Biosafety and Biosecurity: Knowledge, Attitude and Practices of the University Employees as Bases for the Development of a Biorisk Management Program

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BIOSAFETY AND BIOSECURITY: KNOWLEDGE, ATTITUDE AND PRACTICES OF THE UNIVERSITY EMPLOYEES AS BASES FOR THE DEVELOPMENT OF A BIORISK MANAGEMENT PROGRAM

Eden L. Saladar

ABSTRACT

The increasing importance of biosafety and biosecurity in various settings, spurred by global challenges has extended beyond traditional healthcare and laboratory environments to include educational institutions. A descriptive study using a survey method conducted among selected employees of Central Philippine University (CPU) aimed to assess the knowledge, attitudes, and practices (KAP) regarding biosafety and biosecurity.

The study found varying levels of knowledge, attitudes, and practices regarding biosafety and biosecurity among respondents. Although some employees demonstrated strong awareness and positive attitudes, there were significant gaps in practice, indicating a need for improved training and awareness. Among other demographic factors, biosafety and biosecurity practices among different level education varies and when group according to job category significant differences revealed in their attitudes towards biosafety and biosecurity.

The findings highlight the need for enhanced training programs and awareness initiatives to address the identified gaps. The study emphasized the importance of implementing institutional biosafety and biosecurity programs in non-healthcare settings.

In conclusion, despite of general understanding in biosafety and biosecurity, notable gaps in knowledge and inconsistent practices persist. Establishing comprehensive training programs and integrating biosafety and biosecurity into institutional policies are essential for creating safer educational environments.

The study recommends for the development of a Biorisk Management Program at CPU, including regular training, continuous KAP assessments, protocol updates based on global standards, and collaboration with international biosafety organizations. Integration of biosafety and biosecurity education into the curriculum is also recommended.

Chapter 1

Introduction

Background of the Study

Safety has been a worldwide concern. Numerous safety programs, including structural, physical, occupational, health, and other safety measures, have been created among institutions to protect the safety and well-being of all people and communities. But then biological safety, sometimes known as "biosafety," is only practiced in laboratories and healthcare facilities. The use of biosafety in communities and institutions outside of those connected to healthcare and laboratory was relatively new.

Biosafety and biosecurity have been concerned with biological agents that spread infectious diseases from laboratory to community. Both required knowledge, good practice, and a positive attitude. The critical concern of biosafety was the risk of an individual being exposed to biological agents that can cause infection and spread to the community, whereas biosecurity focused on ways to kept these biological agents from being stolen, mishandled, or deliberately applied to put the public at risk. Pathogens or biological agents can emerge or reappeared, and if they were not controlled, they can create epidemic and endemic outbreaks that cause significant patient morbidity and mortality. Spelman, et al. (2002) said that these biological agents or organisms could spread from hospitals to the greater community. Bakanidze, et al. (2010) added that the influence of outbreaks on international security was substantial, affecting state economies, intercontinental trade and travel, public wellbeing and safety, and public trust, and potentially affecting management and control, leading to ineffective governance. This spread of biological agents and its outbreak was shown in this COVID-19 pandemic. Specific clusters of intense community

dissemination were among the SARS-CoV-2 transmission trends in various Southeast Asian countries. (Islam, et al., 2021).

If not effectively contained, biological hazards, whether they were unintentional, intentional, or naturally occurring, can lead to disasters on a regional, national, or even worldwide scale. To lessen these hazards and difficulties, numerous international communities, initiatives, and governmental organizations have been founded, (Gao, 2019). To contain the spread and transmission of these biological agents the healthcare institutions and community must work together. Establishing a Biorisk Management Program (BRM) was required for non-healthcare institutions to handle biosafety and biosecurity issues.

International organizations like the International Federation of Biosafety Associations (IFBA), the American Biological Safety Association International (ABSA), Health and Security Partners (HSP), International Working Group for Life Sciences (IWG), Merrick and Company and others strived to continuously improve and strengthen biosafety and biosecurity implementation. These organizations assist capability development training biosafety officers participating in the creation of the biorisk management program of the institution.

The World Health Organization (WHO, 2006) introduced a theory and strategy for reducing or eliminating the likelihood and effects of human mistakes in the laboratory setting: the biorisk management strategy, which included biosafety, laboratory biosecurity, and ethical responsibility. It also offered the broad "biorisk management" strategy that was developed after careful analysis, in-depth research into current guidelines and practices, examination of global norms and standards, and pertinent ethical issues. This strategy enabled nations and facility administrators to specify and pick the best procedures and safeguards to guarantee that biorisk management goals were achieved. Furthermore, it enables institutions to tailor their laboratory biosecurity policies to their unique situations,

(WHO, 2006). These strategies were included in occupational safety and health regulations to safeguard employees' health and safety at work.

Biorisk Management (BRM) has been primarily focused on clinical and research laboratories in the Philippines and the risk of biological agent transmission from laboratories to the community was real. Lack of biosafety education, improper biosafety procedures, and a callous attitude can all lead to disease outbreaks. According to the National Committee on Biosafety of the Philippines (NCBP) of the Department of Science and Technology (DOST), President Gloria M. Arroyo's Executive Order No. 430 in the Philippines in 1990 established the first biosafety scheme in the developing country (NAST-DOST, 2009), the focus of this biosafety approach was on biotechnology research, such as genetically modified organisms, rather than on biological agents that cause infections. The necessity to develop a Philippine policy framework that can launch a sufficient and well-coordinated response is highlighted by the emergence of biological threats that could potentially affect millions of people. In Southeast Asia, the Philippines was the first country to implement a national biosafety standard, (Destura, 2021).

The Department of Health (DOH) was a government-authorized agency for health the main responsibilities include developing national health programs, technical standards, and guidelines as well as providing national health policy direction. The Department of Health oversees promoting health, preventing, and controlling disease, treating, managing, and rehabilitating patients with the disease, as well as safeguarding people, families, and communities who were exposed to health threats, (EO.No.292, 1987).

Local Government Units (LGUs) served as a conduit between the government and its constituents. It played an important role in community development, addressing community issues and concerns, and implementing policies and procedures. Because of its community influence, it can motivate and mobilize the public. The Inter-Agency Task Force for the control and prevention of Emerging Infectious Diseases (IATF-EID), which was

headed by the Department of Health, was set up by the government in response to an outbreak of an emerging infection. As an IATF-IED member, the Local Government Unit (LGU) played an important role as a frontline in delivering services to the community and acting during local emergency operations, (DILG MC No. 2020-077, 2020).

The Department of Science and Technology (DOST), as an institution involved in research and advancement, biosafety, and biosecurity are considered to be bioethical requirements. On the other hand, in academic institutions, biosafety and biosecurity were taught as part of the curriculum of selected courses. Health and Science courses included some biosafety and biosecurity in their lectures to better prepare students for their future careers. However, the comprehensive concept of biosafety and biosecurity in the academic setting was not yet fully established. According to Qasmi, et al (2019), in the local context, it has been a matter of the utmost importance but was regrettably overlooked at different phases of graduate study, research training, or laboratory professionals' competence development. The spread of infection within an academic community can be minimized and contained if biorisk management was implemented in an academic institution.

Central Philippine University (CPU), as an academic institution, aimed to create a "safety culture," making the campus a haven for all. To ensure safety, the CPU placed a greater emphasis on physical security and safety, putting additional health and safety precautions in place and posting them in conspicuous places. The University Waste Management Program, which included waste segregation, labeling, decontamination, transport, and disposal, was the university-wide biosafety-related policy as shown in the University Medical and Dental Clinics Waste Disposal Guidelines and Laboratory Safety Manual.

CPU valued academics, research, and community including health care services. Selected colleges and departments, particularly in Health and Allied Sciences, make use of biological agents in teaching, laboratory, and research activities to facilitate and enhance the

learning of the students. As for the health care services, they deal with infected patients and were associated with the potential for being exposed to biological agents. While the campus grounds, building repairs, and maintenance were exposed to waste containing biological agents. For safety and compliance with the requirements to operate, these departments established their biosafety protocols and guidelines like the University Waste Disposal Guidelines of the Medical and Dental Clinics and the Laboratory Safety Manual of the College of Pharmacy.However, there was no comprehensive biorisk management program or policy prepared to strengthen these biosafety protocols and guidelines.

Addressing biosafety and biosecurity issues while enhancing the university's safety culture needed a Biorisk Management Program (BRM). Evaluating the knowledge, attitudes, and practices of a selected group of employees, especially those managing biological agents and implementing safety policies and guidelines helped in establishing the Biorisk Management Program for the University. A lack of knowledge and awareness about biosafety would put an individual, an institution, and the community at risk of disease exposure that can spread out to the community to cause a disease outbreak. Knowledge about biological agents, their characteristics, and the mode of transmission would make an individual understand and recognize the significance of biosafety and biosecurity. This would be a basis for developing a strategy to mitigate or control biological hazards or threats and risks. This would encourage an individual to change their attitude in dealing with biological agents, their products, and contaminated waste materials. With knowledge and awareness of the risks from exposure and the consequence associated with biological agents, substandard safety practices can be modified. The basis for creation of a university biorisk management program would be crafted from the knowledge, attitude, and practices of selected CPU personnel involved in handling biological agents and implement safety policies.

Objectives of the Study

This study was conducted to determine the knowledge, attitude, and practices in biosafety and biosecurity of selected employees at Central Philippine University (CPU) as the basis for developing a Biorisk Management Program.

Specifically, this study aimed to:

1. Determine the demographic characteristics of selected CPU employees who work with biological agents and were involved in the implementation of safety measures.
2. Determine the level of knowledge of selected CPU employees in biosafety and biosecurity.
3. Determine the attitude of selected CPU employees toward biosafety and biosecurity.
4. Determine the biosafety and biosecurity practices of selected CPU employees.
5. Determine if there was a significant difference in the level of knowledge, attitudes, and practices of selected CPU employees in biosafety and biosecurity based on their demographic characteristics.
6. Determine if there was a significant association in the level of knowledge, attitudes, and practices of selected CPU employees in biosafety and biosecurity based on their demographic characteristics.
7. Develop of a Biorisk Management Program for the university based on the findings of this study.

Hypotheses of the Study

HO: There was no significant difference in the level of knowledge, attitudes, and practices of selected CPU employees in biosafety and biosecurity based on their demographic characteristics.

HO: There was no significant association in the level of knowledge, attitudes, and practices of selected CPU employees in biosafety and biosecurity based on their demographic characteristics.

Theoretical Framework

Breaking the Chain of Infection

Breaking the cycle of infection, as shown in Figure 1, was the cornerstone upon which the ideas of biosafety and biosecurity were built. For an infection to occur, a microorganism or biological agent must enter through a portal of entry, multiply within the host (human), and then exit through a portal exit. Breaking the chain entails learning about the disease and its causative agent, changing practices and procedures, and eliminating the microbiological agent. A positive attitude toward a safe culture has been essential for sustaining and maintaining a safe environment. The principle of biosafety and biosecurity expanded and strengthened with this concept of preventing the spread of infection, (Coming together to break the chain, 2018).

In hospitals, the infectious control committee was primarily concerned with preventing the spread of infection among patients and healthcare workers, whereas biorisk management focused on strategies to address the spread of infectious agents from laboratory-to-laboratory personnel, hospital employees, patients, and the community. The good practices among healthcare professionals such as proper handwashing and the appropriate use of personal safety equipment, particularly; gloves and face masks, will prevent the spread of disease while in contrast, the lack of knowledge in biological agent, mode of transmission, inappropriate personal protective equipment along with complacent

attitude and bad microbiological practices will lead to disease exposure and if cannot be contained would result to disease outbreak. (Breaking the chain of infection, 2020)

The Local Government Units (LGUs), residents, and institutions must all work together to break the transmission of infection in the community. Each would make a significant contribution to the reduction of cases. The role of institutions was to develop strategies to reduce the risk of infection spread while also ensuring the safety of their stakeholders. To maximize protection by preventing the route of infection transmission at key sites before infectious agents can spread further, infectious illnesses can be prevented, (Bloomfield, et al., 2012)

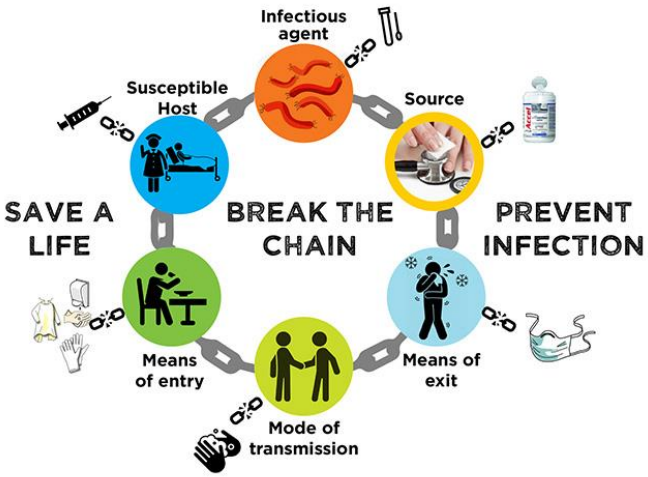

Figure 1. Breaking the Chain of Infection (Coming together to break the chain, 2018)

Biorisk Management (AMP) Model

The laboratory was set up to serve based on the Biorisk Management AMP Model as shown in Figure 2. The Clinical Laboratory played a significant role in the healthcare system by providing diagnostic services through various laboratory processes involving the manipulation of infectious agents and their products. These processes increased the danger of exposure to biological agents, which can infect the public and medical personnel. As a

result, the laboratory implemented the biorisk management program to address and minimize the probability and exposure with biological agents, thereby preventing the consequences of infection and community transmission. The AMP model provided a clear description and guidance in the execution of the Biorisk Management Program in the Laboratories. Salerno and Gaudioso (2015) stated that, Biorisk Management aimed to alter the traditional discipline of laboratory biosafety and biosecurity, which was focused on preset biosafety levels, prescribed biosecurity laws, and checklist-based biosecurity regulations. This traditional approach was biased and more resources were needed. With this biorisk management, the traditional approach can be transformed into a risk assessment and evidence-based approach which was an institutional and situational grounded assessment

Employees' knowledge, attitude, and practices in biosafety and biosecurity were significant in developing strategies for a healthy and safe working environment in institutions other than healthcare facilities. The use of the Biorisk Management, AMP Model, was critical for assessing of disease exposure, formulating strategies to contain the biological agent, reducing the spread of diseases, preventing community transmission, and monitoring the effectiveness of the mitigation control in place. It protected valuable biological materials from theft and malicious use while also promoting institutional integrity. The Biorisk Management, AMP Model, was divided into three parts: Assessment, Mitigation, and Performance.

Academic institutions have been on the path towards excellence and quality education. The use and manipulation of biological agents were key components of learning and research innovations. Biological agents can enter the system because of this. Knowledge of the risks associated with the activity was one of the pillars for determining whether the risk was acceptable or intolerable, manageable, or uncontrollable, and would aid in deciding whether to proceed with the activity or take mitigation measures. According to WHO 4th

Edition, (2020), if the associated risk surpasses an acceptable threshold, the institution and its leadership will ultimately decide whether to accept the risk.

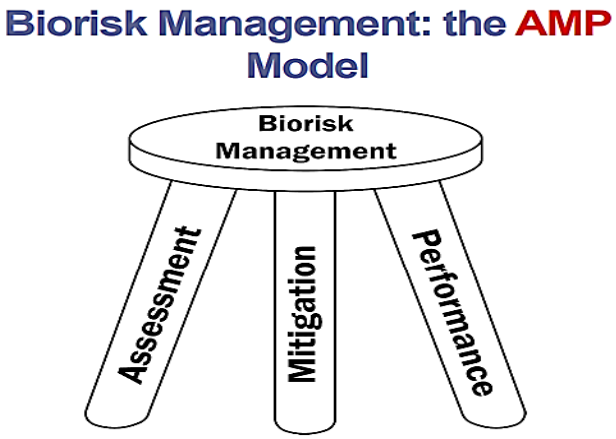

Figure 2. Biorisk Management (AMP) Model (Salerno and Gaudioso, 2015)

Knowledge Attitude and Practices (KAP) Theory

The success of the Biorisk Management Program was strengthened by the Knowledge, Attitude, and Practices (KAP) Theory shown in Figure 3 and supported by Health Belief Model, “KAP Theory” in Figure 4. KAP is a behavior change theory that included three steps; the gathering of information, the creation of attitudes, and the development of behavior, (Fan, et al. , 2018). The KAP model was developed to understand the knowledge gap, how an individual reacts in a certain situation based on the known knowledge, how this knowledge translates into action and how this knowledge, attitude, and practices affect each other.

Knowledge was defined as the acquisition, storage, and application of facts or abilities. Reasoning and perception based on the information gathered was a process of understanding. Attitude was a certain way of reacting to a given situation. Attitude had three components: cognition, affect, and behavior: Cognition, Affective and Behavioral (Rav-Marathe, et al., 2016).

Rav-Marathe, et al. (2016) explained, that the Cognition component encompassed factual and false perceptions about a certain situation, condition, or object however; there was an overlap between knowledge and attitude toward education that may change such beliefs. An example were people mistakenly believing that wearing a face mask was sufficient to prevent transmissible respiratory diseases, which was correct, but the number of infected people was still increasing. In this case, educating the public on the appropriate use of face masks, correct donning and doffing, hand hygiene and disinfection would make it more effective. Additionally, the affective component was the range of emotions toward a situation, condition, or object. In using a face mask, we believed that it was effective to protect ourselves from infectious respiratory disease thus, in a group of friends and families we incline to lower our guard for we felt that we know them and were confident that they were uninfected and we overlooked the possibility of asymptomatic cases. Furthermore, the behavioral component was the tendency to act in a specific way to a given situation, condition, or object. Wearing masks would prevent transmissible respiratory infections; some may follow while others may not.

The attitude towards Biorisk Management given the knowledge about biosafety and biosecurity rests on the belief whether it was true or false as enhanced by providing awareness or education, the feeling about it, and the reaction towards whether to follow or ignore it. Thus, practice was the action because of the application of knowledge. This demonstrated the gain of information through a deeper comprehension of the circumstances, condition, or thing in question as well as the dispelling of misunderstandings as evident by the shift in the person's attitude. This series of actions demonstrated how attitude and knowledge were mutually reinforcing.

Figure 3. Knowledge Attitude and Practices (KAP) Theory (Siltrakool, 2017)

Health Belief Model (HBM)

Health Belief Model (HBM) in Figure 4 described how health decisions were made when adopting pre-emptive measures to prevent disease. The probability to change in a person's behavior was based on their awareness of a threat and illness because of their health-related behavior or action, (Siltrakool, Assessment of Community Pharmacists' Knowledge, Attitude and Practice Regarding Non-Prescription Antimicrobial Use and Resistance in Thailand, 2017). A person was encouraged to change his behavior if he was aware of the risks when exposed to certain hazards such as situations, conditions, or objects and the degree of consequences for taking chances. With this, the likelihood to take precautionary measures was great. In biosafety and biosecurity, if people are aware of the risks of contact with infectious microorganisms and materials or their discharge to the environment and the consequence and impact on health, economy, and national security affecting individuals, families, and community then people are encouraged to change their behavior.

