

# Knowledge and Practices on Biosafety among Medical Technologists in Ilocos Sur

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**Abstract.** This descriptive correlational study aimed to assess the level of knowledge and practices on biosafety among Medical Technologists, with forty-one (41) employed in government-run clinical laboratories and thirty-one (31) working in private clinical laboratories in Ilocos Sur. Most respondents are young, predominantly female, and educated, with varying levels of experience. While most have stable employment, a noticeable gap in biosafety training highlights the need for targeted improvements in safety awareness and education. They possess a moderate level of biosafety knowledge, with a strong understanding of general safety practices, but require further education in specific technical procedures and safety protocols. They generally follow biosafety practices, demonstrating strong adherence to critical protocols. Biosafety training, sex, and the highest level of educational attainment all play a role in biosafety awareness. Biosafety training and length of service are key factors influencing adherence to biosafety practices.

**Keywords:** Biosafety; Ilocos Sur; Knowledge; Medical technologist; Practice.

## 1.0 Introduction

Biosafety refers to the principles, practices, and procedures implemented to prevent unintentional exposure to pathogens, toxins, or genetically modified organisms, thereby ensuring the safety of humans, animals, and the environment. It involves proper handling, containment, and disposal of biological materials in laboratory settings, healthcare facilities, and research environments to minimize the risk of contamination or accidents. Biosafety protocols are designed to protect workers, the public, and the environment from biological hazards, ensuring that scientific and medical practices are conducted safely and responsibly (World Health Organization, 2023).

Laboratories play a vital role in the healthcare system. Accurate, reliable, and timely diagnostic information is crucial for patient diagnosis, and many therapeutic decisions rely primarily on the data provided by clinical laboratories. Similarly, laboratory biosafety and biosecurity activities are crucial in protecting the laboratory workforce and the broader community from unintentional or deliberate exposure to pathogenic biological agents (Geneva, 2020).

Laboratory biosafety refers to the safe management of infectious and hazardous agents in a laboratory environment. It refers to a framework that describes the use of safety equipment, training, and practices to protect workers, the environment, and the community from accidental exposure or unintentional release of infectious and

hazardous agents. The concept of biosafety is of utmost importance and must be given top priority at all times. There must be a continuous effort on the part of laboratories to ensure that their testing procedures are safe and in line with international best practices, thereby safeguarding the safety of staff, patients, and the environment from potentially hazardous pathogens (Alam et al., 2022).

The Occupational Safety and Health Administration (OSHA) defines a hazard as an event or circumstance that poses a threat to people's health and safety. This includes any source of potential damage, harm, or adverse effects on someone or something. These hazards can be classified into five categories: physical, chemical, biological, ergonomic, and psychosocial hazards. Physical hazards include machinery, noise, and temperature extremes. On the other hand, chemical hazards are exposure to toxic substances, flammable materials, and corrosive chemicals. Biological hazards are exposure to viruses, bacteria, or other infectious agents. Moreover, when the type of work, body positions, and working conditions put a strain on the worker's body, they are classified as ergonomic hazards. Lastly, psychosocial hazards include workplace stress, violence, or harassment. Although all these occupational hazards are of equal importance, the risk of laboratory-acquired infections (LAIs) in employees of clinical laboratories is significantly greater than in other occupations, considering the nature of their vocation. This further implies that distinct risks are associated with the laboratory as a workplace.

Given the risks associated with the type and nature of activities conducted in the laboratory, the development of containment principles, as well as the design of appropriate facilities, practices, and procedures to prevent the occurrence of occupational infections and the release of these organisms into the environment, is necessary. Medical technologists play a critical role in biosafety by ensuring the safe handling, processing, and disposal of biological samples and hazardous materials in clinical laboratories. They are responsible for adhering to strict biosafety protocols to protect themselves, their colleagues, and the broader community from exposure to infectious agents, toxic chemicals, and biological hazards. Medical technologists follow established guidelines for the proper use of personal protective equipment (PPE), biosafety cabinets, and sterilization techniques to prevent contamination or accidental release of pathogens.

They are also responsible for ensuring that laboratory equipment is properly maintained and disinfected, and that all biological waste is disposed of by local and international regulations. Additionally, medical technologists are often involved in training laboratory staff on the latest biosafety practices, conducting regular safety audits, and staying updated on emerging infectious diseases and safety innovations. Their attention to detail and commitment to safety are essential for maintaining a safe working environment and ensuring the reliability of laboratory results, which are crucial for patient care and public health (World Health Organization, 2023).

Medical technologists face numerous challenges in maintaining biosafety standards in clinical laboratories, including inadequate training, limited access to personal protective equipment (PPE), and insufficient safety infrastructure. In many settings, there is a lack of standardized protocols for handling infectious materials and waste management, which increases the potential for exposure to harmful biological agents. Additionally, the lack of regular biosafety training and updates on new safety practices often results in improper handling of biological samples and an increased risk of contamination. These challenges are compounded by financial constraints and limited institutional support for maintaining and upgrading biosafety measures (Ghazali et al., 2021).

A study titled "Biosafety Knowledge and Practices among Laboratory Workers in Morocco: A Comparative Study between Public and Private Laboratories" by Bajjou et al. (2020) assessed the knowledge of biosafety among laboratory workers in both private and public sectors. The findings revealed a high level of awareness regarding the use of personal protective equipment (PPE) (92.8%) and waste sorting (100%). However, only 42.1% of participants had intermediate knowledge of biosafety levels and signage, with just 30.2% aware of the technical operations that could generate aerosol risks. The study emphasized the need for improved biosafety training and policy implementation in Moroccan laboratories.

The importance of ongoing education and training for medical technologists cannot be overstated. Continuous professional development is essential for adapting to new technologies and methodologies in laboratory medicine (Biswas et al., 2022). Moreover, studies have shown that staff with extensive knowledge and experience demonstrate better biosafety practices than those with only minimal training, suggesting that biosafety compliance among healthcare workers depends on both experience and education (Bajjou et al., 2020).

A study conducted in Iloilo City, Philippines, by Caberoy-Palec and Malata (2019), titled "Biosafety Knowledge and Practices Among Medical Technologists in Tertiary Laboratories in Iloilo City," revealed that medical technologists working in tertiary laboratories demonstrated high levels of biosafety knowledge and a commendable adherence to biosafety level 2 standards. However, the study also identified significant gaps in their understanding of engineering controls and practices, particularly in the areas of containment equipment and laboratory facilities. These findings highlighted the need for additional biosafety training and ongoing updates to ensure laboratory personnel are fully equipped to handle potential risks. The authors emphasized the importance of reinforcing biosafety programs to address these knowledge deficits and enhance the overall safety standards in clinical laboratories.

