health Care,* **32**(5): 269-275.

Nabil, A. N., Gunaid, E., Moghram, G., Al-Hababi, A. A., Al-Serouni, A. and Khader, Y. S. (2017).Knowledge,and practices of Biosafety among Laboratory Staff Working in Clinical Laboratories in Yemen. *Applied Biosafety,* **22**:168-171.

Nicolini, D. and McKeown, M. (2011). The Role of Leadership in Promoting Safety Culture: A Systematic Review of the Evidence. *International Journal of Health Policy and Management,* **1**(1):1-10.

Nsengimana, V. J. P. and Raphela, S. F. (2024). Knowledge, Attitudes and Perceptions about Occupational Hazards and the Use of Safety Measures among Healthcare Workers in a Teaching Hospital in Rwanda. *African Journal of Biomedical Research****,* 2**(7):13- 19.

Ogunsemi, O., Adeyemi, J., & Ogunlesi, A. O. (2018). Profile of mental health service providers in selected psychiatric facilities in Nigeria. Nigerian Journal of Psychiatry, 16(2):67–72.

Olum, R., Chekwech, G., Wekha, G., Nassozi, D. R. and Bongomin, F. (2020). Coronavirus Disease-2019: Knowledge, Attitude, and Practices of Health Care Workers at Makerere University Teaching Hospitals, *Uganda. Frontiers in Public Health****,* 8**:181.

Oluwatosin, O. A. (2016). Compliance with Standard Precautions by Nurses in a Tertiary Hospital, Ibadan, Nigeria. *Journal of Infection Prevention,* **17**(5):214-219.

Pittet, D., Allegranzi, B., Storr, J. and Donaldson, L. J. (2006).The Global Patient Safety Challenge 2005 – 2006: ‘’Clean Care is Safer Care’’. International Journal of Infectious Diseases, **10**(6):419-424.

Sadoh, W. E., Fawole, A. O., Sadoh, A. E., Oladimeji, A. O. and Sotiloye, O. S. (2016). Practice of Universal Precautions among Healthcare Workers. *Journal of the National Medical Association,* **98**(5): 722-726.

Salwa, M., Haque, M., Islam, S. S., Islam, T. M., Sultana, S., et al., (2022). Compliance of Healthcare Workers with the Infection Prevention and Control Guidance in Tertiary Care Hospitals: Quantitative Findings from an Explanatory Sequential Mixed-Method Study in Bangladesh. *British Medical Journal,* **12**(6):e05487.

Schneider, A., Williams, A. and Geller, E. S. (2017).Developing a Safety Behavior Enhancement Program: Lessons from the Field. *Journal of Healthcare Management,* **62**(2): 142-156.

Stavropoulou, C., Doherty, C. and Tosey, P. (2015). How Effective are Incident Reporting Systems for Improving Patient Safety? A Systematic Literature Review. *The Milbank Quarterly Logo,*  93(4):826-866.

Taneja, J., Mishra, B., Saini, M. and Sharma, M. (2018).Evaluation of Knowledge, Attitude, and Practices of Biosafety among Laboratory Workers. *International Journal of Current Microbiology and Applied Sciences****,* 7**(1):1182-1192.

Weldetinsae, A., Alemu, Z. A., Tefaye, K., Gizaw, M., Alemahyehu, E., Tayachew, A., Derso, S., et al., (2023). Adherence to Infection Prevention and Control Measures and Risk of Exposure among Health‐Care Workers: A Cross‐Sectional Study from the Early Period of COVID‐19 Pandemic in Addis Ababa, Ethiopia. *Health Science,* **6**(6):1365.

World Health Organization. (2020). WHO Guidelines on Hand Hygiene in Health Care. World Health Organization. https://www.who.int/teams/integrated-health-services/infection-prevention-control/hand-hygiene. Accessed 13/05/2024

Zhan, Y., Zheng, H., Wen, D., Zhao, Y. and He, Y. (2017). Factors Associated with Healthcare Workers' Compliance with Standard Precautions in a Hospital in China. *Journal of Hospital Infection,* **96**(3): 328-336.

Zhang, M., Wu, S., Ibrahim, I. M., Noor, M. S. S. and Mohammad, Z. M. (2024). Significance of Ongoing Training and Professional Development in Optimizing Healthcare-Associated Prevention and Control. *Journal of Medical Signals and Sensors,* **14**:13.

Zohar, D. and Luria, G. (2005). A Multilevel Model of Safety Climate: Cross-Level Relationships between Organization and Group-Level Climates*. Journal of Applied Psychology,* **90**(4): 616-628.