Knowledge was the cornerstone of behavior change, while attitudes and beliefs acted as catalysts. For people to modify their unhealthy conduct and implement healthy behavior, the "health belief model" played a crucial role, (Fan, et al. , 2018). In managing biological hazards and risks in Biorisk Management, the knowledge of biosafety and biosecurity was significant to change the belief of the people and understand the threat and consequences.

This would encourage them to change their attitude and act by putting what they had learned into practice.

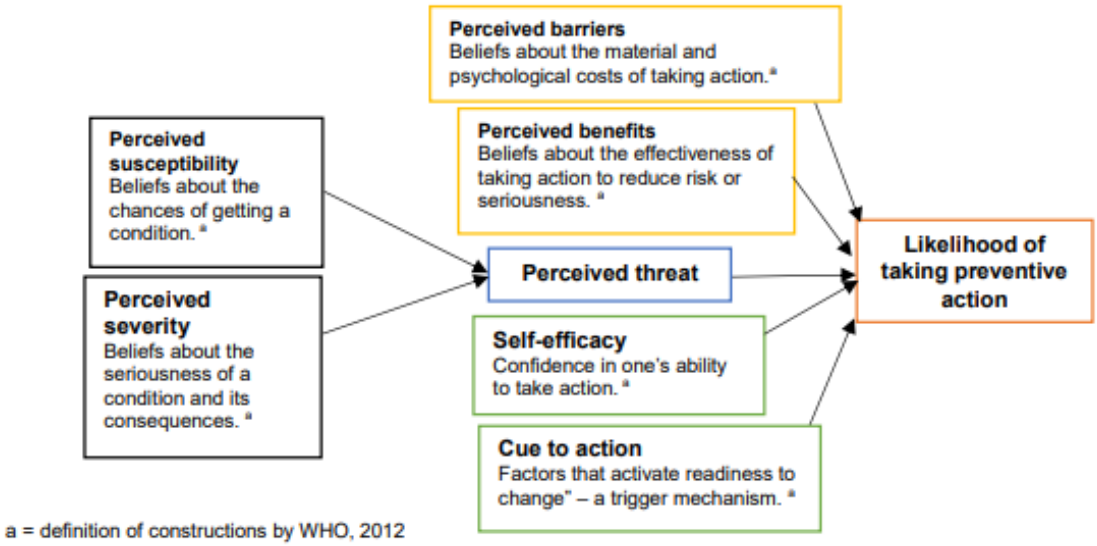

Figure 4. Health Belief Model (HBM) (Siltrakool, 2017)

Conceptual Framework

The assessment of existing biosafety and biosecurity knowledge, attitude, and practices shown in Figure 5 was important in the creation of a Biorisk Management Program for the university. The gap between what was known and what was unknown about biosafety and biosecurity was influenced by the extent of knowledge. The awareness of the safety measures would affect individual, family, and public, influence their attitude and elicit a response, as demonstrated in their practices. Moreover, identified gaps would guide decision-makers on what approach to take, whom to involve, and how to introduce it, thus increasing level of knowledge would determine stakeholder acceptance. The lack of knowledge in biosafety and biosecurity pose a challenge to the effectiveness of the program implementation.

The employees' attitude toward safety was important. It influenced the way the person behaves concerning safety. The positive attitude of the employee profited the

institution which would make the compliance and the implementation of a "safety culture" effective. On the other hand, a lack of biosafety awareness and complacency puts everyone and the community at risk of exposure to biological agents and infectious diseases.

Practice has been the application of knowledge. This was based on the foundation of knowledge as influenced by a person's attitude. An individual may be aware of biosafety and biosecurity, but if the foundation knowledge was insufficient to persuade the individual, altering their attitude would be difficult. To elicit a positive response in terms of attitude change and practice, knowledge must be supported by facts and evidences. Changes in belief and attitude would lead to changes in behavior, which would eventually lead to action. Good laboratory biosafety practices were the result of a solid foundation of biosafety knowledge, which was believed to be effective at lowering the danger of biological agent contamination and the spread of infectious diseases in the community. This knowledge influenced beliefs and attitudes, motivating laboratory personnel to modify their practices.

While knowledge has been the foundation of change, attitude acted as a catalyst and practice was the application. Identifying gaps in the differences and associations in knowledge, attitude, and practices of selected employees based on demographic characteristics would help in crafting strategies as the University develop and implement the Biorisk Management Program.

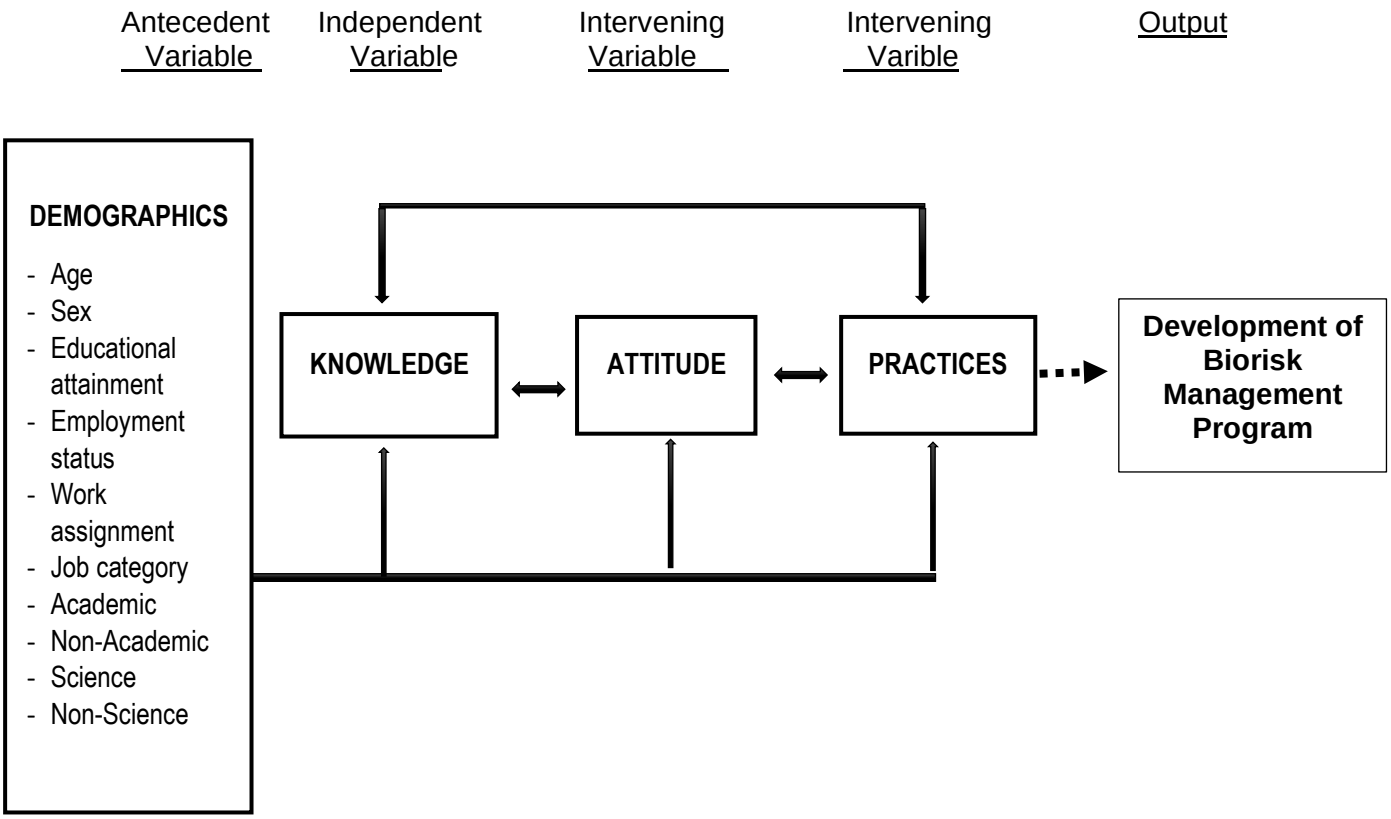

Figure 5. Conceptual Framework

Definition of the Variables and other Terms

Academic – refers to an educator who works at a college or university, that is a member of an institution of learning (Boarnerges, 2017).

Specifically, in this study, academics refer to the faculty and staff from selected colleges and departments at the university that were involved in the delivery of learning instructions and activities to students that deal with biological agents and their products. This includes Colleges of Medicine (COM), Medical Laboratory Science (MLS), Nursing (CON), Pharmacy (COP), College of Arts and Sciences (CAS)- Life Science Department and College of Agriculture, Resources and. Environmental Sciences (CARES)- University Research Center for Product Development.

Acceptable Risk - WHO (2020b) and in this study refers to the risk that is deemed acceptable and permits work to continue while considering the anticipated benefit of the planned actions.

Administrative Procedures – A succession of acts and operations issued or performed by an administrative body on its own motion or upon request, to adjudicate on rights, interests, and obligations of parties of the procedure or decide based on the public interest, according to the laws and other regulations in force (Dragos, 2022).

In this study, administrative procedures refer to policies, guidelines, rules, regulations, protocols, and procedures usually written, communicated, and executed by the institution's management, recognized legal enforcement bodies, or committees, and must be followed by the directed personnel.

Attitude – refers to inclinations to react in a certain way to certain situation; to see and interpret events according to certain predispositions; or to organize opinions into coherent and interrelated structures (Bano et al, 2013).

In this study, an attitude refers to how an employee evaluate, respond, or behave to a certain situation or condition. The evaluation of employees' attitude is determined using a

Likert Scale questionnaire adapted and modified from IWG Self-Assessment Tool (IWG, 2020) and the response, or behavior towards certain situation or condition is measured by whether they have a highly positive, positive, normal, negative, highly negative, or uncertain attitude.

Biological agents - According to WHO (2020a) and in this study, this refers to microbes, viruses, biological toxins, particles, or various pathogenic substances that may infect, irritate, or poison people, animals, or plants and were either naturally present or genetically altered.

Biorisk - According to WHO (2006), this refers to the likelihood that a harmful occurrence (in the limitations of this document: unintentional infection or security breaches, loss, theft, abuse, diversion, or deliberate release) may take place. In BMBL 6th Ed. (2020) it is defined as the result of uncertainty when biological material is the cause of harm, as reflected by the interaction between the effects of an event and the related likelihood of occurrence.

In this study, biorisk refers to the likelihood that a specific adverse event linked with a biological agent or material will cause harm.

Biorisk Assessment - WHO (2006) and in this study, the procedure for determining acceptable and unacceptable risks, including laboratory biosecurity and biosafety risks (risks of illegal entree, loss, theft, misuse, alteration, or purposeful release) and their potential repercussions (WHO, 2006).

Biorisk Management - WHO (2006) and in this study, it is used to describe the analysis of methods and creation of plans to reduce the possibility that biorisks will occur. The facility and its manager (director) are accountable for proving that adequate and reliable biorisk reduction (minimization) measures have been designed and are put into practice under the management of biorisk. To help the facility director set, develop, and achieve biorisk management objectives, a biorisk management committee should be formed.

Biosafety - refers to the concepts, procedures, and methods used in containment to prevent accidental contact with biological agents or their unintentional release (WHO, 2020a)**.**

In this study, biosafety refers to methods being used to avoid exposure to or contact with biological agents, protect oneself from illness, stop the spread of infection to others, and ensure community safety.

Biosecurity - They consist of a collection of ideas, technologies, and procedures that are executed for the safety, management, and responsibility of biological agents and/or the equipment, expertise, and information about their handling. The goal of biosecurity is to prevent illegal release, loss, theft, mishandling, and alteration (WHO, 2020a).

In this study, biosecurity refers to safekeeping measures implemented to identify the threat and/or suspicious individual and prevent them to execute their offensive action that may cause an alarm or will affect the health and safety of the community.

Central Philippine University **(CPU)** - It is a private autonomous university in Jaro, Iloilo City, Philippines. It is a Christian university that is non-stock and non-profit, with a strong academic emphasis, research, and outreach. Providing excellent education, competitive research, and compassionate services to remote communities.

Consequence - WHO (2020a) and this study, refer to the potential harm that exposure could do if it were to happen. This can involve a disease spreading throughout the neighborhood or a laboratory-associated infection, asymptomatic carriage, environmental contamination, or another illness or injury.

Dean - In this study, this refers to the highest position in a college or department that is involved in the implementation of safety measures. The dean is an administrative position in the college or department but may also handle lectures and classes in some cases, particularly when there is a faculty shortage. Deanship is also a tenured position; once the

term is completed, the office will be handed over to the new dean, and the former will serve as a faculty member; thus, the dean falls under the category of faculty in this context.

Department Chair or Head - This refers to the person in charge of the department. In this study, this refers to the dean, section head, or senior personnel who are assigned to lead and have the authority to implement department policies and rules.

Department of Health **(DOH)** - It is the nation's leading healthcare institution. Responsible for ensuring that all Filipinos have access to fundamental public health amenities by regulating the supply of health goods and services and providing high-quality med*ical attention* (DOH, n.d.).

The department that works with biological agents and their products - In this study this refers to the departments in the university that are engaged in the manipulation of pathogenic or infectious agents and their products. This includes Biological Sciences, Medical Laboratory Science, Nursing, Pharmacy, Medicine, Medical and Dental Clinic, Birthing Center and Clinical Laboratory, and General and Janitorial services.

The department that is involved in the implementation of safety measures - In the context of this study, this term refers to the divisions or offices that participate in and support the formulation, execution, supervision, and evaluation of university safety protocols and policies. This includes the University President's Office, the Vice President's Office for Finance and Administration, the Accounting Office, the Cashier's Office, the Security and Safety Office, and the Occupational Safety Office.

Employee - Heathfield (2021) and in this study refers to a person hired by an employer to do a specific job.

Exposure - WHO (2020b) and in this study refers to a situation where a person is close to or comes into contact with biological agents that could be harmful or get infected. The characteristics of the biological agent usually determine the possible exposure routes, which can include inhalation, ingestion, percutaneous damage, and absorption. On the other

hand, some infection routes are unique to the laboratory setting and are not frequently observed in the public.

Faculty - In the context of this study, this refers to teachers who are involved in academic instruction to students in selected colleges and departments that deal with biological agents, regardless of employment status, rank, or designation.

Genetically Modified Organisms **(GMO)** - WHO (2006) and in this study refers to organisms with genetics altered by "recombinant DNA technology" techniques. Recombinant DNA technology is the ability to synthesize a single DNA molecule in a test tube by joining DNA molecules from various sources. Since these practices were used before recombinant DNA technology was discovered (1973), the term "GMO" does not typically apply to species whose genetic composition has been altered through normal crossbreeding or by "mutagenesis" breeding. GMOs frequently cannot be replicated in nature.

G*ood microbiological Laboratory Practices* **(GMLP)** – refers to a fundamental set of guidelines for lab procedures that apply to all biological material-related activities. These procedures assist to safeguard employees while preventing environmental and sample contamination (CBSG 2nd Ed., 2015) and (WHO, 2020b)**.**

In this study, Good microbial laboratory practices (GMLP) also mean good laboratory practices (GLP) refer to a set of practices and procedures in handling biological agents and materials in the laboratory that is based on the notion of biosafety and biosecurity.

Guidelines - WHO defined guideline as broadly as any information product developed that contains recommendations for clinical practice or public health policy. Recommendations are statements designed to help end-users make informed decisions on whether, when and how to undertake specific actions such as clinical interventions, diagnostic tests, or public health measures, with the aim of achieving the best possible individual or collective health outcomes.

In this study, guidelines refer to "Biosafety Guidelines," which contain a detailed plan to guide the development of rules or strategies for implementation.

Hazard - Refers to an object or circumstance that could potentially harm a system, population, or living thing when it is exposed to it. The term "hazard" in the context of laboratory biosafety refers to biological agents that have the potential to harm staff members, as well as people, animals, the public, and the environment. Before a hazard is considered to constitute a risk, the likelihood, and implications of it producing harm must be considered (WHO, 2020b).

In this study hazard, this refers to anything that may cause harm, danger, or possible damage from a procedure, person, or materials related to biological agents or materials.

Incident - WHO (2020a) and this study refer to an event that may expose laboratory workers to trigger the release of biological agents into the surroundings, which may or may not result in physical harm.

Initial Risk - WHO (2020a) and in this study refers to the danger posed by laboratory practices or activities carried out without taking risk management precautions

Infectious Materials – BMBL 6th Ed. (2020), WHO (2020c) and in this study, it refers to any substance, whether liquid or solid, that harbors microorganisms that can infect either humans, animals, or both. This includes patient samples, biological cultures, waste materials from hospitals or clinics, and/or biological products like vaccines.

Knowledge – refers to the capacity to acquire, retain and use information; mixture of comprehension, experience, discernment, and skill (Bano et al, 2013) **.**

In this study, this refers to how employees understand, aware, or being informed of certain issues, concerns, or new concepts about biosafety and biosecurity. It is a state of awareness on how institution implements measures to address safety and security related to biological agents. The evaluation of the employees' level of knowledge or awareness is determined using a Likert scale questionnaire utilizing adapted and modified IWG Self-

assessment tool (IWG, 2020) measured and categorized as very high, high, moderate low, very low and uncertain.

Laboratory-Associated Infection **(LAI)** - It is defined as any illness that is acquired or logically suspected to have been developed because of exposure with a biological agent while performing tasks associated with a laboratory. The secondary cases may be related if there is a person-to-person transfer after the incident. The term "laboratory-acquired infections" also applies to infections that develop in laboratories (WHO, 2020a).

In this study, laboratory-associated infection (LAI) refers to a disease transmitted from the laboratory that adversely impacts laboratory personnel, family, laboratory visitors, clients, and the community who have been exposed to biological agents.

Likelihood **(of a laboratory incident)** - Refers to the possibility that a laboratory mishap will involve exposure to or leakage of a biological agent (WHO, 2020a).

In this study, likelihood refers to the possibility, probability, or chances that certain events will occur, such as disease exposure and contamination.

Local Government Unit **(LGU) -** stats.oecd.org. (2007) and this study refers to Local government units are institutional units that are distinguished for administrative and political reasons and whose economic, judicial, and executive power covers the smallest geographical areas.

Manipulations of biological agents -in this study this refers to scientific procedures, storage, treatment, and disposal of materials used and biological agents used in the instructions and research.

Non-academic - in this study refers to the selected offices or departments at the university that are not directly involved in the delivery of learning instructions and activities to students but deal with biological agents or materials and are involved in the implementation of safety measures. This is divided into two categories: Science and non-science.

Science- refers to a systematic approach to understanding the natural world through observation, experimentation, and analysis. It is a highly structured discipline that follows a set of principles and methodologies, such as the scientific method (Foster, 2023).

In this study this refers to member of non-academic departments or offices that handles, manipulate, or exposed to biological agents and products either directly or indirectly. These departments or offices understands sciences and employs systematic approach includes: birthing center, clinical laboratory, medical and dental clinics.