Despite the acknowledged significance of biosafety, research has revealed that Medical Technologists and other healthcare professionals may have serious knowledge gaps and noncompliance with biosafety procedures. These gaps may arise from various factors, such as a lack of resources, inadequate training, or an organizational culture that is not conducive to biosafety practices. As a result, there may be a greater risk of environmental contamination, accidental release of infectious materials, and occupational exposure to pathogens, which can endanger not only laboratory workers but also patients and the general public.

The Philippines has long been a leader in establishing biosafety regulations, with significant milestones in the development of its biosafety frameworks. In 1991, the country became the first Southeast Asian nation to implement national biosafety guidelines through the creation of the National Biosafety Framework. The guidelines were designed to regulate genetic engineering, biotechnology research, and activities involving non-indigenous organisms. These regulations focused on establishing a comprehensive organizational structure, rigorous evaluation procedures, and containment protocols to manage risks associated with biotechnology. These frameworks are particularly crucial as the Philippines continues to embrace scientific advances, including genetic modification and molecular biology, while prioritizing environmental and human health (National Committee on Biosafety of the Philippines [NCBP], n.d.).

Administrative Order No. 2023-0018, titled "Guidelines on the Licensing of Clinical Laboratories for Molecular Pathology", is a significant step in strengthening the country's biosafety regulations. It introduces detailed procedures for initial licensing, assessing laboratory facilities, and ensuring that they meet required biosafety standards. The order emphasizes the importance of complying with safety measures related to containment, equipment, and facility design to prevent the accidental release of harmful agents and protect laboratory personnel from exposure to biohazards. It also highlights the need for regular biosafety training and updates for laboratory staff to ensure they are equipped with the necessary knowledge to handle potentially dangerous biological substances. By enforcing these guidelines, AO 2023-0018 aims to bolster the country's capacity to manage biosafety risks effectively, particularly as molecular diagnostics and biotechnology-related activities continue to expand in the healthcare sector.

In Ilocos Sur, the challenges to effective biosafety implementation are compounded by limited resources, inadequate training, and insufficient infrastructure. According to a study by the Philippine Association of Medical Technologists (2017), only 30% of laboratory staff in the region have received formal biosafety training, and more than 50% of local laboratories report insufficient access to essential biosafety equipment, such as personal protective equipment (PPE) and biosafety cabinets. Furthermore, 40% of laboratories lack proper containment facilities, which poses a significant risk to both laboratory workers and the environment.

Additionally, the region faces geographical barriers, with approximately 60% of health facilities located in rural areas lacking proper biosafety infrastructure and regular inspections. These figures underscore the need for increased investment in biosafety education, equipment, and infrastructure to improve laboratory safety in Ilocos Sur (Philippine Association of Medical Technologists, 2017).

This study aimed to assess the level of knowledge and practices on biosafety among medical technologists in the region, considering the existing challenges such as limited resources, inadequate training, and insufficient infrastructure. By focusing on Ilocos Sur, this study opts to provide actionable insights that can help strengthen the biosafety culture in the region's healthcare and laboratory settings.

## 2.0 Methodology

### 2.1 Research Design

The researcher employed a descriptive correlational research design, utilizing survey questionnaires to collect data. According to McCombes (2022), descriptive research is an appropriate choice when the research aim is to identify characteristics, frequencies, trends, and categories. It is useful when little is known about the topic or problem. Before you can research why something happens, you need to understand how, when, and where it happens. The descriptive research describes the personal information of the respondents. This study determined the demographic profile of the respondents, including age, sex, civil status, employment status, length of service, and number of trainings related to biosafety. Likewise, the level of knowledge and practices on biosafety among medical technologists was described.

Correlational research involves measuring two or more relevant variables and assessing the relationship between or among them. In other words, the study involves data on the demographic profile of respondents regarding their knowledge and practices of biosafety among medical technologists. Although the research design further describes the characteristics of the respondents, it is the essence of the phenomenon under study. It also uses words like 'where,' 'what,' 'when,' and 'how' in questions only. It enables the prediction of future events based on the present knowledge obtained (Creswell, 2018). The correlation design was used to determine the relationship between the demographic profile of the respondents and their level of knowledge and practices on biosafety.

### 2.2 Research Participants and Locale

The respondents in this research work were from Ilocos Sur province in the Philippines, located in the northwestern part of the country, specifically in Region I, Luzon. It comprises 32 municipalities and 2 component cities, which are organized into two legislative districts: Vigan City, located in the first district, and Candon City, in the second district. The province has a total of 768 barangays. This study was conducted in selected clinical laboratories in Ilocos Sur, as shown in Figure 5, which included both government and private medical institutions providing clinical laboratory services, including those performing fully automated, semi-automated, and manual procedures. According to the Department of Health's official website, which was last updated on June 30, 2024, there are a total of 27 licensed clinical laboratories in the province, comprising 11 government-owned and 16 privately owned facilities, distributed across various municipalities. Some areas, such as Narvacan, have a higher number of private laboratories, while others, like Cabugao and Santa Maria, primarily rely on government-owned facilities. There are 21 regulated hospitals in the region, comprising nine government-owned and 12 privately owned facilities, with service capabilities ranging from Level 1 to Level 2. While most government hospitals offer Level 1 services, private hospitals provide a mix of both Level 1 and Level 2 services. Certain municipalities, such as Sinait, have multiple private hospitals.

The research employed purposive sampling techniques, a type of non-probability sampling considered suitable when the researcher aims to study a particular culture or way of conduct within a specific population. The inherent bias of this technique contributes to its efficiency and remains vigorous even when verified with random probability. It is fundamental for the quality data gathering process.

### 2.3 Research Instrument

This research utilized primary sources of data for analysis and interpretation. The tools for data gathering were based on formulated questionnaires and readings from studies, journals, and articles related to the study. The structure of the questionnaires consisted of the following parts. Part 1 contained the demographic profiles of the respondents, such as age, sex, civil status, highest educational attainment, employment status, length of service, and the number of trainings related to biosafety. Part 2 contained questions on the level of knowledge on biosafety of medical technologists employed in government and private clinical laboratories, adopted from the study of Bajjou et al. (2019) titled "Knowledge of Biosafety Among Workers in Private and Public Clinical and Research Laboratories in Morocco," with revisions made to suit the present study. Lastly, Part 3 contained questions regarding the practices on biosafety of medical technologists, adopted from the study of Geraldez et al. (2023) titled "Knowledge, Attitude, and Practices Towards Laboratory Safety Measures among Notre Dame of Marbel University Medical Technology Students," with necessary revisions.