Non-Science- refers to those that encompasses beliefs, opinions, and practices that are not grounded in scientific evidence. While non-science can hold cultural, religious, or personal significance, it lacks the rigorous methodologies and systematic approach of science (Foster, 2023).

In this study this refers to members of non-academic departments or offices that directly or indirectly handles, manipulates, or exposed to biological agents and its products. These includes the offices under administrative and management, campus, grounds and building upkeep maintenance that their practices were not grounded with scientific approach and based on personal judgement in dealing with the biological agents and materials.

Personal protective equipment (PPE)- WHO (2020a) and in this study refers to personnel's gear and/or attire that serves as a protective shield against microbial pathogens, lowering the risk of exposure. PPE includes, but is not limited to, laboratory coats, gowns, full-body suits, gloves, safety footwear, safety goggles, masks, and respirators.

Policy- defines, as a rule, method, administrative move, inducement, or unofficial custom of governments and other institutions. Allocations of resources frequently reflect policy decisions. Policies in diverse sectors can have an impact on health (CDC, 2015).

In this study, policy refers to a set of rules, guidelines, and procedures in the university to be followed to achieve the purpose or goal.

Practices- refers to the application of rules and knowledge that leads to action. Good practice is an art that is linked to the progress of knowledge and technology and is executed in an ethical manner (Bano et al, 2013).

In this study, practices refer to how ideas, beliefs, and methods based on knowledge are carried out, applied, or put into action. The determination of the employees' practices is determined using a Likert scale questionnaire utilizing adapted and modified IWG Self-assessment tool (IWG, 2020) measured and categorized as always, frequently, occasionally, Irregularly, never and uncertain.

Risk- means a combined likelihood of an incident and the seriousness of the damage (consequences) if that incident did take place (WHO, 2020a)

In this study, risk refers to a danger that personnel may expose to**.**

Risk acceptance- WHO (202b) and in this study refers to the level of risk that is tolerable and permits the continuation of laboratory work, often after risk control measures have been implemented.

Risk assessment- WHO (202b) and in this study refers to a methodical procedure for acquiring data, assessing the risk of contact to or release of workplace hazards, and identifying the best risk management practices to lower the risk to an acceptable level.

Risk control measure- WHO (2020b) and in this study refers to the method of reducing incident or event risk to a manageable level using several strategies, including communication, evaluation, training, and functional and physical controls. The cycle of risk assessment will determine the strategy to employ for risk control as well as the particular kind of risk control measures required.

Risk evaluation- WHO (2020a) and in this study refers to a component in risk assessment when the severity of the potential harm under a specific set of conditions, like a

specific laboratory test, is compared to the risk of exposure to a hazard. A risk evaluation aims to determine if the assessed risk is bearable or whether further targeted risk control measures need to be implemented to prevent or decrease the risks.

Risk or hazard groups- are the outcome of categorizing microbiological agents according to the severity of the disease they are associated with in humans, (CDC NIH, 2020). Risk Groups are based on these key attributes and the method of natural disease transmission (BMBL 6th Ed., 2020).

In this study risk or hazard, the group refers to the characteristics of a microorganism based on its capability to infect, spread, and availability of treatment.

Safety culture- an approach to supporting or enhancing best practices for laboratory biosafety that is fostered in an environment of openness and trust by people and organizations working together, regardless of whether it is outlined in relevant codes of practice and/or legislation (WHO, 2020b).

In this study, safety culture refers to the values, beliefs, and attitudes toward biosafety and biosecurity that are shared by all employees and incorporated into their code of practice to ensure and maintain a safe and secure environment for all.

Selected Central Philippine University (CPU) Employee – in this study, this refers to a worker in the Central Philippine University involved in the handling of biological agents, materials, or its products as part of teaching-learning activities, duties, and responsibilities or involved in the implementation of safety measures including biosafety concerns. This may include faculty and staff in the academic, and non-academic such as those who employ science approach and those who are non-science personnel.

Standard operating procedures (SOPs)- WHO (2020b) and in this study refers to a set of detailed instructions that are well-documented and validated, and that show how to carry out laboratory techniques and procedures following institutional policies, industry standards, and relevant local, national, and international laws.

Staff- refers to includes permanent equivalent employees, casual employees, and other categories who get work-related health and other services from the organization at a facility (BMBL 6th Ed., 2020).

In this study, staff refers to a person or worker who provides support to the delivery of instructions to the students but does not directly teach students.

Threat- refers to the possibility of an unfavorable event happening as a manifestation of a purpose to do harm, harm, disruption, or damage (WHO, 2006).

In this study, threat refers to an intent to perpetrate evil, or damage that may cause chaos or the lives of many people.

Transmission- WHO (2020b) and in this study refers to the direct or indirect transmission of a biological agent (or agents) between living things or from objects to living things via aerosols, droplets, biological samples, vectors, contaminated food, or other contaminated objects.

Significance of the Study

This study would determine the knowledge, attitude, and practices of the Central Philippine University employees who worked with biological agents and were involved in the implementation of safety measures as a basis for developing a University Biorisk Management Program.

University

The knowledge, attitude, and practices of employees who worked with biological agents and were involved in the implementation of safety measures were critical factors in the development of the University's Biorisk Management Program. This program has been developed and implemented in healthcare institutions, specifically hospitals and clinical laboratories. Implementing this Biorisk Management in university has been a challenge.

Recently, where laboratory infections were widespread, the university was one of the most affected institutions. With the implementation of this University Biorisk Management Program, it would be probable to augment safety and security measures from the physical to the biosafety and biosecurity levels. It could be used for international accreditation and as a benchmark by other universities when developing their own University Biorisk Management Program.

Department Handling Biological Materials and Their Products

The implementation of the University Biorisk Program addressed biosafety and biosecurity concerns while also protecting stakeholders from transmissible diseases. This would aid in disease containment by breaking the chain of infection and promoting a healthy and safe environment for all. With this, the department could perform risk assessment and mitigation while constantly monitoring to reduce laboratory-acquired infection and eventual disease transmission in the community. This served as the foundation for developing biosafety and biosecurity policies, rules, guidelines, and procedures.

Community

The highest priority has been public safety. The effective implementation of a Biorisk Management Program would keep the disease from spreading from laboratories to the community. This would uphold the university's social responsibility while also enhancing institutional integrity.

Plan for Utilization of this Study

This study could be used as a foundation for developing strategies for the University's Biorisk Management. As the first university-based biorisk management program, it could serve as a model for other institutions. The successful implementation of this

program could improve the university's biosafety and biosecurity measures and promote everyone's safety.

Limitations of the Study

The respondents of this study were selected employees of Central Philippine University who work with biological agents and were involved in the implementation of safety measures. These employees were categorized as Academic and Non-Academic.

The Academic category includes faculty and staff from Colleges of Medicine (COM), Medical Laboratory Science (MLS), Nursing (CON), Pharmacy (COP), College of Arts and Sciences (CAS)- Life Science Department and College of Agriculture, Resources and. Environmental Sciences (CARES)- University Research Center for Product Development.

The Non-Academic was grouped into Science which includes: Birthing Center, Clinical Laboratory, Medical and Dental Clinics and Non-Science that include: Administrative and Management, Ground, Building, and Maintenance.

The administrative and management includes the offices of the University President and under its administration: the Discipline and Safety Officer and Occupational Safety Health and Pollution Control Officer, Vice President for Finance & Administration, and under its administration: Accounting and Cashier, Vice President for Academic Affairs and Vice President for Student Affairs. These offices were responsible for implementing and funding university safety measures.

The deans, chairs, or department heads of the selected colleges, departments, and offices included in this study fall into the middle management level as they perform administrative functions. The deans, on the other hand, would serve for the duration of their agreement due to the nature of their position. After the term, they would return to their department or college as faculty. Accordingly, they were considered faculty in this study. Although department heads or chairs of non-academic departments, whether permanent or

temporary by designation, perform supervision and administrative functions, for this study in general they were included as staff. Heads or supervisors, as well as subordinates, must have a thorough understanding of biosafety and biosecurity and their implications.

Other colleges, departments, and offices which were not involved in the implementation of biosafety measures and do not work with biological agents, physical, chemical, and radiation hazards were not addressed in this study.

Considering that this study was carried out during the peak of Covid-19 Pandemic and in accordance with the Department of Health's health and safety policy, safety rules, social distancing, room capacity restrictions, and employee limitations were all subject to frequent modifications. Routine tasks like in-person meetings have been replaced by work-from-home programs, virtual meetings, online platforms, and video conferencing, which has reduced the number of people reporting to their workplace. With this, data collection schedule was extended to gather more responses.

Despite of extended deadline and due to the circumstances and conditions, 124 employees willingly took part in the survey and provided insightful feedback regarding the application of biosafety and biosecurity, as well as their beliefs, opinions, leaders' attitudes, and employees' practices. Data was recoded, analyzed, and interpreted based on participant responses to meet the goal of this study.

Duration of the Study

This study began in August 2021 and was expected to be completed by July 2023, taking into consideration health and safety protocols, disruption of services, and quarantine and isolations during the Covid-19 Pandemic.

The data collection period, which was scheduled to begin on March 15, 2023, was extended to September 30, 2023 to accommodate more participants and collect more responses for this study. The extension was made considering the effects of the Covid-19

Pandemic, the shift in work schedules from online to blended learning and work from home, and unstable health situations.

Chapter 2

Review of Related Literature

The establishment of a Biorisk Management Program was recommended. This would address biosafety and biosecurity concerns by developing measures to limit or mitigate hazards, as well as preventing exposure and intentional release of biological agents. Healthcare institutions profited most from the development and formation of this program, but it must begin at the academic institutions, where the basis of knowledge, attitude, and practices was set.

The creation of a biorisk management program for a university or academic institution was new and untested. Establishing this program was challenging. Before this could be implemented in the entire institution, there should be awareness about biosafety and biosecurity from the top management down to the lower level for employees who handle biological agents. The knowledge, attitude, and practices toward biosafety were critical in the creation of Biorisk Management Program. This would serve as a basis for crafting strategies to address the issues and concerns.

Biosafety and Biosecurity

The concepts of biosafety and biosecurity served as the foundation for biorisk management. The WHO Laboratory Manual 4th Ed (2020) and BMBL 6th Ed (2020) emphasized the distinction between biosafety and biosecurity. Programs for biosafety decreased or prevented environmental and human exposure to potentially dangerous biological agents. To maintain biosafety, different levels of laboratory control and containment were used, including restrictions on access to the laboratory and its layout, staff education and training, the use of containment instruments, and secure methods for

handling infectious materials in a laboratory setting. Contrarily, biosecurity works to avoid the mishandling of research data, biological materials, and microbes. Access to resources, research materials, and information were all controlled to achieve this. Despite having different objectives, biosafety and biosecurity measures were typically complementary, (CDC NIH, 2020).

A biosafety program was being integrated as a component of a comprehensive institutional safety program that was evaluating and dealing with all kinds of health and safety concerns inside of the institution, (WHO, Laboratory Biosafety Manual 4th Edition, 2020). Its purpose was to keep personnel safe from infections, intoxications, and illnesses, preventing the release of diseases and toxins, and safeguard the community and the environment. The size, complexity, and nature of the institution as well as the tasks carried out inside it would influence the feature and complexity of the biosafety program. Everyone's dedication was crucial for a biosafety program to succeed. The day-to-day administration of the biosafety program could be decided internally, and tasks could be assigned (CBSG 2nd Ed., 2015) .

Understanding biological agents and the valuable biological materials that need to be safeguarded was necessary to design a biosecurity plan that does not endanger laboratory processes or hinder research. Significant institutional issues may rise from maintaining the safety of pathogens and other delicate infectious materials while permitting unrestricted exchange of research resources and information. As a result, the best way to resolve any potential conflicts was frequently with a combined or tier-based strategy for biological material protection which is in line with the assessed risks. However, in the absence of legal requirements for a biosecurity policy, the health and safety of laboratory personnel and the surrounding area should come first (CDC NIH, 2020). Additionally, laboratory biosafety and biosecurity procedures were vital for defending the staff members of the facility and the community against unintended contact to or release of harmful biological agents. To

guarantee a safe workplace where necessary precautions were taken to decrease the likelihood and severity of any potential biological agent exposure, these actions were carried out with the aid of a risk assessment framework and the establishment of a safety culture (WHO, Laboratory Biosafety Manual 4th Edition, 2020).

The Goal of Biosafety

The ability to diagnose and conduct research has improved due to the rising global demand for better illness diagnosis and control. However, in low-resource nations, there had not always been a correlation between improvements in the ability to identify infectious diseases and improvements in biosafety and biosecurity. Many obstacles prevented low-resource countries from managing biosafety and biosecurity effectively or expanding their sustainable capability (Heckert, R., et al., 2011).

The main objective of biosafety was to assure a safe procedure among laboratory staff in research and clinical laboratory settings. It was frustrating to know that in a study conducted, even after multiple training sessions, there was still a poor level of safety procedure adherence among laboratory employees (Shakoor, S., et al., 2016). Biosafety procedures must be streamlined following acceptable laboratory procedures to reduce workplace accidents and promote a secure environment for testing diagnostic human samples (Shobowale, E., et al., 2015). The difficulties that the healthcare workers were facing were the lack of appropriate biosafety policies and practices. As a result, laboratory biosafety was a significant issue in underdeveloped nations. Other important issues which involved biosafety were lack of training, excessive workload, personnel attitude such as working too quickly, not adhering to safety procedures, doubting the existence of biohazards, failing to wear personal protective equipment, unaware of proper laboratory procedures and biosafety measures, and being resource-poor (Nasim, S., et al, 2012).

The present routine precaution methods, according to Pedrosa & Cardoso (2011), were insufficient to prevent most uncommon infections in hospitals. Furthermore, laboratory personnel capability building and the involvement of laboratory managers as stakeholders in improving practice were crucial, according to Shakoor et al. (2016) who identified workplace characteristics as one of the largest influencers on biosafety practice. Finally, it was advised that biosafety procedures be frequently examined to determine the usefulness of continuous education and training initiatives.

Biorisk Assessment

The institution should do everything reasonably possible to avoid negative health effects caused by workplace exposures (CWA-16393, 2012). This encompassed infection control, health monitoring, and post-exposure care as components of the biorisk management framework. An employee was less probable to get sick from exposure to hazardous, infectious, or physically harmful substances at work if there was a preventative occupational health program in place. A successful treatment plan could lessen the effects on infected workers when working with biological agents. Huigang, L., et al. (2020) added that a biosafety prevention system must be established to effectively respond to infectious disease outbreaks. The difficulties posed by newly emerging and reemerging infectious illnesses, biotechnology concerns, and threats from bioterrorism must be handled by this system with sufficient sensitivity (Gao, For a better world: Biosafety strategies to protect global health, 2019). By focusing on managing biorisks, the institution must encourage national authorities, laboratory managers, and ultimately laboratory staff to assume responsibility for creating the essential safeguards. This would help the institution's biorisk management system function more effectively over time. Therefore, it was important to address, manage, and reduce biorisks in all their potential forms (WHO, 2006) and (CWA-16393, 2012).

In the past, understanding that hazards alone did not pose a threat to people or animals, and that simply identifying a biological agent's pathogenic characteristics was not enough to determine the true risk, was crucial. It was necessary to consider the kinds of procedures that would be carried out using the biological agent as well as the setting in which they will occur. Any facility handling biological agents has a responsibility to its staff and the community to perform a risk assessment of the job they would be assigned and to choose and implement the proper risk control measures to lower those risks to an acceptable level (WHO, Laboratory Biosafety Manual 4th Edition, 2020).

Considering the unique circumstances of each laboratory (procedures, staff knowledge, and equipment), risk assessment was a valuable tool for promoting biosafety. It encouraged labs to consider potential risks and establish appropriate safety measures (WHO, Tuberculosis Laboratory Biosafety Manual, 2012). To evaluate the required levels of controls within each program, risk assessments for the biosafety and biosecurity programs were carried out. In contrast to biosecurity, which assessed methods to maintain the security of biological materials and pertinent sensitive information, biosafety reviewed the proper laboratory techniques and practices essential to prevent exposures and occupationally-acquired infections (CDC NIH, 2020).

Identification of all biorisk-related threats and hazards was the initial stage in the biorisk management process. It was advantageous to seek feedback from organizational specialists on safety and biorisk management in this process and involved the entire work team (CWA-16393, 2012). The purpose of the risk assessment was to gather data, analyze it, and utilize it to support and justify the usage of processes, procedures, and technologies to reduce the risks that were already present. By giving them a better awareness of the biological risks and how they could influence them, the study of this data empowered laboratory staff. As a result, laboratory staff was more likely to carry out their work safely and uphold a safe culture in the laboratory. It also helped to build common values, behavioral

patterns, and views of the importance of safety (WHO, Laboratory Biosafety Manual 4th Edition, 2020).

In the context of laboratory biosafety, the word "likelihood" refers to the probable exposure and/or release outside of the lab. The term "consequence" refers to the intensity of an exposure's impact if it does. This could be due to a disease spreading throughout the community, an infection linked to a laboratory, asymptomatic carrying, environmental contamination, or another illness or injury. As a result, factors such as transmission routes, infectious dose, and communicability must be considered concerning the outcome of exposure or release (WHO, Laboratory Biosafety Manual 4th Edition, 2020).

The final step was to inform all relevant staff about the goal, function, and application of the risk control procedures after they have been selected, approved, and acquired. Only then can they be executed correctly and efficiently. Communication and feedback were essential in biosafety and risk assessment. At a basic minimum, communication of the risks connected to the hazards (biological agents) present, the processes being used, and how the precise risk control methods applied can most effectively reduce those risks. The use of laboratory-specific SOPs, interactive team discussions, job aids, and posters, as well as general awareness-raising through brief publications (like pamphlets and handouts), briefings, and email notifications were additional communication and outreach strategies beyond traditional biosafety training (WHO, Laboratory Biosafety Manual 4th Edition, 2020).

Laboratory Acquired InfectionS (LAIs)

Global public health has been seriously threatened by the emergence of serious infectious illnesses that have sparked a new global crisis. The attitude for controlling and preventing infectious diseases is still serious, and the demands placed on individuals engaged in such initiatives continue to grow. Indeed, the current biosecurity scenario was serious. To support and raise the level of biosafety, increasing knowledge and

consciousness of biosafety issues among governmental, public, and professional groups, and promote technological exchange between specialists and academics in global biosafety (Zhou, D., et al., 2019).

According to a survey on "*Survey of laboratory-acquired infections around the world in biosafety level 3 and 4 laboratories*", over the past century, a wide range of bacteria, viruses, parasites, and fungi has been reported as causes of laboratory-acquired infections; workers in the field were susceptible to exposure to these infectious agents. Nevertheless, most laboratory-associated infections have been reported voluntarily, and it was impossible to ascertain the actual number of cases or the specific risks to workers (Wurtz et al, 2016). Infections acquired in laboratories were as old as the laboratories. Microorganisms were transferred to laboratory personnel simultaneously with the introduction of their cultivation. Such infections have been thoroughly characterized, and strategies for preventing or avoiding them have been developed (Petts et al, 2021).

Preventing laboratory-acquired infections, the laboratories must have a durable biorisk management system in place to prevent the loss of vital human resources, particularly in the event of a public health emergency (Sarwar et al, 2022). A biosafety culture in microbiology laboratories was essential in conducting safe research. Research advancement would be ensured without compromising environmental or public health by creating local and national biosafety regulations and policies in conjunction with it (El-Shokry et al, 2022).

To acquire the necessary knowledge to handle biologically hazardous compounds in line with internationally recognized procedures, laboratory staff education and training were essential. To educate laboratory personnel about the epidemiology, pathogenicity, and human susceptibility of LAIs, workshops should also be organized. Consequently, several health risks resulting from biologically hazardous materials could be eliminated, reduced, or managed through the appropriate application of nationally and internationally certified

protocols, which include appropriate microbiological practices, containment devices and apparatus, adequate facilities and resources, protective barriers, and specialized training and education for laboratory personnel (Peng et al, 2018).

Biosafety Knowledge Attitude and Practices During Pandemic

A primary concern of biosafety efforts was the risk of exposure of infectious disease to individuals and communities. Infectious disease agents' emergence and reemergence became a public health concern. As the causative agent of COVID-19, SARS-COV2 caused havoc and altered global perceptions of health and safety. There has been a global shift in workplace biosafety attitudes and practices. To address concerns about disease transmission, staff should be divided into more manageable teams or shifts, and the number of consecutive days work must be considered. In addition, split team arrangements, workplace physical distance, worker health monitoring (to detect early infection), and the usage of PPE were all noted and advised (Lim, et al, 2020).

According to a study titled "*Paradigms about the COVID-19 pandemic: knowledge, attitudes, and practices from medical students*," many students had negative attitudes, but there were some students who were interested in volunteering, had substantial knowledge, and who would constitute a skilled workforce in the future. They could gain from the opportunity to reinforce, enhance, and progress their training. Their negative attitude was associated with a lack of personal protective equipment, so providing these was possibly one of the best strategies to guarantee that all students received training (Lincango-Naranjo, et al., 2021). Gebretsadik et al. (2021) found that in contrast to the medical students who indicated high level of knowledge, there was an alarming lack of understanding, negative attitude, and inadequate practice surrounding the COVID-19 pandemic, all of which need to be improved right now. Low levels of education and interaction with confirmed COVID-19 cases were shown to be significantly correlated with poor knowledge, whereas bad practice

was found to be strongly correlated with poor knowledge, low levels of education, and a history of travel. Furthermore, it was advised that COVID-19 knowledge, attitude, and practice improvement programs for health educators must be set into place as soon as feasible.

Monkeypox (MPX) disease, caused by a Monkeypox virus, was another biological agent of concern that had recently threatened the world. Exposure to someone who had a monkeypox rash, such as face-to-face, skin-to-skin, mouth-to-mouth, or mouth-to-skin contact, including sexual contact, could result in the transmission of this zoonotic viral infection from animals to people. It should be noted that this was a skin-to-skin infection rather than a sexually transmitted illness. This can also be transmitted through contaminated environments such as clothing, bedding, and towels, and was referred to as fomite transmission (WHO, 2022). Early in the 1970s, monkeypox was thought to be a tropical disease of Western and Central Africa that was neglected, but by 2022, it had spread to Europe and North and South America, (Ricco, et al., 2022) and now a global threat.

SARS-CoV-2 and the Monkeypox virus were biological agents that were crucial for biosafety and biosecurity. This could be avoided by implementing biosafety and biosecurity measures. Adequate knowledge of these biological agents, combined with a positive attitude, will reinforce good practices, and help to control disease transmission more effectively. Monkeypox knowledge was unsatisfactory, with significant gaps in all areas. In turn, risk perception analysis revealed that Monkeypox was significantly overlooked as a pathogen, especially when compared to SARS-CoV-2, TB, HIV, and HBV (Ricco, et al., 2022).

Biosafety and biosecurity knowledge, attitudes, and practices were crucial in the prevention and control of transmissible diseases. Infectious disease is caused by biological agents, and understanding these biological agents is critical for disease containment. Several studies had revealed gaps in knowledge about biological agents of concern that

contribute to its transmission and risk of exposure (Ricco, et al., 2022), (Harapan, et al., 2020) and (Abdi, et al., 2015). However, if there was sufficient information, it could produce a positive mindset and beneficial practices (Haq, et al, 2012). To encourage preventive behavior among the public, health officials and legislators must advance knowledge and efficacy beliefs (Lee, et al., 2021).

The Biorisk Management Culture

The responsibility of the university to students, staff, and the community were to foster a "culture of safety," with biosafety and biosecurity as a component of the biorisk management program was one of the most crucial aspects of this culture. The university strived for a "culture of excellence" in academics, research, and outreach. Biorisk Management Culture (BRMC) was a component of organizational culture that highlighted responsible behavior in the Life Sciences, biosafety, and biosecurity claims, Khripunov (2017) in the research "Biorisk Management Culture: Concept, Model, Assessment." The fundamental components were the outcome of worldwide standards and legal frameworks, as well as national laws that were formed with due consideration of international norms. The workforce must internalize BRMC, a subset of organizational culture, for it to be maintained. This requires that it be relatively congruent with the dominant organizational culture. To support or enhance laboratory biosafety best practices, individuals from all corners of the organization work together to foster a biosafety culture. This culture consists of a set of values, beliefs, and behavioral patterns that were instilled and facilitated in an open and trusting environment. The success of a biosafety program depends on this culture, which was grounded on the active engagement of all employees across the firm and mutual trust, as well as a commitment from the management. The foundation for an effective biosafety program was the establishment and maintenance of a biosafety culture (WHO, Laboratory Biosafety Manual 4th Edition, 2020) and (Khripunov, I., et al., 2017).

According to Khripunov, I., et al. (2017), a comprehensive weapon of mass destruction (WMD) non-proliferation strategy that incorporated culture might benefit greatly from a successful BRMC in terms of biosecurity culture. Given the intricate nature of biosafety/biosecurity oversight systems, the requirement for evidence-based judgment (e.g., on staffing, improvement areas, training program selection), and the ability to identify changes in behavior connected to a specific intervention, it was imperative to regularly evaluate the benefits and drawbacks of BRMC.

The WHO Laboratory Manual Fourth Edition (2020), stated that the international bioresearch community should work toward a culture of biorisk management. One common trend was that facility managers must be involved in the choice of protocols, control measures, and authentication systems rather than relying on a prescriptive approach that addresses biosafety and associated issues and demands adherence to a rigid practice. Goal-setting approach outlined the expected output for facilities and placed responsibility on a single condition to ensure that set goals were met. Additionally, this called for the participation of committed managers and leaders who acknowledged actions and played a critical role in promoting and assisting the growth of a global biorisk management culture. With the help of this method, nations and facility administrators could specify and pick the best biorisk management controls and systems to guarantee the accomplishment of the stated biorisk management objectives. It enabled organizations to customize their laboratory biosecurity plans to fit their needs (WHO, 2006).

The Biorisk Management Program

The World Health Organization (WHO) together with other international biosafety and biosecurity organizations directed that nations and organizations utilize the biorisk management for healthcare facilities and research institutions to contain the spread, exposure and threat of disease transmission to the public. This was strengthened by the

agenda for responsible Life Sciences research in "Responsible Life Sciences Research for Global Health Security- Guidance Document," issued in 2010. Research excellence, biosafety and ethics, and laboratory biosecurity were the three pillars of this integrated system, which also prioritize public health. Additionally, the strategy for managing biorisk strives to guarantee the responsible, secure, and safe handling of biological resources. It was developed with assistance from the Life Sciences community to help international organizations respond to unintentional or intentional biological hazards to human well-being and the environment (Qasmi, S. et al., 2019).

The development of a thorough laboratory biosafety and biosecurity culture was one of the objectives of the biorisk management method. This approach also aimed to improve the general working setup and pushed for expected competent laboratory management (WHO, 2006). It was impossible to find a "one-size-fits-all" remedy for biosecurity and biosafety problems (ASEAN Nations, 2010). A Biorisk Management Culture (BRMC) must be developed to establish a set of appropriate employee behavior standards. Biorisk mindfulness and culture were influenced by employee assessments and attitudes (Khripunov, I., et al., 2017).

It was crucial to remember that the problems with biorisk management that have been discovered were not just problems for low-resource nations; many of them also affected high-resource nations. Technical literature on biosafety and biosecurity was essential for disseminating biorisk management principles and practices to the user community (Heckert, R., et al., 2011). To improve biorisk management, the organization needs to concentrate on preventing nonconformities and unwanted events at their source. System defects were systematically found and fixed, which improved system efficiency and biorisk management (CWA15793, 2011). The key components of an efficient Biorisk Management implementation were drive, dedication, leadership, accountability, expertise,

competence, learning and development. While they were all significant, putting other ideas into practice require knowledge and training, (Khripunov, I., et al., 2017).

Abad, (2014) and Khripunov, I., et al., (2017) agreed that a successful biorisk management system and an effective culture were dependent on the top management's strong commitment to providing adequate resources and priorities, necessitating a set of principles that leaders impose rules, decision-making processes, management systems, and employee behavior at all levels in their organizations. These guidelines should be followed throughout the organization clearly and consistently, and people should be aware of them. Medina et al. (2017) added that an established Biorisk Management Committee was required for a Biorisk Management System to continuously improve.

The Role of Biorisk Management In the University

Universities, as a foundation for learning, innovate in the direction of quality education by providing students with a broad range of knowledge and skills in academics, research, and extension. As a result, the use of biological infectious agents in science and health, both academic and research, had grown and exposed students, faculty, and staff, and alerting the public to the danger of illnesses acquired in laboratories. Depending on the individual and community, the impact of these infections ranged from negligible to disastrous.

Bowolaksono, A. et al (2021) stated in their study "*Analysis of Bio-Risk Management System Implementation in Indonesian Higher Education Laboratory*" the developing countries that faced numerous challenges when it comes to implementing biorisk management in laboratories. Moreover, educational institutions were considered biohazardous workplaces. Laboratory accidents like Laboratory Acquired Infections (LAIs) could happen, and every action that took place in a laboratory facility carried significant risks to both human health and the community. Furthermore, it was crucial to carefully handle

pathogens in the teaching laboratory. The absence of established biosafety regulations specific to the teaching laboratory, on the other hand, had forced educators and institutions to build their protocols. As a result, different institutions had different levels of biosafety and inconsistent biosafety procedures (Emmert, Biosafety Guidelines for Handling Microorganisms in the Teaching Laboratory: Development and Rationale, 2013). The adoption of a biorisk management system must be evaluated in any activity that involved the handling of biological agents to reduce the impact and occurrence of laboratory accidents (Bowolaksono, Analysis of Bio-Risk Management System Implementation in Indonesian Higher Education Laboratory, 2021).

The increase in disease transmission cases in the community could be attributed to the accidental or deliberate release of biological agents from laboratory activities used for diagnostics or research. This could be due to a lack of knowledge among personnel who handle these biological agents, an easygoing and uncaring attitude, and poor biosafety practices. According to Guerrero and Serrano (2017) in their study "*Biorisk Assessment of Natural Science Laboratories: Contributing to the Culture of Safety and Security in the University*," There was no functioning biosafety management system in many academic laboratories in the Philippines. Some biosafety issues had not been addressed even though this has been in existence for almost ten years. For instance, there were no SOPs for biological transfer, receiving, and decontamination of culture media, or disposal of animal carcasses in the university's operations manual. This information was not contained in a single document, and there was no committee or biosafety officer in charge of BRM matters. According to Qasmi, et al. (2019), biorisk management was a major concern that was unfortunately inadequate in the local context of graduate education, research training, and the development of professional laboratory skills at various levels. There had not been many published studies on graduate students' awareness of this issue.

Differences in Knowledge Attitude and Practices

Knowledge on Biosafety and Biosecurity. Due to the absence of biosafety information or understanding of where evidence was kept, senior executives and decision-makers may not fully understand the significance of biosafety and biosecurity best practices. Because of the neglect or low priority given to these problems, funding for biosafety and biosecurity was limited or nonexistent. The situation was made worse by the frequent widespread ignorance of recommended methods at the laboratory level (Heckert, R., et al., 2011). Furthermore, graduate students, researchers, and laboratory technologists/technicians had little knowledge of biorisk management, which could pose risk to individuals, communities, and the environment (Qasmi, S. et al., 2019).

In creating initiatives to lessen the dangers connected to managing and removing infectious pathogens, Coelho, A &, Dez J., (2015) and Sewell, (1995) agreed that based on knowledge of the infectious agent's pathogenicity, the host's susceptibility, and most critically, its mechanism of transmission, laboratory staff training and education were crucial. For efficient biorisk management, it was essential to comprehend the risks and uncertainties (WHO, 2006). To clear up any confusion, biosafety refers to all precautions taken to avoid exposure to disease-causing organisms and/or the discharge of toxins into the environment (Coelho, A. & Díez, J., 2015). Training employees to understand the importance of safety measures and to practice them was the cornerstone of all safety initiatives. When safety measures were commensurate with the risk, employees were more inclined to comply. Laboratory management and staff must work together to establish and implement safety procedures that lessen the likelihood of laboratory-acquired diseases and laboratory accidents even if full safety in the laboratory was impossible (Sewell, Laboratory-Associated Infections and Biosafety DAVID, 1995).

The effectiveness of the program depends on the significance of training as a part of biosafety and biosecurity. Employees need to be aware of the risks posed by diseases and

toxic substances at work, as well as the precautions to take and the equipment to use. Both learning (theory) and training were included in the training program (i.e., practical) (CBSG 2nd Ed., 2015). Reviewing important biosafety precautions that might be disregarded owing to the pressures of everyday work was given the chance at annual safety training (Frieden, T. et al, 2012).

Although clinical laboratory science educators had a modest understanding of regulations, they could point out areas that require attention, such as the absence of biosafety workshops and seminars, the existence of laboratory-acquired infections, and the ineffective communication of institutional and national safety guidelines. There was a need to increase their understanding of several biosafety-specific subjects, such as the usage of a biosafety manual, accountability for complying with biosafety laws, personal protective equipment, biosafety containment level, and safety during routine laboratory work (Cruz, C., et al., 2015). Improving knowledge and comprehension of workplace biosafety and biosecurity require pertinent instruction, training, and concrete demonstration. To achieve effective biorisk management across all institutions was still needed. Allocating adequate resources and making efforts to encourage and preserve biosafety culture at the individual and organizational levels by holding such educational seminars regularly. However, fostering an ethical and safe culture, as well as applying effective biorisk management, appears to be the most probable means of preventing biological material misuse and meaningfully improving control of latent dual-use problems in the life sciences community (Muneer, S., et al, 2021) and (Qasmi, S. et al., 2019).

The result of various researches conducted claims that effective and hygienic laboratory techniques were either not used or were only hardly known. Although they were aware of these safety measures, the personnel was not adhering to the rules and were unconcerned about the implementation of biosafety principles due to the absence of a biosafety officer (Nasim, S., et al, 2012), (Elduma, 2012), and (Idris AF and Bayoumi M,

2016). To address this shortcoming, proper institutional awareness was necessary. Institutional biosafety assistance was essential to keep track of, manage and document laboratory-acquired infections and mishaps. There was also a critical need for fundamental training programs to increase laboratory employees' understanding of fundamental self-hygiene practices and biosafety concepts. A biological safety officer oversees upholding biosafety precautions in the lab and overseeing operations involving protocols, tools, staff, storage, material transfer and transit, correct disposal of biological material, and other things. To enhance all laboratory biosafety implementation, they also want laboratory leadership that can collaborate with the biological safety officer and employees (Ahmad, S., et al, 2019).

Attitude on Biosafety. Understanding the community's disease-related knowledge, attitudes, and practices was an important determinant of community participation in program implementation (Li, D. et al, 2015). According to Khripunov, I., et al. (2017), beliefs and attitudes were the cornerstone of the Biorisk Management Culture (BRMC) and govern the conduct of everyone involved in the regulation, management, or operation of bio facilities or activities as well as anybody who handle them.

Managers' and employees' behavior in support of an acknowledgment of the necessity for biorisk management was primarily driven by laboratory-wide beliefs and attitudes. These attitudes and beliefs include: (1) the notion that biorisks were a danger to public health on a global and national scale; (2) the likelihood that biological material would be misused by both insiders and outsiders; and (3) the idea that biosecurity was just as crucial to biorisk management as biosafety.

According to Goswami, H., et al. (2011), inadequate application of safe laboratory techniques, ignorance of necessary safety precautions, and apathy are all factors that contributed to numerous mishaps in laboratories. J. Zaveri & Karia, J., (2012) also agreed

that there was an inadequate understanding, attitude, perception, and adherence to general work precautions.

Practices on Biosafety. One of the key determinants of effective biosafety practice was the assessment of workplace variables. The development of laboratory capabilities and the participation of laboratory managers as stakeholders in practice improvement were essential. Regulatory agencies undertaking biosafety assessments and government-initiated programs were necessary (Shakoor, S. et al, 2016). The recommendations for the practice of biosafety were based on professional judgment by international microbiology experts; however, they must be implemented responsibly until evidence-based research can confirm their validity in the lack of supporting evidence-based study and documentation (Frieden, T. et al, 2012).

Utilizing safe work procedures in handling toxic or infectious materials safeguarded workers from pathogens and helped discontinue the release of these substances. All safe work practices involving biological materials begin with good microbiological laboratory practices. All personnel could easily understand and implement standard operating procedures (SOPs) that were drafted to ensure safe working conditions (CBSG 2nd Ed., 2015). Developing and implementing acceptable biosafety and biosecurity best practices in low-resource nations were challenging; funding partners and low-resource nations must be aware of this and work together to overcome it (Heckert, R., et al., 2011).

In certain circumstances, biosafety and biosecurity procedures may be contradictory in demanding the development of policies that accommodate both sets of objectives by personnel and management. For instance, signage may result in a disagreement between the two programs. To inform individuals of any potential hazards inside the laboratory, it is a standard biosafety procedure to display signage on the doors. On biohazard signs, the name of the agent, specific hazards associated with its use or handling, and the investigator's contact information are frequently provided. These processes could conflict

with security objectives. When developing institutional laws, biosafety and biosecurity issues needed to be consistent with the dangers that have been identified (CDC NIH, 2020).

Several studies conducted in various parts of the world concluded that a lack of responsiveness and resources contributed to poor biosafety practices among laboratory technicians (Idris AF and Bayoumi M, 2016), (Nasim, S., et al., 2012), (Ahmad, S., et al, 2019), (Khan, S., et al, 2014), (Sadia, N. et al., 2010) and (Shobowale, E., et al., 2015). On the contrary, Alkandari, A., et al, (2013) stated that although they had sufficient knowledge and a positive attitude, primary healthcare providers displayed inadequate practice. This demonstrated the critical importance of implementing initiatives to improve Hospital Acquired Infection (HAI) healthcare policies. According to Ahmad, S., et al. (2019), laboratory personnel were more likely to be exposed to infections because of improper management and risky laboratory procedures during sample collecting, processing, specimen discarding, and other procedures because they are not sufficiently informed about biosafety risks.