The questionnaire was presented for validation by five (5) experts knowledgeable in a discipline relevant to the field of this research study. Table 2 outlines the qualifications of the five experts contributing to the study. Expert A, a research professor, holds a Master's degree in Public Health and Medical Technology, with extensive

experience in research design, data analysis, and mentoring in the healthcare field. Expert B, an anatomical pathologist, is an M.D. with board certification and over five years of practice, specializing in medical laboratory processes and biosafety protocols. Expert C, a clinical pathologist, is also an M.D. with board certification and substantial experience in clinical laboratory safety, biosafety regulations, and laboratory accreditation. Expert D, a safety officer, holds a degree in Occupational Health and Safety, with certifications in OSHA standards and expertise in developing and auditing biosafety protocols in clinical settings. Finally, Expert E, an M.D. heading the Infection Control Committee, is a specialist in infectious diseases or microbiology with leadership experience in infection control, biosafety regulations, and staff training within healthcare environments.

The survey questionnaire underwent reliability testing among 20 individuals who were not part of the respondents. Based on the data gathered, it was revealed that the instrument obtained a reliability score of 0.84, indicating that the survey questionnaire is highly reliable. Additionally, the validation result is 4.72, indicating that the research instrument is highly valid.

#### **2.4 Data Gathering Procedure**

The researcher obtained permission from the Dean of the Graduate School and the laboratory's head to conduct the study. The questionnaires were distributed in two formats: paper-based questionnaires, which were personally handed out by the researcher to the intended respondents, and online questionnaires, which were sent to the respondents via Google Forms through Facebook Messenger or email. To ensure confidentiality, the respondents' answers were kept private and were solely used for this study. The content and objectives of the research were clearly outlined to the respondents, and the data collected were carefully screened for missing information or incomplete responses. The researcher thoroughly analyzed all the collected data from the survey questionnaire and made appropriate interpretations based on the responses. An observation technique was also used to verify data from the interviews. The interactions and behavior of the participants were observed during the interview process. Observation is an empirical research method used in qualitative studies focused on understanding behavior and interactions as they unfold in real-time. Proper coding of participants was done during the interview process to maintain confidentiality.

#### **2.5 Ethical Considerations**

This research study was guided by the following ethical principles throughout its conduct:

##### ***Non-maleficence***

The researcher adhered to this principle by ensuring that the study did not cause harm to the respondents or the general public. Any actions or threats that might have posed harm, pain, suffering, or incapacitated the respondents were avoided by Varkey (2020).

##### ***Benevolence***

The researcher fulfilled the obligation to act in the best interest of the respondents by upholding moral principles to protect and defend their rights, preventing harm, and removing conditions that could cause harm. Unlike non-maleficence, this principle not only calls for avoiding harm but also promoting the welfare of the respondents, ensuring that the study contributes meaningfully to their safety and well-being, as emphasized by Varkey (2020).

##### ***Respect for Autonomy***

The researcher respected the autonomy of participants, ensuring that they made informed decisions about their participation in the study. Participants voluntarily consented to take part, understanding the relevant risks and benefits involved. The study further upheld their right to withdraw at any point without consequence, as outlined by AVAC (n.d.).

##### ***Justice***

The researcher ensured fairness and equitable treatment of participants in selecting those who met the inclusion criteria for the study. The research objectives guided the selection of participants, ensuring that all participants, regardless of their background or status, had an equal opportunity to contribute to the study and benefit from its outcomes, following Varkey (2020).

### ***Respect for Anonymity, Confidentiality, and Privacy***

The researcher maintained the confidentiality and privacy of participants. The identities and information obtained from respondents were kept confidential, with codes, symbols, and signs used to prevent the disclosure of vital information. Proper handling, storage, and disposal of data ensured that no information could be linked to individuals.

### ***Acknowledgment of Others' Works and Ideas***

The researcher acknowledged the contributions of previous researchers and studies, both published and unpublished, that were relevant to the research. Proper citations were provided throughout the study to acknowledge the work of others.

## **3.0 Results and Discussion**

The demographic profile of the respondents, as seen in Table 3, revealed a diverse yet predominantly young workforce. The largest group of respondents is under 30 years old, representing 43% of the total sample, while those aged 30-39 years make up 31%. This indicates that a significant portion of the workforce is relatively early in their careers. In contrast, only 21% are between 40 and 49 years old, and a small percentage (6%) are 50 years and older, which may suggest a younger and potentially more mobile workforce. In terms of sex, the sample is primarily female, with 63% of respondents identifying as women, compared to 38% male respondents. This could reflect the gender dynamics within the industry or the population being studied.

Regarding civil status, the majority of respondents are married (57%), followed by those who are single (38%). Only a small fraction is separated (4%) or widowed (1%), indicating that most of the respondents are in stable marital relationships. As regards highest educational attainment, the respondents are highly educated, with 81% holding a baccalaureate degree. A smaller percentage, 17%, have completed a master's degree, and just 3% hold a doctorate. This suggests a well-educated workforce, though fewer individuals have pursued higher education beyond a bachelor's degree.

Employment status reveals that 68% of respondents have permanent employment, while 32% are in provisional (temporary) roles. This highlights a relatively stable workforce, although the temporary positions may indicate some level of job insecurity for a portion of the respondents.

When examining length of service, 43% of respondents have been employed for 1-5 years, indicating a workforce that is still building experience in their current roles. Additionally, 26% have 6-10 years of service, and 18% have more than 10 years of experience. However, 13% have been in their roles for less than a year, which suggests a turnover rate or a newly hired group. Lastly, biosafety training is an area where a noticeable gap exists: 56% of respondents report having no training related to biosafety, while 40% have received 1-2 trainings. Only a small portion has undergone more extensive training, pointing to a potential area for development in enhancing safety awareness and education among the workforce.

### **3.1 Level of Knowledge on Biosafety**

Table 1, which examines the level of knowledge on biosafety, reveals that respondents possess varying levels of understanding regarding important biosafety practices. Using the provided rating scale, the responses are classified as Highly Knowledgeable (HK), Knowledgeable (K), and Moderately Knowledgeable (MK).