Strong safety culture was required to develop good biosafety laboratory practices (Huang, Y. , et al, 2019). Human factors should be considered as well because laboratory personnel's competence and the capacity to adhere to recognized biosafety policies and procedures, especially Good Microbial Practices and Procedures (GMPP), were likely to have a significant influence on the risk of accidents. Even the most technically advanced facility or piece of equipment can only guarantee user safety if the user was properly trained and practiced competency (WHO, Laboratory Biosafety Manual 4th Edition, 2020). Training was a potent tool for changing perceptions and conventions. In low-resource nations or areas, creating specialist training staff through a Train-the-Trainer methodology was an effective way to start and sustain long-term reform in biosafety standards (Heckert , et. al, 2011).

The ability to adjust one's attitude was driven by knowledge. A shift in mindset was required to achieve the best practices. Lack of biosafety and biosecurity awareness leads to

inadequate biosafety and biosecurity procedures, as well as workplace mishaps connected with exposure or deliberate release of biological agents to cause infection and disease outbreaks. Proper knowledge could influence indifferent attitudes. As a foundation for building Biorisk Management for the University, an assessment of the level of knowledge, attitude, and practices about biosafety and biosecurity from the top-level management to the selected staff handling biological agents was required.

Relationship of Knowledge, Attitude and Practice

Knowledge and Attitude. In an investigation of knowledge, attitude, and practices done on workers returning to work under COVID-19 epidemic revealed that awareness of prevention and control for safety was good, though there were differences in knowledge in personal protection among different occupational groups. There were no differences in attitude and practice (Fan, et al, 2021).

Attitudes and adherence to preventive actions were positively correlated with knowledge and educational level. This correlation suggests that increased knowledge and education translate into more constructive attitudes and improved behaviors. Better adherence to preventive measures could be attained by modifying attitudes through focused interventions, which would improve overall safety response (Devkota et al, 2021). A study showed evidence of relationship among knowledge and attitudes and preventive behaviors. Moreover, knowledge was an essential predictor of attitudes and behaviors, contributing to advancing intervention strategies to promote and sustain the public's precautionary behaviors (Lee et al., 2021). Significant findings were also found in another study which indicated that knowledge directly influence attitudes (Puspitasari et al, 2020).

In contrast, a study found significant gaps in knowledge, disparities in attitudes, and discrepancies in practice. Moreover, all of which provide for significant room for development (Gopalakrishnan et al, 2021).

Knowledge and Practices. Competent workers understood the importance of safety while at work. They had extensive knowledge in safe work standards, nevertheless they displayed unsafe practices. Nonetheless, employees who had good knowledge, positive attitudes, and safe work practices, would help to lower workplace risks, and support the institution in overcoming upcoming obstacles (Ngah et al, 2022).

A study on COVID-19 in Bangladesh revealed a gap in understanding and response to COVID-19. Although half of the population showed an adequate knowledge of the virus, they lacked the appropriate attitude and safety practices. This implied that positive practices cannot be achieved solely by knowledge (Haque et al, 2021).

Conversely, findings of a survey performed in Karachi, Pakistan, indicated that laboratory workers lacked knowledge of biosafety precautions and good laboratory practices. Additionally, basic training programs needed to be established to raise awareness of these concepts and good laboratory practices (Nasim et al, 2010). Moreover, a study conducted in Yemen revealed that laboratory employees had weak commitment to biosafety policies and fair to poor knowledge of and practices in biosafety. This evidence emphasizes how important it is to improve laboratory biosafety procedures and programs (Nabil Al-Abhar et al, 2017).

Attitude and Practices. In the framework of Biorisk Management Culture (BRMC), positive attitudes towards biosafety and biosecurity should translate into responsible practices. BRMC aimed to strengthen existing protocols and procedures by fostering these positive attitudes (Khripunov, I., et al., 2017). Positive attitudes toward laboratory safety protocols and adherence to the institution's biosafety protocols were indicators of effective laboratory practice (Geraldez et al, 2023).

In the Philippines, a study on dengue fever revealed that knowledge and attitude are inconsistent with actual practices. For knowledge and attitude had a meaningful impact on practices, the study emphasized the significance of behavioral modification (Herbuela et al,

2019). Moreover, in a study about COVID-19 concluded that while most participants demonstrated good knowledge and an optimistic attitude, their level of practice was lower than expected to maximize effective control measures. This gap between attitude and practice indicated that having a positive attitude did not necessarily translate into appropriate actions (Gebretsadik, et al., 2021). Another study showed that there was no correlation found between having sufficient knowledge and engaging in more cautious measures. Diverse positive affective attitudes had varied predictive correlations with preventive practices, suggesting that attitudes may be more important in motivating people to take preventative action (Luo et al, 2022) . Likewise, a study on biological waste management indicated that while health care professionals' attitudes were positive, their knowledge and practices were found to be inadequate (Sharma et al, 2019).

Synthesis

The development of a Biorisk Management Program (BRMP) in universities was essential for addressing biosafety and biosecurity concerns. A successful BRMP ensured the safe handling of biological agents and was crucial for preventing laboratory-acquired infections (LAIs) and accidental releases of pathogens. Commitment from the top management to the laboratory personnel was vital for the program's success (CBSG 2nd Ed., 2015).

Biosafety and Biosecurity Concepts

Biosafety focused on preventing exposure to harmful biological agents through containment and control measures. Different levels of laboratory control and containment were employed to maintain biosafety, including access restrictions, staff education and training, use of containment instruments, and secure handling methods for infectious materials.

Biosecurity aimed to prevent the misuse of biological agents and materials by controlling access to research data, materials, and pathogenic agents. While biosafety and biosecurity had different objectives, they were complementary and essential for protecting laboratory personnel and the community (WHO Laboratory Manual 4th Ed., 2020).

Challenges in Implementing Biorisk Management Program (BRMP)

Developing countries and educational institutions faced significant challenges in implementing standardized biosafety protocols. Inconsistent biosafety practices across institutions highlight the need for uniform protocols and regulations (CDC NIH, 2020).

Knowledge, Attitudes, and Practices (KAP)

There was often a lack of sufficient knowledge about biosafety and biosecurity among laboratory personnel and decision-makers. Comprehensive education and training programs were necessary to address these gaps. Positive attitudes towards biosafety were necessary but not always sufficient to ensure safe practices. There was often a gap between attitudes and actual practices. In the context of practices, safe laboratory practices were crucial but often inadequate due to insufficient training and awareness. Effective biosafety practices require proper resources and institutional support.

Relationship between KAP

Several studies indicated a significant gap between knowledge and actual practices, with knowledge not always translating into safe practices. Positive attitudes towards biosafety can influence practices, but there are inconsistencies in how attitudes impact behavior. Effective biosafety practices require comprehensive training programs, proper resources, and institutional support.

Behavioral Modification

To achieve an effective BRMP there should be a modification of behavior. Behavioral change was essential to align knowledge and attitudes with actual practices. These involved regular training, awareness programs, and fostering a culture of safety and responsibility.

In summary, establishing an effective Biorisk Management Program in universities is crucial to address the discrepancies between knowledge, attitudes, and practices. This requires comprehensive education, training, and behavioral interventions to ensure that positive attitudes and adequate knowledge translate into safe and responsible practices. Building a strong biosafety and biosecurity culture within academic institutions is essential for mitigating risks and protecting both laboratory personnel and the broader community.

Chapter 3

MethodologY

Research Design

This is a quantitative study. Data was collected through surveys using questionnaires. The data was used in descriptive analysis, comparison of differences, and determining relationships between employees' knowledge, attitude, and practices.

Target Population, Selection and Sampling Procedure

The study population consisted of selected Central Philippine University employees who work with biological agents and were involved in the implementation of university safety measures. These employees were divided into two clusters: academic and non-academic.

The Academic cluster included selected academic colleges and departments that work with biological agents and were involved in student teaching and learning. While the non-academic clusters were selected offices under Administrative and Management, Healthcare Services, and Ground and Building Upkeep Maintenance.

Inclusion Criteria

In selecting a sample for this study, the following were considered:

Respondent must be an employee of Central Philippine University (CPU) working with a biological agent and be involved in the implementation of safety measures for the university. This was clustered into academic and non-academic.

Academic cluster consisted of dean, faculty and staff of colleges and departments that work with biological agents who give direct instructions and assistance during the activity.

Non-academic cluster included those non-teaching employees who play a significant role in the implementation and funding of safety measures in the university. Those who were directly handling patients, front-line workers in offices as they were directly entertaining clients and students and personnel handling and having exposure to waste as academic cluster; while those who were involved in implementation of policies and guidelines as well as allotting funds for operation and sustainability of safety measures were considered as non-academic cluster.

Exclusion Criteria

This study excluded CPU employees working in offices, colleges, and departments that do not work with biological agents and were not involved in the implementation of safety measures and all non- CPU employees. Student assistants were not included in this study.

Sampling Procedure

Samples were selected based on the set inclusion and exclusion criteria. Academic clusters include the dean, faculty, and staff from Colleges of Medicine (COM), Medical Laboratory Science (MLS), Nursing (CON), Pharmacy (COP), College of Arts and Sciences (CAS)- Life Science Department and College of Agriculture, Resources and. Environmental Sciences (CARES)- University Research Center for Product Development. Non-academic clusters included selected offices under Administrative and Management, Healthcare services and Ground and Building Upkeep Maintenance.

Selected offices under Administrative and Management include: Office of the University President under this were the Discipline and Safety Officer and Occupational Safety and Health Officer and Pollution Control Officer; the Vice President for Finance & Administration includes Cashier and Accounting; the office of the Vice President for Academic Affairs and Vice President for Student Affairs. The Healthcare Services consisted

of the Medical Clinic, Dental Clinic, Clinical Laboratory, and Birthing Center; while the ground and building upkeep maintenance consisted of janitors assigned to buildings and ground.

Table 1 below shows how samples were taken from the population. With a margin of error of 5% and a confidence level of 95%, 214 respondents out of the 480 total population were selected as the actual sample. As indicated in Table 1, 214 were drawn equitably from each category. Below is the distribution of sample size and population. Purposive sampling with non-random selection was employed in this study.

Table 1. Population and Sample Group Distribution

Population Description: Selected university employees who handle biological agents and were involved in the implementation and funding of the program

Population Size: 480
Sample Size: 214

Cluster/ Category	**Cluster Size**		**Sample Groups**	**Sample Size Distribution** ***(Sample needed + response rate adjustment*)***	
	Total	Sample needed		**Faculty**	**Staff**
ACADEMIC (total):	393	**177**	College of Medicine = 191 Faculty= 184 Staff= 7	83	7
Faculty	374				
Staff	19				
			College of Nursing= 98 Faculty= 96 Staff= 2	44	2
			College of Medical Laboratory Science = 48 Faculty= 46 Staff= 2	22	2
			College of Pharmacy= 22 Faculty= 20 Staff= 2	10	2
			Department of Life Science= 13 Faculty= 11 Staff= 2	11	2
			CARES- Research= 21 Faculty= 17 Staff= 4	9	4
	SUBTOTAL			179 +	19

Table 1

Continuation

Cluster/ Category	Cluster Size		Sample Groups	Sample Size Distribution *(Sample needed + response rate adjustment*)*
NON-ACADEMIC	87	**39**		
Science Related	18	8	Birthing Center	3
			Medical Clinic	9
			Dental Clinic	4
			Clinical Laboratory	2
Non-Science Related	31	14	Building	13
			Grounds	15
			Plumber	3
Administrative	38	17	Office of President	15
			VP Academic Office	4
			VP Administration Office	4
			Cashier	4
			Accounting	9
			Occupational Safety and Health Officer and Pollution	1
			Control Officer	1
			Discipline and Safety Officer	
	SUBTOTAL			**87**
Sample size Needed= 214			**Sample to collect with adjustment (faculty+ staff+ non academics) = 285**	

** For subgroups with a population of 15 and lower shall be taken as a whole sample*

Out of 480 total population, 214 samples were needed to participate in this study. Considering the response rate and dropout rate adjustment in the sample needed to collect was 285 as shown in table 1. This 285 included the proportionately distributed sample from the clusters and those sub-groups with a small population of 15 and below which was taken as a whole. The 214 was the minimum sample needed to achieve the 95% confidence level with a 5% margin of error. An increase in this number of samples would decrease the margin of error. Hence, those qualified, complete, and valid responses were only included in this study.

However, during a survey conducted with a target population of 480 individuals and the expected sample size as calculated from 95% confidence level with a 5% margin of error which was 214 participants and including all members from departments with 15 employees, which led to a higher anticipated number of 285 participants. Despite of this expectation, only 124 respondents participated in the survey.

Several factors contributed to this discrepancy. The survey was conducted during the pandemic, a time of significant stress, uncertainty, and changes in daily routines. These conditions likely affected participation rates. Additionally, the transition to blended learning, involving both in-person and online teaching, introduced further stress and logistical challenges for potential respondents, reducing their availability or willingness to participate. Survey fatigue, resulting from frequent requests for survey participation, may have also played a role. Communication issues during the pandemic could have led to potential participants not receiving the survey or reminders. Technological barriers related to the shift to online surveys, as well as personal or family health concerns due to COVID-19, further contributed to the lower response rate. These factors collectively explained why only 124 out of the expected 285 participants responded to the survey.

Data Collection

Data collection used was a survey that uitilized a validated questionnaire as adapted from the *International Working Group (IWG) on Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences* (IWG, 2020). This questionnaire was modified into Likert Scale. This group was created for collaboration and a community of practice comprised of representatives from governments, academia, industry, professional and international organizations, and other organizations from around the world, using crowdsourcing to develop guiding principles and educational/training resources to support and promote a culture of global biosafety, biosecurity, ethical, and responsible conduct in the life sciences, based on the culture model and assessment methodology developed by International Atomic Energy Agency (IAEA) for the nuclear safety and security culture. The group was convened by the U.S. Department of Health and Human Services and the U.S. Department of Agriculture. The group supports and promotes a global culture of biosafety, biosecurity, and responsible conduct in the life sciences, as well as effective oversight of

dual-use research and engagement among the health, scientific, biotechnology, enthusiast, and security communities, to reduce the risk of science misuse (IWG, 2021).

Before the collection of data, the proposal, consent letter, and questionnaire were submitted to the ethics and review committee for approval. A letter to collect data was sent to the University President. The approved letter, consent letter, and questionnaire were encoded through the google form and a link was sent to the respondents. A printed set of approved letters, consent forms, and questionnaires were also provided for those who have no online access.

Data Collection Instrument

The adapted and modified instrument from *the International Working Group (IWG) on Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences* was validated and translated into the local dialect. The survey instrument was divided into the Demographics profile and Knowledge, Attitude, and Practices.

The demographic profile included relevant information about the respondents, their work status, and assignment as significant in the implementation of biorisk management for the university.

The Knowledge, Attitude, and Practice questionnaire was adapted from the IWG document "*Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences -- (Self) Assessment Framework – January 2020*". Modifications from original document done on selected questions were taken and categorized according to knowledge, attitude, and practices on biosafety and biosecurity which evolved in areas of Management Systems**,**

Behavior of Leadership and Personnel, Principles for Guiding Decisions and Behaviors and Beliefs, Opinions, and Attitudes (IWG, 2020).

The IWG document “Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences: Self- Assessment Framework,” (January 2022) provided the following descriptions:

a. Management Systems

An organizational culture of biosafety, biosecurity, and responsible conduct in the life sciences included policies, processes, procedures, and programs that prioritize biosafety and biosecurity and had a significant impact on biorisk management functions.

b. The behavior of Leadership and Personnel

Leadership behavior. These were specific patterns of behavior and actions of leaders, including supervisors, and middle and upper-level managers, that were intended to promote more effective biorisk management. Expectations, decision-making, oversight, effective communication, motivation, and inspiration/trust-building should be highlighted, among other things.

Personnel behavior. These were the desired outcomes of leadership efforts and management system operations that should be emphasized. Among other things are professional conduct, adherence to approved, validated procedures and research protocols, teamwork and cooperation, and vigilance.

c. Principles for Guiding Decisions and Behaviors

The importance of principles for guiding decisions and behaviors in biorisk management should be highlighted. Examples included, but were not limited to, leadership, commitment and responsibility, professionalism, and competence, learning and improvement, maintaining public trust, and codes of conduct (including codes of ethics).

d. Beliefs, Opinions, and Attitudes

Beliefs and attitudes toward biosafety and biosecurity, including dual-use research of concern and cyber biosecurity should be assessed and reinforced regularly through training and education should be aimed to increase awareness of the risks and risk-mitigation strategies associated with working in a laboratory with biological materials (e.g., accidental exposure, infection, or release; intentional theft and/or misuse; and others such as cybersecurity, radiological,chemical, physical safety, and others)

Data Processing and Data Analysis Plan

Using Likert Scale, the collected data was edited, coded, and analyzed using the SPSS software. The descriptive analysis included frequency distribution, mean, median, mode, and standard deviation of the respondents' demography, knowledge, attitude, and practices. These were presented in frequency tables and graphs.

The inferential analysis used the t-Test and ANOVA to test the hypothesis on the differences of respondents on biosafety and biosecurity knowledge, attitude, and practices; While to test for association, a Spearman RHO test was used.

Using a Likert Scale, the selected questions from IWG document were categorized and clustered according to knowledge, attitude, and practices. Interpretations and discussions based on Likert Scale interpretation is shown on Table 2 on the next page.

Table 2. Likert Scale Interpretation

MEAN	DESCRIPTION	INTERPRETATION
KNOWLEDGE		
4.15-5.00	Very High	The employee has full understanding of the concepts of biosafety and biosecurity, their significance, and how the organization is putting them into action.
3.42-4.14	High	The employee understands some of the fundamental ideas and principles of biosafety and biosecurity, as well as some of its applications in the organization and its significance.
2.49-3.41	Moderate	The employee lacks a thorough understanding of certain biosafety and biosecurity concepts and principles. They understand the importance of these ideas, but they do not know how the institution is putting them into action.
1.66-2.48	Low	The employee knows very little about the fundamental ideas and concepts of biosafety and biosecurity. They are also unaware of the importance of these ideas and how the organization is putting them into action.
0.83-1.65	Very Low	The employee has heard but not did not understand the biosafety and biosecurity nor aware of its importance and how the organization is putting them into action.
0.00-0.82	Uncertain	The employee does not know biosafety and biosecurity, its significance, or whether the company is implementing them.

Table 2

Continuation

ATTITUDE		
4.15-5.00	Highly Positive	The employee demonstrates strong commitment and understanding of the significance of biosafety and biosecurity, as evidence by the embracing the laws and procedures and adherence to protocols in preventing accidental exposure and deliberate release of biological agents.
3.42-4.14	Positive	The employee takes a proactive attitude on biosafety and biosecurity, understanding its significance on safety and security, adhering to guidelines, policies, and protocols to avoid accidental exposure to biological agents and deliberate release of biological agent.
2.49-3.41	Normal	The employee complies with biosafety and biosecurity rules, regulations, and procedures to avoid accidental exposure to biological agents and deliberate release of biological agents without realizing the significance to safety and security.
1.66-2.48	Negative	The employee defies biosafety and biosecurity policies and procedures because they are not certain of the importance of preventing accidental exposure or deliberate release of biological agents will ensure safety and security.
0.83-1.65	Highly Negative	The employee refuses to follow biosafety and biosecurity policies and procedures and they are not convinced that preventing accidental exposure and deliberate release of biological agents are important in safety and security.
0.00-0.82	Uncertain	The employee feels uncertain about adhering to biosafety and biosecurity guidelines and protocols when handling biological agents.

Table 2

Continuaion

PRACTICES		
4.15-5.00	Always	The employee consistently adheres to biosafety and biosecurity policies and guidelines and always integrates good biosafety practices and procedures in handling biological agents.
3.42-4.14	Frequently	The employee regularly integrates appropriate biosafety practices and procedures when handling biological agents and consistently complies with biosafety and biosecurity policies and guidelines.
2.49-3.41	Occasionally	The employee sometimes follows biosafety and biosecurity policies and guidelines, but infrequently integrates appropriate biosafety practices and procedures when handling biological agents.
1.66-2.48	Irregularly	The employee rarely adheres to biosafety and biosecurity policies and guidelines and seldom adopts appropriate biosafety practices and procedures when working with biological agents.
0.83-1.65	Never	The employee while working with biological agents does not adhere to appropriate biosafety practices and procedures nor conforms to biosafety and biosecurity policies and guidelines.
0.00-0.82	Uncertain	The employee was unsure if they were following the proper biosafety and biosecurity policies and guidelines or adhering to suitable practices and procedures when handling biological agents.

Ethical Consideration

Before the conduct of the research, the proposal was submitted to the CPU Research Ethics Committee for review and approval. Google forms were utilized for the informed consent form and the research questionnaire. Each participant was requested to read the Informed Consent Form and had been given time to ask questions regarding the conduct of the survey. Only after the consent form had been signed voluntarily, the link to the questionnaires was forwarded to the participants to answer.

For participants with no internet access, hard copies of the Informed Consent Form and Questionnaires were utilized**.** Participants who wish to withdraw anytime were allowed to do so, and their data was removed from the file.

Electronic data was kept in a password-protected laptop, known only to the researcher. Hard copies were kept in a locked cabinet. All data was kept for a minimum of at least 2 years, after which, unnecessary files were deleted from the laptop, and hard copies were shredded.

Confidentiality and anonymity were always ensured throughout the process, by making sure no identifying information of the participants was incorporated in the data, and code numbers were only utilized. The results of the research were presented for final defense and publishing, but the anonymity of the participants were always maintained.

There should be no compensation to be given to the participants of the research. There were less than minimal risks expected in this research, but should the participants notice any form of social or mental effects from answering the questionnaire, they would be requested to inform the researcher immediately so the issues may be addressed effectively.

The result of this study were used as a basis for formulating strategies for creating Biorisk Management Program for the University which benefited the institution, its stakeholders, and the community as they embrace the " safety culture". The most significant contribution of this study was to raise awareness, motivate people to change attitudes, and implement best practices in biosafety and biosecurity. The implementation of the Biorisk Management Program by Central Philippine University would not only protect the health and safety of its stakeholders but also enhanced the safety of the community against the unintentional release of biological agents and prevent community exposure.

The result of this study was presented to the Central Philippine University School of Graduate Studies. This was also submitted for publication and presentation in scientific fora and conventions. Anonymity would be strictly implemented when the results of the study were shared.

Chapter 4

Result and Discussions

When handling biological agents and materials, Biorisk Management paved the way for the "Culture of Biosafety, Biosecurity and Responsible Institution". It safeguards stakeholders from unintentional exposure to these toxins and biological agents as well as deliberate released that both of which could have serious consequence for the university and community.

Additionally, as the university developed a "Culture of Biosafety and Biosecurity," the assessment of the knowledge, attitude, and practices from selected CPU employees provided information about the management system, leadership, and personnel behavior, decision-guiding principles, as well as beliefs, opinions, and attitudes related to biosafety and biosecurity that served as a foundation for the development of the University's Biorisk Management Program.

Profile of Respondent

Table 3 presented the distribution of respondents based on their demographic characteristics. Out of 124 respondents, 31.5% aged 30 years old and below, 19.4% were 31-40 years old, 16.9% were 41-50 years old, 18.5% were 51-60 years old, and 13.7% were 61 years old and above. It can be observed that most of the respondents were aged 30 years old and below, and the least came from those whose age fell within the range of 61 years old and above. In terms of sex, 62.9% were females and 37.1% were males. This indicated that more than half of the respondents were females compared to males which accounted only a smaller percentage.

Additionally, when categorized by highest educational attainment nearly 90% of the respondents were degree holders which comprised of college graduates (42.7%), Master’s degree and master’s level (29.8%) and PhD or doctorate level (16.1%) and a little above

10% comprised the non-degree holder which include vocational or technical, college level, high school, and elementary.

Meanwhile, when classified as to their employment status permanent employees comprised 55.6 % of the respondents and the rest were of contract of service, which is also the same as part time comprised16.9%, probationary status comprised 5.6%, and job hire comprised 4.8%. This showed that more than half of the respondents hold a permanent status in the university.

Moreover, when categorized as to job category more than half of the respondents or 54.5% were faculty while other categories such as health service personnel was 12.9%, ground and building upkeep maintenance and staff was 12.1% and the dean, chairperson and department heads were of 8.1% of the total respondents.

Furthermore, when grouped according to work assignment of those who participated in this survey 72.6% of the respondents were from the academe and 37.4% from the non-academe. For non-academe, 11.3% were from science-related work, and 16.1% were from non-science and others.

Table 3. Distribution of Respondents

Categories	f	%
Entire Group	124	100.0
Age		
30 years old and below	39	31.5
31-40 years old	24	19.4
41-50 years old	21	16.9
51-60 years old	23	18.5
61 years old and above	17	13.7
Sex		
Female	78	62.9
Male	46	37.1
Highest Educational Attainment		
Others	14	11.3
College Graduate	53	42.7
Master's Degree, Master's Level	37	29.8
Ph.D., Doctorate Level	20	16.1
Employment Status		
Job Hire	6	4.8
Contract of Service	21	16.9
Part-time	21	16.9
Probationary	7	5.6
Permanent	69	55.6
Job Category		
Grounds and Building Upkeep Maintenance	15	12.1
Healthcare Service Personnel	16	12.9
Staff	15	12.1
Faculty	68	54.8
Dean, Chairperson, Department Head	10	8.1
Work Assignment		
Academe	90	72.6
Non-Academe	34	27.4
Science	14	11.3
Non-Science and Others	10	16.1

Knowledge in Biosafety and Biosecurity

Table 4 showed the summary statistics on the knowledge in biosafety and biosecurity of selected CPU employees who handled and were exposed to biological agents and materials. Overall, the mean knowledge in biosafety and biosecurity of the entire group was high. Based on distribution of respondents as shown in Table 4 nearly half or 41.7 % of the participants had high knowledge, and very high knowledge, 12.1 % had moderate and the rest had very low and low knowledge on how the management addressed biosafety and biosecurity through decision guiding principles, beliefs, and opinions.

In this study, nearly half of those who participated had high knowledge of the risk of exposure to biological agents, regardless of whether they were released accidentally or on purpose, as well as the potential that these biological agents could be utilized as biological weapons by offenders. They were also highly aware that the university is taking steps to reduce the risk associated with the use of biological agents and materials, including disseminating information, developing strategies, strengthening policies and procedures, and providing ongoing biosafety and biosecurity training through participation in seminars and training sessions.

Additionally, participants were also highly knowledgeable of the effects of dubious behavior, and they had come up with actions for reporting staff members who behave inexplicably as well as measures to investigate, apprehend, suspend, or dismiss employees who willfully violate biosafety and biosecurity protocols and endanger their fellow workers, faculty, staff, researchers, institution, and community. Thus, they were highly aware of the performance standards set by the university for them.

In addition to individuals with high knowledge on biosafety and biosecurity, nearly half of the participants also possessed very high knowledge of the potential impact of the leakage of sensitive information to biosecurity and agreed that there should be a regulated procedure to access these sensitive data or information and a qualified reliable personnel was needed in handling biological agents and materials. They were very highly aware of the benefits of risk assessment, thereby it should also be conducted to identify hazards and potential dangers, and then appropriate mitigation strategies should be chosen to deal with these risks. Participants had a very high knowledge and awareness of the advantages of conducting regular fire and earth drills as preventative steps to get ready for unforeseen, adverse occurrences and disasters.

Although majority of the participants had a high to a very high level of knowledge in most of the information on how the university management address issues and concerns

about biosafety and biosecurity on biological agents and materials, this survey also revealed as shown in Table 5, that some participants had a moderate low to very low level of knowledge on the issue of dual use research of concern, the potential for insider threats, as well as a practice in the emergency response to biological spills.

Table 4. Knowledge of Selected CPU Employees in Biosafety and Biosecurity

Knowledge	M	Description	SD
Entire Group	3.88	High	0.779
1. My university has procedures in place to keep employees informed on the risks of unintentional and/or intentional release of, or exposure to, biological agents and/or toxins that are stored or handled at our facilities	3.97	High	1.249
2. The university has mitigation procedures in place to reduce the risk of unintentional and/or intentional release of, or exposure to, biological agents and/or toxins stored or handled at our facility.	3.86	High	1.309
3. My university conducts emergency response drills on fire regularly.	4.44	Very High	0.724
4. My university conducts emergency response drills on earthquake regularly.	4.38	Very High	0.916
5. My university conducts emergency response drills for biological spillage regularly.	3.19	Moderate	1.496
6. There is a procedure in place for employees to report unusual behavior in a co-worker.	3.58	High	1.403
7. My university has continuing biosafety and biosecurity education and/ or competency training for employees.	3.63	High	1.364
8. Information regarding biosafety and biosecurity measures, procedures, and policies are in place and readily available to employees.	3.78	High	1.227
9. There is an established internal communication procedure to inform employees about biosafety and biosecurity incidents and near misses.	3.65	High	1.289
10. There is a waste management procedure that includes decontamination of wastes before disposal available to employees.	3.91	High	1.243
11. At my university, the dean and department chair/head encourage employees to enhance their biohazard education and awareness.	3.97	High	1.182
12. In my university, there are measures in place to investigate, reprimand, suspend or terminate employees who willfully violated the biosafety and biosecurity protocol.	3.74	High	1.242
13. The dean or department chair/head communicates with staff about specific performance expectations in areas that affect biosafety and biosecurity.	3.91	High	1.203
14. My university has an *insider threat* mitigation program.	3.03	Moderate	1.623
15. I am aware of the concept and implications of dual-use research of concern.	3.28	Moderate	1.446

Table 4

Continuation

16. I am aware of the threat of bioterrorism and biological weapons.	3.91	High	1.282
17. Controlling access to sensitive information is important to biosecurity.	4.16	Very High	1.062
18. I am aware that there are ethical, legal, and societal issues and consequences attached to my work.	4.43	Very High	0.756
19. Each personnel or employee at my university has the necessary competency to perform their assigned tasks safely and effectively.	4.27	Very High	0.830
20. Risk assessments are important tools to identify areas of improvement and specific measures for reducing risk, including the level of safety/biosafety required.	4.46	Very High	0.748

Note: 4.15-5.00 = Very High; 3.42-4.14 = High; 2.49-3.41 = Moderate; 1.66-2.48 = Low; 0.83-1.65 = Very Low; 0.00-0.82 = Uncertain

Table 5 presented the distributions of the selected CPU Employees on the Level of knowledge in biosafety and biosecurity. Most of the employees were both very high and high (41.1%), and there were only few who had a low (1.6%) or very low (4.0%) level of knowledge of in biosafety and biosecurity.

Table 5. Distribution of Respondents on the Level of Knowledge in Biosafety and Biosecurity

Level of Knowledge	f	%
Very High	51	41.1
High	51	41.1
Moderate	15	12.1
Low	2	1.60
Very Low	5	4.00

Attitude Towards Biosafety and Biosecurity

Table 6 showed the summary statistics for the attitude towards Biosafety and Biosecurity of selected CPU Employees who were exposed and handled biological agents and toxins. It revealed that the mean of the entire group had highly positive attitude towards biosafety and biosecurity in pursuit of professional excellence and continual learning to improve performance. As shown in Table 7, majority or 61.3% of selected employees who took part in this study had demonstrated a highly positive attitude towards embracing personal responsibility for biosafety and biosecurity.

The respondents presented a highly positive attitude to maintain safety by following the guidelines, procedures, policies, and standards that were pertinent to their job and practices. Thus, they agreed that it was not appropriate to tag along ("piggyback*") with a worker who had permission to enter a restricted area. They also reported near misses as crucial to ensure safety and security, in addition to laboratory accidents and incidents. They engaged in risk analysis, decision-making, and other tasks that directly affected them, applying the lessons they gained from emergency exercises to enhance their performance in safety and emergency responses to disasters and unforeseen events. Without worrying about the repercussions of losing their jobs or having their careers negatively affected, they had a very positive attitude when reporting illnesses or other problems that had an influence on biosafety and biosecurity. To ensure effective biosafety and biosecurity at work, they had a highly positive attitude toward admitting mistakes, accepting responsibility, and developing a plan to overcome obstacles or implement corrective actions. They also carefully considered the implications and potential applications of their work, establishing a balance between the pursuit of scientific knowledge and the accomplishment of assigned tasks and moral obligations to society.

The university administration took a highly positive approach and placed a high value on biosafety and biosecurity, so any shortcomings or weaknesses were quickly fixed. When the staff members performed tasks involving biological hazards and risks such as handling infectious agents, conducting novel studies involving infectious microorganisms and waste disposal, they were more concerned with the safety of the employees from disease exposure than with the result or output. The deans and the department chairmen exhibited a highly positive attitude as they commit to biosafety and biosecurity through words and performances. They were approachable and allowed effective two-way communication, and encouraged staff to raise any issues or suspicions without worrying about facing repercussions. The management of the institution had a very positive outlook on the

assurance that future biosafety performance would be supported by technical knowledge and experience, and they had encouraged and reinforced their staff to do the same, which motivated and improved their performance.

Additionally, Table 6 revealed that 32.3% of the participants who were selected employees had a positive attitude and would take a proactive approach and adhere to the university's-imposed biosafety and biosecurity procedures policies and standards. As they "brainstorm" rather than "blamestorm" and placed more focus on asking "What went wrong?" than "Who was wrong?" They had a constructive attitude while resolving problems during incidents or near-misses. They also had a positive approach towards improvement rather than blaming.

Table 6. Attitude of Selected CPU Employees toward Biosafety and Biosecurity

Attitude	M	Description	SD
Entire Group	4.25	Highly Positive	0.692
1. Utilizing the lessons learned from emergency drills has improved my performance in safety and emergency responses.	4.27	Highly Positive	0.839
2. My department chair sets a good personal example of practices aimed at reducing biohazard risks.	4.11	Positive	1.030
3. I am confident that I can report my illness or other conditions that may have an impact on biosafety/biosecurity without fear of losing my job or having other negative consequences in my professional career.	4.19	Highly Positive	0.940
4. It is not acceptable to tag along ("piggyback*") with an employee who is authorized to enter a restricted area.	4.20	Highly Positive	0.937
5. My university places a high importance on biosafety and biosecurity.	4.15	Highly Positive	0.952
6. Employees take part in risk assessment, decision-making, and other activities that affect them.	4.18	Highly Positive	0.884
7. The deans and department chairs are approachable, allow effective two-way communication, and encourage employees to report concerns or suspicions without fear of disciplinary action.	4.28	Highly Positive	0.760
8. Encouragement and reinforcement received from deans, department chairs, peers, and subordinates significantly influence my work performance.	4.33	Highly Positive	0.773
9. Deans and department chairs demonstrate their commitment to biosafety and biosecurity through words and actions.	4.18	Highly Positive	0.856
10. Everyone holds personal responsibility for biosafety and biosecurity.	4.27	Highly Positive	0.868

Table 6

Continuation

Attitude	M	Description	SD
11. When an incident or near miss occurs, 'brainstorming' takes place rather than 'blamestorming.' The question is, "What went wrong?" rather than "who was wrong?" ", emphasizing improvement over blame.	4.04	Positive	1.015
12. I consider the implications and potential applications of my work, as well as the balance between the pursuit of scientific knowledge or the completion of assigned tasks and my ethical responsibilities to society.	4.22	Highly Positive	0.842
13. There are university policies or standards on biosafety and biosecurity practices enforced and followed by the employees.	4.12	Positive	0.861
14. Admitting mistakes, taking responsibility, and developing a plan to overcome challenges and/or implement corrective actions are essential components to ensure effective biosafety and biosecurity in the workplace.	4.36	Highly Positive	0.839
15. Striving for professional excellence through self-assessment and continuing education will improve work performance.	4.46	Highly Positive	0.748
16. I always abide by all laws, rules, policies, and standards that are relevant to my work and practices to ensure safety.	4.47	Highly Positive	0.780
17. Biosafety and/or biosecurity deficiencies or vulnerabilities are corrected with a sense of urgency.	4.33	Highly Positive	0.862
18. My university is more concerned with the safety of the employees or workers from disease exposure than with the outcomes or output of our work when we carry out tasks involving biological hazards and risks (like conducting research involving infectious microorganisms for novel studies or handling these infectious microorganisms, such as in infectious waste disposal).	4.23	Highly Positive	0.847
19. The assurance of future biosafety performance is supported by technical expertise and experience.	4.25	Highly Positive	0.823
20. I believe that it is important to report not only laboratory accidents and incidents but also near misses.	4.41	Highly Positive	0.865

Note: 4.15-5.00 = Highly Positive; 3.42-4.14 = Positive; 2.49-3.41 = Normal; 1.66-2.48 = Negative; 0.83-1.65 = Highly Negative; 0.00-0.82 = Uncertain.

Table 7 presented the distribution of the selected CPU employees on their attitude towards Biosafety and Biosecurity. It showed that majority of the employees or 61.3 % had highly positive attitude and 32.3% were positive towards embracing personal responsibility for biosafety and biosecurity. Few or 4.8% have neutral or normal attitude and very few or insignificant or 0.8% were uncertain and have a highly negative attitude.

Table 7. Distribution of Respondents on the Attitude towards Biosafety and Biosecurity

Level of Attitude	f	%
Highly Positive	76	61.3
Positive	40	32.3
Normal	6	4.8
Highly Negative	1	0.8
Uncertain	1	0.8

Biosafety and Biosecurity Practices

The summary statistics for the biosafety and biosecurity practices of selected CPU employees who were exposed and handled biological agents and materials were presented in Table 8. Meanwhile, Table 9 showed the distribution of respondents on biosafety and biosecurity practices. Majority or 40.3 % answered “always” while some or 31.5 % answered “frequently”. However, there were also few or 14.5% who answered “occasionally”, and 8.1% answered “irregularly”. Contrasting to that, there were 3.2% of employees who were “uncertain” and there were 2.4 % who never practiced biosafety and biosecurity in their workplace. Considering these responses when taken as a group, the data revealed in Table 8 that the mean of the entire group of respondents frequently practices biosafety and biosecurity and its related activities.