Starting with the highest level of knowledge, the most accurate understanding among the respondents is seen in the question related to the "Biohazard" sign, with 90.3% of respondents answering correctly. This indicates that the majority of individuals are aware that the biohazard sign indicates the presence of potentially hazardous biological substances in a laboratory, which is a critical safety measure. Similarly, personal protective equipment (PPE) and the removal of PPE to prevent contamination were other topics where respondents displayed a high level of understanding, with 94.4% correctly identifying the importance of careful removal. Additionally, the segregation of biohazardous waste from general trash, as well as the disposal of needles and scalpels in sharps containers, were also highly understood, with correctness rates of 84.7% and 87.5%, respectively. The awareness of personal belongings being stored outside the laboratory (90.3%) and minimizing aerosol-generating procedures (72.2%) was also well understood by a significant portion of the sample.

**Table 1. Level of Knowledge on Biosafety**

|    | Indicators                                                                                                                                                                             | Correct Answers<br>(Frequency) | PS          | DE       |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------|----------|
| 1  | The "Biohazard" sign posted at the entrance to a laboratory indicates that potentially hazardous biological substances are present inside the laboratory.                              | 65                             | 90.3        | HK       |
| 2  | In a biological safety level 2 laboratory, all the manipulations must be performed in a microbiological safety cabinet.                                                                | 23                             | 31.9        | MK       |
| 3  | Personal protective equipment should be carefully removed before leaving the laboratory or clinical environment to prevent the spread of contamination.                                | 68                             | 94.4        | HK       |
| 4  | Human tissue and body fluids are considered infectious only when the result confirms the presence of the pathogen.                                                                     | 34                             | 47.2        | MK       |
| 5  | Bleach is the most effective solution for cleaning a surface contaminated with biological fluids.                                                                                      | 28                             | 38.9        | MK       |
| 6  | Biohazardous waste must be segregated from general trash.                                                                                                                              | 61                             | 84.7        | HK       |
| 7  | Waste such as needles and scalpels should always be disposed of as biohazardous waste in a sharps container.                                                                           | 63                             | 87.5        | HK       |
| 8  | Gloves should be removed when soiled with biological materials.                                                                                                                        | 60                             | 83.3        | HK       |
| 9  | Infectious materials that are not glass or sharp should be disposed of in a biohazard container.                                                                                       | 30                             | 41.7        | K        |
| 10 | A laboratory must maintain a written biosafety manual accessible to all personnel.                                                                                                     | 22                             | 30.6        | K        |
| 11 | Vaccination against specific pathogens is recommended for laboratory personnel working with infectious agents.                                                                         | 29                             | 40.3        | K        |
| 12 | All laboratory personnel should receive training on emergency procedures for spills and exposure incidents.                                                                            | 32                             | 44.4        | K        |
| 13 | It is not acceptable to eat, drink, or apply cosmetics in the laboratory, even if there are no visible hazards, to ensure safety and prevent potential exposure to harmful substances. | 42                             | 58.3        | K        |
| 14 | Personal belongings, such as bags and coats, should be kept in designated areas outside the laboratory.                                                                                | 65                             | 90.3        | HK       |
| 15 | When working with potentially infectious materials, it is important to minimize the use of aerosol-generating procedures.                                                              | 52                             | 72.2        | HK       |
|    | <b>Mean Percentage Score</b>                                                                                                                                                           | <b>45</b>                      | <b>62.4</b> | <b>K</b> |

*Legend: 70% - 100% = Highly Knowledgeable (HK); 50% - 69% = Knowledgeable (K); 30% - 49% = Moderately Knowledgeable (MK)*

The next category includes questions where respondents were classified as "Knowledgeable" (K). The question regarding the disposal of infectious materials that are not glass or sharps in biohazard containers had 41.7% correct answers, placing it in the "Knowledgeable" range. Similarly, a written biosafety manual in laboratories (30.6%) and the need for laboratory personnel to be vaccinated against specific pathogens (40.3%) were also areas of lower knowledge, as indicated by the percentages in the lower "Knowledgeable" category. Training on emergency procedures for spills and exposure incidents (44.4%) and the importance of not eating, drinking, or applying cosmetics in the laboratory (58.3%) demonstrated that respondents had some level of understanding. However, they fell into the "Knowledgeable" range rather than the highly knowledgeable range.

Finally, the questions on more specific aspects of biosafety, such as whether all manipulations in a biological safety level 2 laboratory should be performed in a microbiological safety cabinet (31.9%) and whether bleach is the best solution for cleaning biological fluid spills (38.9%), were the least well-understood, falling into the "Moderately Knowledgeable" (MK) category. This suggests that while respondents may have general knowledge of biosafety, specific technical aspects require further education or clarification.

The Overall Mean Percentage Score (MPS) for the respondents' knowledge on biosafety is 62.4%, which falls into the "Knowledgeable" (K) category. This indicates that, on average, the respondents possess a moderate to good understanding of biosafety practices. While many of the questions demonstrated a high level of awareness, particularly in general safety measures such as the use of personal protective equipment and the recognition of biohazard signs, there were some areas where the knowledge was less robust. These included specific technical procedures, such as the proper disposal of certain infectious materials and the correct cleaning methods for biological spills.

The MPS of 62.4% suggests that respondents at this level have developed fundamental knowledge, skills, and core understandings of biosafety, and with little guidance, can transfer these understandings through authentic performance tasks.

The study of Halatoko et al. (2024) on “Knowledge, attitudes and practices in biosafety and biosecurity in medical biology laboratories in Togo” and this present study share similar findings regarding the varying levels of knowledge on biosafety among healthcare professionals, with both studies identifying gaps and areas for improvement. In the previous study, while 49.1% of laboratory professionals demonstrated good knowledge, the knowledge scores were significantly influenced by prior training in biosafety and biosecurity (BSS). However, training did not impact attitudes or practices. Similarly, this present study found that respondents had varying levels of knowledge, with 90.3% demonstrating high awareness of the biohazard sign, personal protective equipment (PPE), and proper waste disposal. However, particular areas such as emergency procedures for spills and the need for vaccinations were less understood, which mirrors the findings from the Togo study that identified gaps in knowledge despite moderate overall scores.

Both studies highlighted the importance of continuous training and improving working conditions to enhance biosafety knowledge and practices. In a previous study, 62.4% of respondents demonstrated good attitudes and practices; however, concerns were raised regarding the use of mobile phones and eating or drinking in the laboratory. In this study, the respondents demonstrated strong adherence to critical biosafety practices, such as the use of PPE and the segregation of biohazardous waste. However, areas like the disposal of non-sharp infectious materials and cleaning procedures for biological spills showed lower awareness. The findings from both studies emphasized the need for further targeted biosafety training, particularly in specific technical procedures and emergency protocols, to bridge the knowledge gaps and ensure better biosafety practices in healthcare settings.

### 3.2 Extent of Practices on Biosafety

Table 2 presents the respondents' practices on biosafety, as measured by their responses on a Likert scale, where the weighted mean (WM) of each indicator shows the extent to which each practice is followed. The scores range from "Always Practiced" (AP) to "Never Practiced" (NP), based on the responses.

**Table 2.** *Extent of Practices on Biosafety*

| Indicators                   |                                                                                                                            | 5  | 4  | 3  | 2  | 1  | WM          | DE        |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------|----|----|----|----|----|-------------|-----------|
| 1                            | I follow the standard protocol in handling specimens in the laboratory.                                                    | 34 | 22 | 14 | 2  | 0  | 4.22        | AP        |
| 2                            | I recap the needles after blood collection.                                                                                | 56 | 14 | 2  | 0  | 0  | 4.75        | AP        |
| 3                            | I discard laboratory wastes immediately into their proper hazardous waste container.                                       | 33 | 22 | 15 | 1  | 1  | 4.18        | OP        |
| 4                            | I remove rings, watches, bracelets, or other accessories before performing hand hygiene.                                   | 21 | 32 | 15 | 2  | 2  | 3.94        | OP        |
| 5                            | In the laboratory, we have written guidelines for those who are exposed to HIV, HBV, HCV, and other bloodborne infections. | 18 | 24 | 23 | 5  | 2  | 3.71        | OP        |
| 6                            | In the laboratory, we have standard protocols for those who are exposed to bloodborne infections.                          | 34 | 22 | 13 | 2  | 1  | 4.19        | OP        |
| 7                            | In the laboratory, we have written guidelines on proper waste disposal.                                                    | 31 | 23 | 12 | 5  | 1  | 4.08        | OP        |
| 8                            | All laboratory personnel follow the written guidelines on bloodborne infections and proper waste disposal.                 | 32 | 12 | 14 | 10 | 4  | 3.81        | OP        |
| 9                            | I dispose of sharps and needles in the designated sharps container.                                                        | 27 | 21 | 17 | 5  | 2  | 3.92        | OP        |
| 10                           | I always use personal protective equipment (PPE) when handling potentially infectious materials.                           | 26 | 25 | 11 | 8  | 2  | 3.90        | OP        |
| 11                           | I ensure that all specimens are labeled adequately before transport or storage.                                            | 28 | 20 | 21 | 2  | 1  | 4.00        | OP        |
| 12                           | I perform a risk assessment before starting any new laboratory procedure.                                                  | 10 | 14 | 11 | 25 | 12 | 2.79        | SP        |
| 13                           | I immediately report any spills of biological materials to the appropriate personnel.                                      | 13 | 16 | 17 | 18 | 8  | 3.11        | SP        |
| 14                           | I participate in regular training sessions on biosafety and infection control.                                             | 3  | 9  | 22 | 16 | 22 | 2.38        | SP        |
| 15                           | I maintain a clean and organized workspace to minimize the risk of contamination.                                          | 21 | 34 | 15 | 1  | 1  | 4.01        | OP        |
| <b>Average Weighted Mean</b> |                                                                                                                            |    |    |    |    |    | <b>3.80</b> | <b>OP</b> |

**Legend:** 4.21-5.00 = Always Practiced (AP); 3.41-4.20 = Often Practiced (OP); 2.61 – 3.40 = Sometimes Practiced (SP)

Starting with the highest-rated practices, the recapping of used needles after blood collection (WM = 4.75) is consistently "Always Practiced" (AP) by respondents. This indicates a firm adherence to safety protocols regarding needle handling, a crucial practice for preventing needlestick injuries and potential exposure to bloodborne pathogens. Following close behind, the practice of adhering to standard protocols in handling specimens in the laboratory (WM = 4.22) also falls under "Always Practiced" (AP). This reflects that a significant portion of respondents consistently follow proper laboratory protocols, ensuring the safety and integrity of laboratory procedures.

Other practices, such as discarding laboratory wastes immediately into the proper hazardous waste containers (WM = 4.18) and ensuring specimens are labeled adequately before transport or storage (WM = 4.00), are also "Often Practiced" (OP). These practices are crucial in maintaining an organized and safe laboratory environment, thereby

minimizing the risks of contamination and misidentification. Similarly, the proper removal of rings, watches, and bracelets before performing hand hygiene (WM = 3.94) and the use of personal protective equipment (PPE) when handling potentially infectious materials (WM = 3.90) are also "Often Practiced" (OP). While these practices are not universally followed at all times, a large portion of respondents still frequently engage in these actions, highlighting the importance of personal hygiene and protective gear in minimizing exposure to hazards.

Some practices, such as having written guidelines for those exposed to bloodborne infections (WM = 3.71) and maintaining written protocols for waste disposal (WM = 4.08), fall into the "Often Practiced" (OP) category. While not all respondents may be fully aware of or engaged with these guidelines, the existence of protocols in the laboratory indicates an effort to standardize safety measures. Additionally, the practice of ensuring that laboratory personnel follow written guidelines (WM = 3.81) is also rated as "Often Practiced" (OP). However, there appears to be variability in how rigorously all staff follow these guidelines.

The overall average weighted mean (AWM) of 3.80 suggests that the respondents are more likely to perform biosafety practice. While many biosafety practices are frequently followed, there is room for further improvement in the consistency and frequency of these actions, especially in more specialized safety measures.

The studies by Padde et al. (2022) and Alam et al. (2022) both assessed biosafety practices, with a particular focus on laboratory settings, and share some similarities with the findings of this present study. However, there are also notable differences in the scope and context of the research. The study by Padde et al. (2022), conducted among medical laboratory students, highlighted the importance of incorporating practical application and simulation-based teaching reforms in biosafety and biorisk management to improve competency. Similarly, the study on biosafety practices by Alam et al. (2022) identified gaps in laboratory practices, including low vaccination rates for hepatitis B and inadequate awareness of biohazard handling among cleaning staff, which could compromise overall biosafety. In contrast, the findings of this study revealed generally strong adherence to essential practices, such as recapping used needles and handling specimens according to standard protocols, with scores indicating that these actions were "Always Practiced" (AP) or "Often Practiced" (OP).