The mean responses of the entire group in Table 8 showed that the institution frequently embraces a culture that supports and fosters cooperation, trust, communication, and public transparency in addition to encouraging adherence to biosafety and biosecurity protocols. The necessary standard operating procedures (SOPs) in implementing biosafety and biosecurity measures were provided by the deans or department heads. This led to the successful handling of biosafety and biosecurity infractions. The norms of conduct were monitored for adherence to approved or verified methods of research protocols.

Apart from receiving training on identifying high-risk behavior in oneself, fellow workers, visitors, and those who wanted to visit the department, office, or facility, the staff members were kept informed about possible hazards and protocols for risk management. The mitigation strategies were put into place to lessen the risk of unintentional exposure and

intentional release of biological agents and toxins stored or handled at the facilities. There were comprehensive protocols in place for handling mishaps involving chemical and biological agent spills and splashes. An adequate instruction on the techniques that are needed to be done without endangering safety and security was regularly provided to the employees. Individual biosafety and biosecurity performance evaluations and assessments were conducted on a regular basis by the department. Before allowing competent and qualified staff access to high-risk infectious agents and toxins, risk assessments were regularly conducted and decisions were made to limit risks. Any suspected colleague activity that could raise the risk of an accidental or deliberate release of biological agents or toxins was reported to the director of the department or another appropriate person in authority. Workers were routinely reminded of the lessons they had learned from near misses or violations involving biosafety and biosecurity and they were encouraged to apply those lessons to enhance performance.

Majority of the respondents as shown in Table 9 said that the institution has always applied best practices and lessons learned in its departments and offices that dealt with biological agents and toxins. Information was consistently conveyed in an proper manner, and this included standard procedure to always wear appropriate PPE while carrying out work in a secure and safe manner. They used decontamination techniques to prepare infected materials for routine waste disposal.

Contrary to this, few employees admitted that newly hired staff occasionally received an orientation that included a discussion of the protocols and codes of behavior relating to biosafety and biosecurity concerns, even though senior employees had regularly practiced and adhered to the biosafety and biosecurity procedures.

Table 8. Biosafety and Biosecurity Practices of Selected CPU Employees

Practices	M	Description	SD
Entire Group	3.74	Frequently	1.098
1. Procedures and rules of conduct related to biosafety and biosecurity is explained during new employee orientation.	3.30	Occasionally	1.567
2. Mitigation procedures are implemented to reduce the risk of unintentional and/or intentional release of, or exposure to, biological agents and/or toxins stored or handled at our facilities.	3.52	Frequently	1.405
3. My university has a procedure in place and uses it as a detailed action during incidents such as spillage and splashes of biological agents and chemicals.	3.48	Frequently	1.451
4. Employees are reminded of the lessons acquired from biosafety/biosecurity violations or near misses and use them to perform better.	3.49	Frequently	1.411
5. Employee's individual biosafety/ biosecurity performance assessment is given importance and done as scheduled by the department.	3.48	Frequently	1.423
6. Before workers are granted access to pathogens and toxins, they are screened for appropriate credentials, skills, and personal traits for the job.	3.55	Frequently	1.558
7. Deans or department chairs/heads inform employees about the risks and control measures in place to reduce the risks of unintentional and/or intentional release of biological agents and/or toxins stored or handled at the facility.	3.73	Frequently	1.237
8. Dean or department chairs/heads monitor adherence to the approved/validated procedures (or research protocols) and rules of conduct.	3.69	Frequently	1.326
9. Deans or department heads provide the required standard operating procedures (SOPs) to implement biosafety and biosecurity measures.	3.90	Frequently	1.265
10. The unusual or suspicious change in my colleague's behavior that raises the risk of unintentional or intentional release or exposure to biological agents or toxins is reported to our department's head or person in authority.	3.43	Frequently	1.588
11. I participate in risk assessment and decision-making processes to reduce the risk of unintentional and/or intentional release of, or exposure to, biological agents and/or toxins stored or handled at my department or facility.	3.43	Frequently	1.363
12. In my department or facility, contaminated materials are properly disinfected before disposal to general waste.	4.15	Always	1.160
13. My university/ department/ office applies lessons learned and best practices.	4.19	Always	1.062
14. My university promotes public transparency regarding its biosafety and biosecurity compliance.	3.94	Frequently	1.245
15. My university provides training on recognizing signs and symptoms of high-risk behavior in oneself, co-workers, and outsiders who would like to access the facility, department, or office.	3.68	Frequently	1.347

Table 8

Continuation

Practices	M	Description	SD
16. Biosafety and biosecurity violations are handled appropriately.	3.80	Frequently	1.343
17. My university practices a culture that supports and encourages trust, collaboration, consultation, and communication regarding biosafety and biosecurity.	4.02	Frequently	1.265
18. I have received adequate training on the procedures necessary to conduct my work without compromising safety and security.	3.63	Frequently	1.423
19. I report data with integrity and accuracy.	4.19	Always	1.265
20. I wear appropriate adequate PPE to perform my work safely and securely.	4.15	Always	1.301

Note: 4.15-5.00 = Always; 3.42-4.14 = Frequently; 2.49-3.41 = Occasionally; 1.66-2.48 = Irregularly; 0.83-1.65 = Never; 0.00-0.82 = Uncertain.

Table 9 showed the distribution of the selected CPU employees on their Biosafety and Biosecurity degree of practice. It revealed that majority or 40.3% of the employees responded “always” and 31.5 % “frequently” practices biosafety and biosecurity and its related activities. There were some employees or 14.5% that responded “occasionally” and 8.1% “irregularly” practiced it. However, few or 3.2% admitted that they were “uncertain” and 2.4% “never” applied biosafety and biosecurity practice in their workplace.

Table 9. Distribution of Respondents on Biosafety and Biosecurity Practices

Degree of Practice	f	%
Always	50	40.3
Frequently	39	31.5
Occasionally	18	14.5
Irregularly	10	8.1
Never	3	2.4
Uncertain	4	3.2

Difference in Knowledge, Attitudes, and Practices in Biosafety and Biosecurity of Selected CPU Employees Based on Demographic Profile

Sex. Table 10 presented the significant differences in the knowledge, attitudes, and practices of selected CPU employees in biosafety and biosecurity based on sex. The t-test for independent samples results revealed that, when grouped by sex, the significant values

for the knowledge, attitudes, and practices of selected CPU employees in biosafety and biosecurity were all greater than the alpha level of significance; thus, the null hypotheses for these categories must not be rejected. This suggested that there was no significant difference in the knowledge of selected CPU employees in biosafety and biosecurity (t (122) = 1.236; p = 0.219). Similarly, no significant difference was found in the attitudes of selected CPU employees towards biosafety and biosecurity (t (122) = 0.503; p = 0.616). Moreover, there was no significant difference existed in biosafety and biosecurity practices of selected CPU employees when grouped by sex (t (122) = 0.966; p = 0.336).

Knowledge on biosafety and biosecurity based on sex. In the level of knowledge between sex (Wehrwein, E et al, 2007), there were different learning styles and preferences among males and females; however, when the sex preferences were balanced, this lead to no significant gender differences as revealed in the learning outcomes (Yu, 2021). Accordingly, this supports the result that there was no significant difference in knowledge in biosafety and biosecurity of selected CPU employees when based according to sex. Male employees had the same knowledge as of the female employees on how the institution would manage and deal with the issue of biosafety and biosecurity. The same findings were found in the study "*Knowledge, Attitude, and Practices towards Laboratory Safety Measures Among Notre Dame of Marbel University Medical Technology Students*" (Geraldez et al, 2023).

Attitude on biosafety and biosecurity based on sex. In this study, it was also revealed that regardless of the sex, attitude towards biosafety and biosecurity was the same as shown in Table 10. Geraldez (2023) agreed that sex had no influence in the knowledge, attitude, and practices towards biosafety. Attitudes were often the result of experience or upbringing regardless of being a male or a female. They could have a powerful influence over behavior and affect how people acted in various situations. While attitudes were enduring, they could also change and these could be influenced by beliefs and learnings.

Attitudes were learned in a variety of ways as well as a tendency to evaluate things in a certain way. It played a pivotal role in shaping human behaviour (Cherry, The Components of Attitude Definition, Formation, Changes, 2023). It created a frame of thought that shapes on how one would behave in personal and professional life (Laff, R & Ruiz W, 2023)· In the past, it was observed that interactions with positive attitudes often resulted in positive outcomes. This laid a strong foundation for the development of positive behavior towards biosafety and biosecurity

In contrast, when the approach of interactions was with negative attitudes, it was more likely to find fault, made negative judgments, and expected a negative result. Adopting a positive attitude did not mean avoiding challenges and only talking about constructive observations and ideas, it also included adopting an optimistic mindset (Laff, R & Ruiz W, 2023)· Likewise, understanding contradicted with attitude but, more significantly, it was also associated with more reasonable and more perceptive attitudes. The importance of this is that knowledgeable people were less supportive of unethical or doubtful topics than people who lack knowledge particularly in making sound judgement in engaging in dual use of research of concern using biological agent, toxins, and its product (Evans G., & Durant J, 1995).

Practices on biosafety and biosecurity based on sex. In biosafety and biosecurity practices, Table 10 revealed that it was the same, irrespective of male or female, and the same result was shown in the study conducted by Geraldez et al (2023). In the study “The Relationship between Knowledge and Practice,” findings showed that there was no difference between men and women in health knowledge and health practices (Dowell, The Relationship between Knowledge and Practice, 2015). There were three thoughts of knowledge and practice; first is the **"*knowledge-<u>for</u>-practice*."** It is a formal knowledge and theory were used to improve practice. Here, the basic principle of biosafety and biosecurity, the risks and consequences if exposed to biological agents were explained to the

employees. Understanding the significance of these concepts help and improved their practices. Secondly is the “***knowledge-in-practice*****."** This referred to a practical knowledge that was embedded in the employees’ practice. Those employees who were engage in biological agent had a deep understanding and expertise in handling biological materials and toxins. Lastly is the **"*knowledge-of-practice*."** This was from practical knowledge that was generated from information, interrogation, and interpretation. The generated local knowledge of practice was working within the contexts of inquiry communities to theorize and construct their work and to connect it to larger social, cultural, and political concerns (Cochran-Smith, M. & Lytle, S.L., 1999). The CPU personnel were aware that associated with their work were the risk of exposure to biological agents and the risk of getting infected with diseases was part of their work or activities. With this knowledge, they heightened their practices to minimize the risk of exposure to biological agents and protect themselves from getting infected with certain diseases.

Table 10. Significant Differences in the Knowledge, Attitudes, and Practices of Selected CPU Employees in Biosafety and Biosecurity based on Sex

Sex	Mean	t-value	df	p
Knowledge		1.236	122	0.219
Female	3.81			
Male	3.99			
Attitude		0.503	122	0.616
Female	4.28			
Male	4.21			
Practices		0.966	122	0.336
Female	3.66			
Male	3.86			

Age. The result of the knowledge, attitudes, and practices in biosafety and biosecurity of selected CPU employees by age is shown in Table 11. The results of the One-way Analysis of Variance test showed that, when grouped by age, the significant values for the biosafety and biosecurity, the knowledge, attitudes, and practices of selected CPU employees were all higher than the alpha level of significance. This meant that the null hypotheses for these categories cannot be rejected. This suggested that there was no significant difference in the knowledge of selected CPU employees in biosafety and biosecurity ($F(4, 119) = 1.224$; $p = 0.304$). Similarly, no significant difference was found in the attitudes of selected CPU employees towards biosafety and biosecurity ($F(4, 119) = 0.163$; $p = 0.957$). Moreover, there was no significant difference existed in biosafety and biosecurity practices of selected CPU employees when grouped by age ($F(4, 119) = 0.601$; $p = 0.663$). Irrespective of age, the CPU personnel had the same knowledge, attitude, and practices for handling and managing biological agents in a safe and secured manner.

Knowledge on biosafety and biosecurity based on age. A deeper knowledge of biological agents and the practice of preventative measures were significant in preventing the disease's progress, promoting improved behavior and attitudes (Abdalqader et al, 2020). In this study, as shown in Table 11, age had no significant impact in the knowledge of biosafety and biosecurity of the employees who handle or manipulate biological agents and

materials. Regardless of age, knowledge on the hazards and risks associated when exposed to biological agents, materials and toxins were the same.

On the contrary, in a study conducted in a healthcare setting, participants younger than 30 years old were more likely to have appropriate knowledge than those in the age groups of 41–50 or older than 50. This difference in proportion of Healthcare Workers (HCWs) with adequate knowledge was observed (Almohammed et al, 2021). Unsatisfactory knowledge was found significantly higher associated with the age of over 40 years in services among Medical Laboratory Technicians in selected government Healthcare Institutions in Colombo District Sri Lanka. This evidence on prone to lose of knowledge was due to time progression and lack of updates of professional knowledge (Abhayaratne, et al, 2020). Additionally, in the study conducted by Geraldez et al (2023), it was said that significant difference were found when knowledge was associated with age.

Attitude on biosafety and biosecurity based on age. In terms of attitude, this study showed similar result, that age had no influence in the attitude towards safety as conducted by Geraldez et al (2023). While knowledge was dependent on an individual's interpretation of biosafety and biosecurity, perception of the risks and outcomes associated with handling biological agents, their attitudes and practices, as well as the results of their health-related behavior or activity suggested that they had a positive attitude that was unaffected by age differences and was attributed to the shift in their opinion and decision-making (Siltrakool, 2017).

Practices on biosafety and biosecurity based on age. In practices towards biosafety and biosecurity, this study also revealed as shown in Table 11 that age had no significant influence and is of the same result as shown in the study of Geraldez et al (2023). Irrespective of age, employees who handle biological agents and materials were cautious as for their personal safety is concerned. In contrast, the study "Age differences in knowledge, attitudes and preventive practices during the COVID-19 pandemic in Spain"

found that a downturn in risk perception, knowledge, concern, and preventive practices was concurrent with a high rate of virus transmission among young people. There was a feeling of despair and severe tiredness consistently higher in the elderly (Herrera et al, 2022). Moreover, it was found that in order to improve elderly patients' practices and behavior in the face of a health crisis, the healthcare system must work to enhance elderly patients' comprehension of the rise in illness cases and transmission (Al-Abedi, G., 2022). Additionally, healthcare workers under 40 years old were more likely to consistently use appropriate practices than those who are over 40 years old. However, for those different age groups who had a positive attitude, there was no statistically significant difference in their practices (Almohammed et al, 2021).

Table 11. Significant Differences in the Knowledge, Attitudes, and Practices of Selected CPU Employees in Biosafety and Biosecurity based on Age

Age	Mean	df	F-value	p
Knowledge		4 ; 119	1.224	0.304
30 years old and below	4.06			
31-40 years old	3.88			
41-50 years old	3.69			
51-60 years old	3.92			
61 years old and above	3.65			
Attitude		4 ; 119	0.163	0.957
30 years old and below	4.28			
31-40 years old	4.25			
41-50 years old	4.15			
51-60 years old	4.26			
61 years old and above	4.32			
Practices		4 ; 119	0.601	0.663
30 years old and below	3.89			
31-40 years old	3.62			
41-50 years old	3.87			
51-60 years old	3.67			
61 years old and above	3.48			

Highest Educational Attainment. Table 12 presented the significant differences in the biosafety and biosecurity knowledge, attitudes, and practices of selected CPU employees according to highest level of education. The results of the One-way Analysis of

Variance test revealed that, when grouped by educational attainment, the significant values for the biosafety and biosecurity knowledge, and attitudes were higher than the alpha level of significance. As a result, the null hypotheses for these categories cannot be rejected. This suggested that there was no significant difference in the knowledge of selected CPU employees in biosafety and biosecurity ($F (3, 120) = 1.571$; $p = 0.200$). Similarly, no significant difference was found in the attitudes of selected CPU employees towards biosafety and biosecurity ($F (3, 120) = 0.393$; $p = 0.758$). On the other hand, the practice of the selected CPU employees was lower than alpha level of significance, which led to the rejection of the null hypothesis. This meant that a significant difference existed in biosafety and biosecurity practices of selected CPU employees when grouped by highest educational attainment ($F (3, 120) = 3.420$; $p = 0.020$). Multiple comparison using LSD revealed that a significant difference in practices was present in between college graduate and doctorate level or graduate ($p = 0.003$), and in between others (elementary, highschool, etc.) and doctorate level or graduate ($p = 0.018$).

Knowledge of biosafety and biosecurity based on Highest Educational Attainment. The level of education had no significant influence on the knowledge of employees on biosafety and biosecurity as shown in Table 12. This study revealed that irrespective of their educational attainment, they understood and were mindful of the risks of exposure to biological agents and materials. Another study concluded that regardless of educational attainment, people who were aware of the risk of exposure to biological agents were more likely to adopt protective behaviors, raised awareness, and show concern for safety and security (De Pretto et al, 2015). Moreover, it may play a significant role in determining attitudes and behaviors, as well as awareness of the disease and how it spreads (Diaz-Quijano et al, 2018).

Conversely, the level of knowledge varied by sociodemographic characteristics showed that females and individuals with higher levels of education demonstrated higher

levels of knowledge (Lee et al, 2021). Additionally, there were several studies that agreed professionals are more knowledgeable than non-professionals; nevertheless they were similar and they demonstrated proper behavior and positive attitude (Gopalakrishnan et al, 2021), (Almohammed et al, 2021) and (Abu-Siniyeh & Al-Shehri, 2020).

Attitude on biosafety and biosecurity based on Highest Educational Attainment. It was also shown in Table 12 that the educational attainment had no influence on the attitude of employees. Employees who were knowledgeable on biosafety and biosecurity had a positive attitude in accepting responsibilities in preventing the spread of infection through unintentional exposure of an individual and deliberate release of biological agents to the community. This was supported by another study which revealed that education level had no relation with attitude towards biosafety (Ahammed et al, 2023).

On the contrary, the results of the study by Abhayaratne et al. (2020) showed that while there was a positive overall attitude associated with being less than 40 years old, employees' ongoing professional development would be beneficial in helping them reach accepted levels of attitudes, particularly for those over 40. Continuous professional development may not be comparable to highest level of academic education; however, it served to upgrade awareness of the professionals at all levels. Attitude varied across the level of education, work experience, and level of knowledge. A positive attitude and undergoing a formal training predicted to have better practices (Balugya et al, 2022).

Practices on biosafety and biosecurity based on Highest Educational Attainment. Table 12 revealed a significant difference in the biosafety and biosecurity practices of employees who handled biological agents based on educational attainment. There were several studies that revealed the same result. Employees with varying levels of education may understand the same risks of disease exposure and its effects, but as their educational attainment increased, their perspectives, opinions, and interpretations changed which was evident in the ways they responded to it. Moreover, it was linked to a better

understanding and implementation of safety protocols. High level of educational attainment exhibited better knowledge and attitudes towards biosafety, leading to more consistent and reliable practices and emphasized the role of education in shaping effective biosafety protocols and ensuring compliance (Mehta & Diwakar, 2021) and (Tolentino et al, 2021).