Despite the positive practices observed in this present study, gaps remain, particularly in more specialized practices such as performing risk assessments before new procedures or participating in regular biosafety training, which were rated as "Sometimes Practiced" (SP). This finding aligns with those of Padde et al. (2022) and Alam et al. (2022), which identified gaps in practical biosafety training and inadequate implementation of safety measures. For instance, the study by Padde et al. (2022) highlighted that students often lacked exposure to high-level biosafety labs and had negative attitudes toward internships, potentially limiting their practical experience. The study by Alam et al. (2022) also revealed that only a small percentage of laboratories had appointed biosafety officers or provided appropriate protective measures, such as safety goggles.

While these two studies emphasized the need for targeted biosafety training and reforms to improve safety practices, this present study suggests that specific safety protocols are consistently followed; however, there is still room for improvement in the consistency and frequency of adherence to biosafety measures. The low scores for participation in regular biosafety training suggested that ongoing education is necessary to further strengthen biosafety awareness among laboratory personnel, echoing the need for more structured and comprehensive biosafety training as identified in the two previous studies. In all cases, there is a clear recognition of the need to improve both theoretical knowledge and practical application to ensure that biosafety measures are effectively implemented across different laboratory settings.

### **3.3 Relationship between Demographic Profile and Level of Knowledge on Biosafety**

The Pearson correlation analysis, as presented in Table 3, reveals significant relationships between certain demographic factors and knowledge of biosafety practices, particularly regarding the number of biosafety trainings attended. One of the most notable findings is the strong positive correlation between the number of trainings on biosafety and respondents' knowledge about the "Biohazard" sign (Pearson correlation = 0.147,  $p = 0.000$ ). This suggests that individuals who attended more biosafety training sessions were more likely to understand the importance of the "Biohazard" sign, highlighting the impact of training on increasing awareness of safety protocols in the laboratory. A similar positive relationship is observed with Personal Protective Equipment (PPE) handling, where a higher number of biosafety trainings correlated with better knowledge about the correct removal of PPE to prevent contamination (Pearson correlation = 0.141,  $p = 0.001$ ).

**Table 3.** *Correlation between Demographic Profile and Level of Knowledge on Biosafety*

|    | Indicators                                                                                                                                                                             |                                        | Age           | Sex           | Civil Status  | Highest Educational Attainment | Employment Status | Length of Service | Number of Trainings on Biosafety |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------|---------------|---------------|--------------------------------|-------------------|-------------------|----------------------------------|
| 1  | The "Biohazard" sign posted at the entrance to a laboratory indicates that potentially hazardous biological substances are present inside the laboratory.                              | Pearson Correlation<br>Sig. (2-tailed) | .079<br>.059  | .007<br>.864  | .062<br>.141  | -.043<br>.306                  | .051<br>.223      | .002<br>.964      | .147**<br>.000                   |
| 2  | In a biological safety level 2 laboratory, all the manipulations must be performed in a microbiological safety cabinet.                                                                | Pearson Correlation<br>Sig. (2-tailed) | .080<br>.058  | .013<br>.753  | .089*<br>.035 | .055<br>.193                   | .020<br>.636      | .026<br>.544      | .039<br>.352                     |
| 3  | Personal protective equipment should be carefully removed before leaving the laboratory or clinical environment to prevent the spread of contamination.                                | Pearson Correlation<br>Sig. (2-tailed) | .051<br>.224  | .018<br>.664  | .079<br>.060  | -.029<br>.494                  | .008<br>.854      | .027<br>.528      | .141**<br>.001                   |
| 4  | Human tissue and body fluids are considered infectious only when the result confirms the presence of the pathogen.                                                                     | Pearson Correlation<br>Sig. (2-tailed) | .005<br>.905  | .083*<br>.048 | .038<br>.371  | .020<br>.632                   | .008<br>.846      | .024<br>.577      | .057<br>.173                     |
| 5  | Bleach is the most effective solution for cleaning a surface contaminated with biological fluids.                                                                                      | Pearson Correlation<br>Sig. (2-tailed) | .035<br>.408  | .064<br>.126  | .048<br>.256  | .013<br>.763                   | .068<br>.107      | .009<br>.831      | .082<br>.051                     |
| 6  | Biohazardous waste must be segregated from general trash.                                                                                                                              | Pearson Correlation<br>Sig. (2-tailed) | .074<br>.078  | .037<br>.381  | .014<br>.743  | .038<br>.370                   | .033<br>.427      | .045<br>.286      | .106*<br>.011                    |
| 7  | Waste, such as needles and scalpels, should always be disposed of as biohazardous waste in a sharps container.                                                                         | Pearson Correlation<br>Sig. (2-tailed) | .090*<br>.032 | .024<br>.565  | .050<br>.234  | -.072<br>.088                  | .014<br>.739      | .021<br>.614      | .050<br>.231                     |
| 8  | Gloves should be removed when soiled with biological materials.                                                                                                                        | Pearson Correlation<br>Sig. (2-tailed) | .016<br>.702  | .031<br>.458  | .034<br>.426  | .074<br>.079                   | .048<br>.257      | .051<br>.228      | .123**<br>.003                   |
| 9  | Infectious materials that are not glass or sharp should be disposed of in a biohazard container.                                                                                       | Pearson Correlation<br>Sig. (2-tailed) | .020<br>.629  | .041<br>.336  | .029<br>.494  | .084*<br>.047                  | .032<br>.454      | .003<br>.935      | .134**<br>.001                   |
| 10 | A laboratory must maintain a written biosafety manual that is accessible to all personnel.                                                                                             | Pearson Correlation<br>Sig. (2-tailed) | .022<br>.605  | .021<br>.616  | .041<br>.333  | .070<br>.097                   | .048<br>.259      | .022<br>.602      | .090*<br>.032                    |
| 11 | Vaccination against specific pathogens is recommended for laboratory personnel working with infectious agents.                                                                         | Pearson Correlation<br>Sig. (2-tailed) | .029<br>.489  | .027<br>.516  | .035<br>.407  | .066<br>.118                   | .019<br>.653      | .032<br>.454      | .133**<br>.001                   |
| 12 | All laboratory personnel should receive training on emergency procedures for spills and exposure incidents.                                                                            | Pearson Correlation<br>Sig. (2-tailed) | .070<br>.095  | .080<br>.056  | .057<br>.177  | .081<br>.055                   | .048<br>.253      | .017<br>.680      | .062<br>.143                     |
| 13 | It is not acceptable to eat, drink, or apply cosmetics in the laboratory, even if there are no visible hazards, to ensure safety and prevent potential exposure to harmful substances. | Pearson Correlation<br>Sig. (2-tailed) | .072<br>.088  | .066<br>.119  | .023<br>.592  | .081<br>.055                   | -.052<br>.218     | .016<br>.705      | .128**<br>.002                   |
| 14 | Personal belongings, such as bags and coats, should be kept in designated areas outside the laboratory.                                                                                | Pearson Correlation<br>Sig. (2-tailed) | .031<br>.456  | -.067<br>.111 | .051<br>.224  | -.079<br>.062                  | -.069<br>.100     | .034<br>.426      | .124**<br>.003                   |
| 15 | When working with potentially infectious materials, it is important to minimize the use of aerosol-generating procedures.                                                              | Pearson Correlation<br>Sig. (2-tailed) | .041<br>.332  | .043<br>.303  | .076<br>.070  | .036<br>.389                   | .003<br>.949      | .037<br>.381      | .089*<br>.035                    |

Another significant correlation was found between the number of biosafety trainings and proper waste disposal practices (Pearson correlation = 0.106,  $p = 0.011$ ), indicating that respondents who received more training were more likely to adhere to protocols for discarding hazardous waste. The analysis also shows that vaccination recommendations for laboratory personnel were better understood by those who had attended more training sessions (Pearson correlation = 0.133,  $p = 0.001$ ). This suggests that individuals who have been trained are more

aware of the importance of vaccination in the laboratory setting, which is crucial for preventing infections from hazardous biological materials.

Interestingly, sex was found to have a significant correlation with knowledge about when human tissue and body fluids are considered infectious (Pearson correlation = 0.083,  $p = 0.048$ ), with women demonstrating a better understanding of this concept. Additionally, educational attainment was positively correlated with knowledge about the proper disposal of infectious materials that are not glass or sharps (Pearson correlation = 0.084,  $p = 0.047$ ), suggesting that individuals with higher education levels tend to have a more thorough understanding of biosafety practices.

While there were some non-significant correlations, particularly with Age, Civil Status, and Employment Status, the findings indicate that biosafety training plays a central role in improving knowledge about laboratory safety measures. This emphasizes the importance of regular and comprehensive training programs to ensure that laboratory personnel are well-equipped with the knowledge and skills to manage biosafety risks effectively.

The study by Tolentino et al. (2021) highlighted that Filipino Registered Medical Technologists (RMTs) demonstrated a good understanding of and adherence to biosafety principles and that their application of COVID-19 biosafety protocols was commendable. The study revealed no significant differences between public and private clinical laboratories, highlighting that most RMTs, regardless of the laboratory setting, adhered to biosafety protocols. This finding aligns with the positive outcomes observed in the current study, where biosafety training was significantly correlated with improved knowledge of crucial safety elements, including the "Biohazard" sign, PPE handling, and proper waste disposal practices. Both studies emphasize the positive impact of training in promoting a safety culture and improving the knowledge and application of biosafety practices.

However, a notable contrast is the focus on demographic variables in the current study. The findings revealed that factors such as the number of biosafety trainings attended were strongly correlated with improved knowledge, particularly in areas like PPE handling and hazardous waste disposal. Additionally, the current study found that sex and educational attainment were significant predictors of biosafety knowledge, with women showing a better understanding of when human tissue and body fluids are considered infectious, and individuals with higher education levels having a better grasp of waste disposal protocols. This contrasts with Tolentino et al. (2021), which did not highlight specific demographic factors as being significantly associated with differences in biosafety knowledge, attitudes, or practices among Filipino RMTs, regardless of their work setting. The findings from both studies underscore the importance of targeted biosafety training in enhancing knowledge and compliance with biosafety protocols. While Tolentino et al. (2021) highlighted the general effectiveness of training across various laboratories, the current study placed greater emphasis on the role of specific demographic factors, suggesting that personalized training and educational approaches may further improve biosafety practices in laboratory settings. Both studies supported the notion that fostering a strong safety culture through continuous education and training is essential for ensuring laboratory safety.

### **3.4 Relationship between Demographic Profile and Extent of Practices on Biosafety**

The Pearson correlation analysis between demographic factors and the extent of biosafety practices, presented in Table 4, reveals several significant relationships, particularly concerning the number of trainings on biosafety. One of the strongest correlations is observed with the statement "I follow the standard protocol in handling specimens in the laboratory" (Pearson correlation = 0.111,  $p = 0.008$ ). This finding indicates that the more training a respondent has received on biosafety, the more likely they are to adhere to standard laboratory protocols. This underscores the importance of proper training in encouraging adherence to established safety procedures.

Sex also showed significant correlations with a few biosafety practices. For instance, "I recap used needles after blood collection" (Pearson correlation = 0.045,  $p = 0.283$ ) demonstrated a positive but weak relationship with sex, though it was not statistically significant. Similarly, "I discard sharps and needles in the sharps container" (Pearson correlation = 0.080,  $p = 0.058$ ) showed a weak but notable correlation with employment status, suggesting a potential link between respondents' employment status and their practices regarding sharps disposal. Moreover, the length of service has some significant relationships with biosafety practices. For example, respondents with longer tenure in the laboratory are more likely to report practicing "I always use personal protective equipment (PPE)" (Pearson correlation = 0.103,  $p = 0.015$ ) and "I maintain a clean and organized workspace" (Pearson

correlation = 0.739,  $p = 0.106$ ). These findings suggest that individuals with more experience in laboratory settings tend to follow best practices more consistently, likely due to a greater familiarity with safety protocols.

Another interesting finding is that age and civil status did not demonstrate significant correlations with most of the biosafety practices, implying that age and marital status may not be significant determinants of adherence to laboratory safety protocols. However, educational attainment was weakly associated with practices surrounding risk assessment before initiating new laboratory procedures (Pearson correlation = 0.097,  $p = 0.104$ ), suggesting that those with higher education may be more proactive in assessing risks. In general, the analysis suggests that factors such as the number of training sessions on biosafety, length of service, and, to a lesser degree, employment status play key roles in the extent to which laboratory personnel engage in biosafety practices. This highlights the importance of continuous education and training in ensuring laboratory personnel are well-versed in and consistently apply biosafety protocols.

**Table 4.** *Correlation between Demographic Profile and Extent of Practices on Biosafety*

|    | Indicators                                                                                                                 |                 | Age  | Sex  | Civil Status | Highest Educational Attainment | Employment Status | Length of Service | Number of Trainings on Biosafety |
|----|----------------------------------------------------------------------------------------------------------------------------|-----------------|------|------|--------------|--------------------------------|-------------------|-------------------|----------------------------------|
| 1  | I follow the standard protocol for handling specimens in the laboratory.                                                   | Pearson         | .050 | .009 | .000         | -.029                          | .049              | .058              | .111**                           |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .232 | .837 | 1.000        | .495                           | .245              | .167              | .008                             |
| 2  | I recap the needles after blood collection.                                                                                | Pearson         | .055 | .045 | .054         | .010                           | .030              | .038              | .035                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .192 | .283 | .196         | .804                           | .482              | .362              | .411                             |
| 3  | I discard laboratory wastes immediately into their designated hazardous waste containers.                                  | Pearson         | .039 | .026 | .036         | .022                           | .088*             | .016              | .024                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .360 | .536 | .393         | .597                           | .036              | .703              | .567                             |
| 4  | I remove rings, watches, bracelets, and other accessories before performing hand hygiene.                                  | Pearson         | .056 | .009 | .047         | .050                           | .059              | .048              | .050                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .187 | .827 | .268         | .236                           | .159              | .257              | .238                             |
| 5  | In the laboratory, we have written guidelines for those who are exposed to HIV, HBV, HCV, and other bloodborne infections. | Pearson         | .028 | .005 | .003         | .028                           | .071              | .036              | .014                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .510 | .897 | .942         | .508                           | .091              | .396              | .736                             |
| 6  | In the laboratory, we have standard protocols for those who are exposed to bloodborne infections.                          | Pearson         | .003 | .033 | .006         | .017                           | -.067             | .087*             | -.058                            |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .937 | .435 | .883         | .680                           | .111              | .038              | .165                             |
| 7  | In the laboratory, we have written guidelines on proper waste disposal.                                                    | Pearson         | .002 | .002 | .003         | .014                           | .051              | .039              | .070                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .961 | .965 | .942         | .746                           | .223              | .353              | .094                             |
| 8  | All laboratory personnel follow the written guidelines on bloodborne infections and proper waste disposal.                 | Pearson         | .006 | .032 | .014         | -.058                          | -.078             | .107*             | -.009                            |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .886 | .451 | .732         | .165                           | .063              | .011              | .831                             |
| 9  | I dispose of sharps and needles in the designated sharps container.                                                        | Pearson         | .025 | .000 | .024         | .031                           | .080              | .103*             | .001                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .557 | .999 | .563         | .463                           | .058              | .015              | .973                             |
| 10 | I always use personal protective equipment (PPE) when handling potentially infectious materials.                           | Pearson         | .008 | .016 | .017         | .012                           | .079              | .075              | .035                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .854 | .701 | .686         | .784                           | .061              | .073              | .409                             |
| 11 | I ensure that all specimens are labeled adequately before transport or storage.                                            | Pearson         | .566 | .566 | .566         | .566                           | .566              | .566              | .566                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .015 | .013 | .025         | .036                           | -.057             | -.018             | .070                             |
| 12 | I perform a risk assessment before starting any new laboratory procedure.                                                  | Pearson         | .722 | .763 | .557         | .388                           | .178              | .670              | .097                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .059 | .001 | .047         | .035                           | .014              | .110**            | .104*                            |
| 13 | I immediately report any spills of biological materials to the appropriate personnel.                                      | Pearson         | .161 | .989 | .267         | .401                           | .731              | .009              | .014                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .032 | .001 | .013         | .072                           | .023              | .018              | .085*                            |
| 14 | I participate in regular training sessions on biosafety and infection control.                                             | Pearson         | .452 | .983 | .764         | .089                           | .582              | .663              | .042                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .073 | .026 | .000         | .042                           | -.058             | .014              | .061                             |
| 15 | I maintain a clean and organized workspace to minimize the risk of contamination.                                          | Pearson         | .082 | .535 | 1.000        | .314                           | .170              | .739              | .145                             |
|    |                                                                                                                            | Correlation     |      |      |              |                                |                   |                   |                                  |
|    |                                                                                                                            | Sig. (2-tailed) | .058 | .013 | .035         | -.028                          | .090              | .106              | .021                             |

The study by Geraldez et al. (2023) and the findings from the current study both highlighted the critical role of training in improving biosafety knowledge and practices. Geraldez et al. (2023) found significant differences in knowledge based on age and year level among medical technology students, with older and more advanced students demonstrating better knowledge of biosafety. However, the current study suggested that the number of biosafety trainings is more strongly correlated with better adherence to biosafety practices, such as handling specimens and using PPE. This underscored the importance of continuous, practical training, which appears to play a pivotal role in reinforcing safety protocols in both student and professional laboratory environments.

While Geraldez et al. (2023) found no significant differences in attitudes and practices based on demographics, the current study revealed that factors such as experience, length of service, and educational level had a notable impact on biosafety practices. The study also highlighted that training was the most significant factor in enhancing laboratory safety measures, particularly among more experienced laboratory personnel. This contrast suggested that, in professional settings, hands-on experience and continuous education may be more crucial for maintaining high biosafety standards than in academic settings, where knowledge alone is a significant determinant.

## 4.0 Conclusion

The respondents are a young, predominantly female, and educated workforce with varying levels of experience. While most have stable employment, a noticeable gap in biosafety training highlights the need for targeted improvements in safety awareness and education. They possess a moderate level of biosafety knowledge, with a strong understanding of general safety practices, but require further education in specific technical procedures and safety protocols. They generally follow biosafety practices, with strong adherence to critical protocols. Biosafety training, sex, and highest educational attainment play a role in biosafety awareness, and biosafety training and length of service are key factors influencing adherence to biosafety practices.

The following recommendations are proposed to enhance biosafety knowledge and practices. The action plan may be reviewed and then utilized as a strategic framework for improving biosafety practices in healthcare settings, with regular assessments to track its effectiveness. Hospital administrators may prioritize continuous biosafety training and allocate resources to ensure adherence to established safety protocols. The Department of Health may enforce biosafety regulations across healthcare institutions and provide support for training programs and compliance monitoring. Future researchers may investigate the effectiveness of biosafety training programs and explore strategies for overcoming barriers to the consistent implementation of biosafety practices.

## 5.0 Contributions of Authors

Introduction – Honey Lyn V. Ramos; Methodology; Results and Discussions – Jonathan C. Diola; Enhanced and gave additional literature – Ma. Christina B. Ortega

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## 7.0 Conflict of Interests

The researchers declare no conflicts of interest.

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