For instance, individuals with higher levels of education often demonstrated better adherence to biosafety protocols and a deeper understanding of biosecurity measures. This was evident from studies where professionals with advanced degrees tend to have more rigorous training and exposure to the latest developments in biosafety, leading to more competent practices in the laboratory environment. According to the "Competency Guidelines for Public Health Laboratory Professionals" and other related studies also agreed that such differences can significantly impact the overall safety and security standards maintained within public health laboratories (CDC, 2015), (APHL, 2022), (Sharp et al, 2020).

On the other hand, a study by Mohammed et al. (2023) indicated that safety practices were influenced by the length of service, years of study, and knowledge. Those with higher education typically received more in-depth training on biosafety and biosecurity principles leading to a stronger theoretical understanding of risks and mitigation strategies. Thus, they were equipped with skills to analyze safety protocols and identify potential weaknesses or areas for improvement. On the other hand, individuals with extensive experience might become overly comfortable with routine procedures, potentially leading to a relaxed approach to safety protocols. Over time, some workers might develop unofficial shortcuts to complete tasks faster, which could bypass safety measures and result in diverse practices among employees (Mohammed et al, 2023).

In contrast, there were several studies that contradict with this result. It was showed that level educational attainment has no significant impact on biosafety and biosecurity practices. A research study titled "Influence of Education Level on Women's Knowledge, Attitude, and Practices to Control the Transmission of COVID-19 in the Democratic Republic

of the Congo" found that women with higher educational levels did not necessarily demonstrate enhanced comprehension, attitudes, or practices concerning suitable approaches for disease prevention and control. This indicated that the impact of educational attainment on biosafety and biosecurity practices can vary depending on the context and specific circumstances of the study (Loleka & Ogawa, 2022). In another study titled "Knowledge, Attitudes, and Practices on Biosafety among Filipino Registered Medical Technologists: A Comparative Study," results revealed that there was no significant differences the levels of knowledge, attitudes, and practices on biosafety among registered medical technologists working in public and private clinical laboratories in various regions of the Philippines. This indicated that educational attainment did not significantly affect biosafety practices among these professionals (Tolentino et al, 2021).

Several literatures pointed out that certain competency, such as active listening and adherence to established protocols, do not significantly vary across different educational levels. This was because these competencies were often part of mandatory training programs that all employees underwent, regardless of their educational background. Consequently, even those with lower levels of formal education can perform effectively in biosafety and biosecurity roles if they had received adequate training and support (CDC, 2015). While educational attainment can enhance theoretical knowledge, practical competencies such as adherence to safety protocols were consistently maintained across different educational levels through comprehensive training and continuous professional development (APHL, 2022).

Biosafety and biosecurity practices do not exhibit significant differences based on the level of educational attainment. Both biosafety and biosecurity measures are rooted in risk assessment and management methodologies that require personnel expertise and responsibility. There were programs which ensure that the personnel are qualified through training and documentation of technical expertise, which is a standard requirement

regardless of educational attainment. Similarly, laboratory biosecurity practices also focus on personnel reliability and training. Both biosafety and biosecurity programs necessitate the development of practices and procedures involving all laboratory personnel, promoting a culture of safety and security that transcends educational backgrounds (BMBL 2020) (ISO35001:2019, 2019).

Overall, a strong foundation in biosafety practices is likely crucial for everyone in the laboratory, regardless of educational attainment. However, a deeper understanding of the scientific concepts might provide some personnel with a better ability to perform complex tasks or identify potential deviations from protocols (Sharp et al, 2020).

Table 12. Significant Differences in the Knowledge, Attitudes, and Practices of Selected CPU Employees in Biosafety and Biosecurity based on Highest Educational Attainment

Highest Educational Attainment	Mean	Df	F-value	p
Knowledge		3; 120	1.571	0.200
Others	3.99			
College Graduate	4.02			
Master's Degree, Master's Level	3.77			
Ph.D., Doctorate Level	3.63			
Attitude		3; 120	0.393	0.758
Others	4.09			
College Graduate	4.31			
Master's Degree, Master's Level	4.25			
Ph.D., Doctorate Level	4.22			
Practices		3; 120	3.420*	0.020
Others	4.02			
College Graduate	3.97			
Master's Degree, Master's Level	3.63			
Ph.D., Doctorate Level	3.13			

Note: * Significant at α = 0.05.

Employment Status. Based on employment status, Table 13 showed no significant differences in the biosafety and biosecurity knowledge, attitudes, and practices of the selected CPU employees. The results of the One-way Analysis of Variance test revealed that, when grouped according to employment status, the significant values for the biosafety and biosecurity knowledge, attitudes, and practices of selected CPU employees were all higher than the alpha level of significance. This implied that the null hypotheses for these

categories cannot be rejected. This suggested that there was no significant difference in the knowledge of selected CPU employees in biosafety and biosecurity ($F(4, 119) = 1.740$; $p = 0.146$). Similarly, no significant difference was found in the attitudes of selected CPU employees towards biosafety and biosecurity ($F(4, 119) = 0.649$; $p = 0.629$). Moreover, there was no significant difference existed in biosafety and biosecurity practices of selected CPU employees when grouped by employment status ($F(4 , 119) = 0.640$; $p = 0.635$).

Knowledge on biosafety and biosecurity based on Employment Status.

While it was said that competent workers understood the importance of safety while at work, Table 13 showed that employees regardless of their employment status has the same understanding of biosafety and biosecurity. When handling biological agents and materials their knowledge of the risks when exposed and the impact once infected was the same. In contrasts, employees may be knowledgeable about workplace safety, yet they practiced risky behavior. Nevertheless, a significant number of employees had sound knowledge, positive attitudes, and safe behaviors, all of which helped to lower workplace risks and support the company in overcoming arising challenges. Employees who continuously perform effectively and put what they have learned into practice can be guaranteed by ongoing safety in the workplace through training programs, assessments, and management oversight. A lower accident rate, lower expenditures associated with the work process, or a lower employee turnover rate could all be indicators of superior worker performance (Ngah et al, 2022).

Attitude of biosafety and biosecurity based on Employment Status. The personnel's employment status had no impact on the knowledge, attitude, or practices of the selected CPU employee with regard to biosafety and biosecurity. There was no distinct difference in their attitudes and actions toward safety, their understanding of how management implements biosafety and biosecurity whether they were on a probationary, part-time, permanent, or contract-based employment arrangement. Nonetheless, creating a

safe and healthy work environment requires a shift in employees' attitudes about workplace safety practices. By implementing these, organizations can enhance worker attitudes regarding biosafety and biosecurity measures and create a culture of safety in the workplace (Jenifer & Anandan, 2023).

Practices of biosafety and biosecurity based on Employment Status. Among selected employees who handle biological agents and materials irrespective of their employment status had the same biosafety and biosecurity practices as shown in Table 13. Their practices and attitude aligned with their understanding of the risk of exposure and the possible impact when exposed to and get infected with the biological agents they were dealing with. On the contrary, several studies revealed how employment status affects the practices of the employees. According to BMBL 6th Ed (2020), employment status, including job roles and levels of responsibility, significantly influences the adherence to and implementation of biosafety practices. Individuals in supervisory or managerial positions are typically responsible for enforcing biosafety protocols and ensuring that all personnel adhere to safety standards. The BMBL 6th Edition (2020) emphasized the importance of tailored biosafety practices according to the employment status and roles within a laboratory setting. Supervisory personnel play a pivotal role in enforcing safety protocols, while frontline workers are essential for the practical implementation of these practices. Permanent staff exhibited higher adherence rates to good microbiological standards compared to temporary or contract workers, possibly due to more comprehensive and ongoing training programs (Barnie et al, 2019). Additionally, another study found that permanent employees generally adhere more consistently to biosafety protocols compared to temporary or contractual staff. This difference was attributed to the level of training, access to resources, and job security that permanent employees typically have (Kozajda et al, 2020).

Table 13. Significant Differences in the Knowledge, Attitudes, and Practices of Selected CPU Employees in Biosafety and Biosecurity based on Employment Status

Employment Status	Mean	df	F-value	p
Knowledge		4 ; 119	1.740	0.146
Job Hire	3.97			
Contract of Service	4.25			
Part-time	3.91			
Probationary	3.87			
Permanent	3.75			
Attitude		4 ; 119	0.649	0.629
Job Hire	4.36			
Contract of Service	4.45			
Part-time	4.24			
Probationary	4.33			
Permanent	4.18			
Practices		4 ; 119	0.640	0.635
Job Hire	3.53			
Contract of Service	4.05			
Part-time	3.70			
Probationary	3.44			
Permanent	3.70			

Job Category. The significant differences in the biosafety and biosecurity knowledge, attitudes, and practices of selected CPU employees according to job category were presented in Table 14. The results of the One-way Analysis of Variance test revealed that, when grouped according to job category, the significant values for the biosafety and biosecurity knowledge, and practices of selected CPU employees were greater than the alpha level of significance. This meant that the null hypotheses for these categories cannot be rejected. This suggested that there was no significant difference in the knowledge of selected CPU employees in biosafety and biosecurity ($F(4, 119) = 1.007$; $p = 0.407$). Similarly, there was no significant difference that existed in biosafety and biosecurity practices of selected CPU employees when grouped by job category ($F(4, 119 = 1.281$; $p = 0.281$). While a significant difference was observed in the attitude of the employees having a value lower than alpha level of significance. This simply means that a significant difference was found in the attitudes of selected CPU employees towards biosafety and biosecurity ($F(4, 119) = 2.513$; $p = 0.045$). Moreover, the multiple comparison result, using LSD, revealed

a significant difference in the attitude towards biosafety and security of the staff and healthcare service personnel (p = 0.005), and of staff and faculty (p = 0.005).

Knowledge of biosafety and biosecurity based on Job Category. Table 14 revealed that there was no discernible disparity in knowledge related to biosafety and biosecurity, beliefs, opinions, or guiding principles regardless of job category. Irrespective of the work groups to which the university's employees, including the deans, the chairpersons, the department heads, the faculty, the staff, the health, and maintenance services belong, they understand how management ensured biosafety and biosecurity. No matter what job category the employees belong, they all have similar knowledge and beliefs about biosafety and biosecurity; thus, the university has effectively communicated and enforced biosafety and biosecurity principles across all levels of employment among different work groups. Consequently, a study stated that when personnel possessed a good knowledge, positive attitudes, and safe practices, this would aide in reducing workplace hazards (Ngah et al, 2022). Employees across different job categories that possessed good biosafety knowledge, maintained positive attitudes towards safety, and consistently engaged in safe practices, created a robust framework for minimizing workplace hazards. This ensured a safer environment tailored to the specific risks associated with their roles.

Attitude on biosafety and biosecurity based on Job Category. On the other hand, in Table 14 revealed that, when employees grouped according to their job category such as department head, faculty, staff, health care or maintenance personnel had diverse in attitude towards biosafety and biosecurity. Employees from different job categories had varying perceptions of the risks associated with their work. The importance of biosafety and biosecurity hold different weights depending on job duties. The faculty prioritized teaching activities and research progress, while healthcare workers were more focused on patient care. This influenced their attitudes towards biosafety and biosecurity. While knowledge levels might be the same, the depth of biosafety training or personal experiences with

incidents could influence attitudes. Someone who had witnessed a safety breach and experienced the consequences had a stronger safety focus compared to someone with limited training or experience.

Although there was a shared understanding of the importance of biosafety and biosecurity measures across different job categories, the attitudes and compliance levels differ significantly. There were notable differences in employees' attitude as they perceived risk exposure to highly infectious biological agent among job categories. Healthcare workers and frontline staff perceived a higher risk due to their direct contact with patients and the public, while administrative and remote-working employees perceived a lower risk. Healthcare workers and those in direct contact with patients were more likely to strictly comply with biosafety protocols. In contrast, those in non-healthcare roles or working remotely may exhibit varying levels of compliance based on their work environment and perceived risk (Lee et al, 2021). A comparable result was revealed in Table 14. Science-based job categories such as healthcare service personnel had positive attitude towards biosafety than non-science based job category such as support office staff.

The job category was associated with the level of attitude. In health care setting, the majority of nurses had a good attitude towards infection prevention control, followed by doctors, then orderlies, and lastly the anesthetists (Alhassan et al, 2021).

Similarly, the mean attitude significantly varied across educational levels, main occupations, and marital status (Yoseph et al).

Workers with more experience in procedures and protocols tend to have a more positive attitude towards biosafety and biosecurity practices. Thus, they were more likely to recognize the importance of these practices based on their firsthand experiences with potential hazards. Administrative and support staff may face different barriers to implementing safety measures compared to operational workers. These barriers could include lack of resources, insufficient training, or inadequate communication of safety

protocols from management (Ngah et al, 2022), This supported the result in Table 14 that showed a significant variation in attitude according to job category. Administrative support staff may perceive lesser risk of exposure to biological agent; thus, it showed complacency in their attitude towards biosafety and biosecurity than those who were directly exposed to biological agents.

Applying "3D Model Of Attitude" by Jain, analyzing each component (Affect, Behavior, Cognition) for different job categories, significant differences and similarities can be identified in attitudes towards biosafety and biosecurity. This study revealed that while there was a common understanding of the importance of biosafety and biosecurity across various job categories, significant differences existed in perceived risk, resource access, practical implementation, and the barriers faced. Strategic approaches that address these specific differences were necessary to effectively manage biosafety and biosecurity attitudes and practices across different job roles (Jain, V, 2014).

In the study of Sengupta et al. (2022), it highlighted the shared understanding and support across various job categories, but the significant differences existed in perceived risk, access to preventive measures, levels of hesitancy, and the influence of knowledge on attitudes.

Contrasting to the influence of job category on attitude towards biosafety and biosecurity, there were several studies that showed no significant difference in the attitude of employees regardless of the job group they belonged. Employees who were aware of the significance of biosafety and biosecurity procedures regardless of job categories understood how important it was to abide the safety procedures in avoiding mishaps and health problems. Their attitude conveyed a common dedication to follow safety procedures, realizing that doing so was crucial for both their and coworkers' safety (Ngah et al, 2022). Other several studies also did not find statistically significant differences in attitudes across job categories (Halatoko et al, 2024) and (Geraldez et al, 2023).

Although most respondents showed admirable attitudes toward biosafety principles, there was no significant difference detected in the understanding, attitude, practice, or application of biosafety protocols. This indicated that their workplaces had an established safety culture foundation (Tolentino et al, 2021). Likewise, there have been studies where employees who directly engaged in biological agents possessed sound safety knowledge, but failed to integrate it, hence their attitude remained the same. This was strengthened by another study that revealed that there were no changes in attitude despite possible variances in personal safety knowledge among different job categories (Fan, et al, 2021).

Practices of biosafety and biosecurity based on Job Category. Employees from different job categories had no significant difference in biosafety and biosecurity practices in handling biological agents and materials as shown in Table 14. Regardless of what group work they belong, the safety and security practices were the same. They adhere to biosafety and biosecurity procedures and protocols for handling biological agents and materials. It showed that the institution provided an effective and comprehensive training to all employees, ensuring that everyone understood and applied the biosafety and biosecurity measures. Standard operating procedures (SOPs) and guidelines were likely well-communicated and enforced leading to consistent implementation across all job categories. Additionally, it was also shown that the employees had a sufficient understanding of the risk of exposure to biological agent as they had a good safety practice. A study agreed that it should be essential to institutionalize measures that promote safety practices, minimize exposure to hazards, and adequately reinforce staff capacity and capability through drills and trainings, as the high level of knowledge demonstrated by personnel was also changing with practice. The safety training and drill procedure ought to be modified to newly emerging and job-specific safety concerns based on practical evidence (Aluko et al, 2016).

Furthermore, regular training and hands-on demonstrations should be used to reconcile knowledge, attitude, and practices (Pandey et al, 2021).

Table 14. Significant Differences in the Knowledge, Attitudes, and Practices of Selected CPU Employees in Biosafety and Biosecurity based on Job Category

Job Category	Mean	df	F	p
Knowledge		4 ; 119	1.007	0.407
Grounds and Building Upkeep Maintenance	4.05			
Healthcare Service Personnel	4.00			
Staff	3.55			
Faculty	3.90			
Dean, Chairperson, Department Head	3.76			
Attitude		4 ; 119	2.513*	0.045
Grounds and Building Upkeep Maintenance	4.18			
Healthcare Service Personnel	4.48			
Staff	3.78			
Faculty	4.32			
Dean, Chairperson, Department Head	4.25			
Practices		4; 119	1.281	0.281
Grounds and Building Upkeep Maintenance	4.04			
Healthcare Service Personnel	4.19			
Staff	3.60			
Faculty	3.63			
Dean, Chairperson, Department Head	3.54			

Note: * Significant at α = 0.05

Work Assignment. Table 15 presented the significant differences in the biosafety and biosecurity knowledge, attitudes, and practices of selected CPU employees according to their work assignments. The results of the One-way Analysis of Variance test revealed that, when grouped according to work assignment, the significant values for the biosafety and biosecurity knowledge, attitudes, and practices of selected CPU employees were all more than the alpha level of significance. As a result, the null hypothesis for these categories was not rejected. This suggested that there was no significant difference in the knowledge of selected CPU employees in biosafety and biosecurity ($F(2, 121) = 0.659$; $p = 0.519$). Similarly, no significant difference was found in the attitudes of selected CPU employees towards biosafety and biosecurity ($F(2, 121 = 1.076$; $p = 0.344$). Moreover, there was no significant difference existed in biosafety and biosecurity practices of selected CPU employees when grouped by work assignment ($F(2 , 121 = 1.700$; $p = 0.187$).

Knowledge on biosafety and biosecurity based on work assignment. The knowledge in biosafety and biosecurity of selected CPU employees regardless of their work assignment was the same as shown in table 15. The biosafety and biosecurity knowledge has been conveyed to the employees and interpretation on how to relate on their individual work assignment accordingly. Specific to the work they were assigned, they understood the hazards and associated risks in handling biological agents and materials. A study concluded that the level of knowledge among workers were relatively satisfactory; training on workplace safety, health programs and other appropriate trainings provide professional growth opportunities and result to effective performance of the workers and help workers in performing their best (Ngah et al, 2022). Moreover, overall knowledge may be satisfactory but prone to lose in time progression. Regular updates and training were recommended emphasizing on their key work areas (Abhayaratne, et al, 2020) (Gopalakrishnan et al, 2021).

Moreover, a study showed that some workers had knowledge that they were aware of prevention control measures (Fan, et al, 2021).

In contrast, there were several studies that showed that there were fair to poor and even inadequate knowledge in biosafety and emphasized on strengthening biosafety program and requires training to update knowledge (Almohammed et al, 2021), (Al-Abhar et al, 2017), (Islam et al, 2020).

Attitude on biosafety and biosecurity based on work assignment. Table 15 also showed that selected employees who handle biological agent and materials had the same attitude on the perceived risk of exposure in handling biological agents and materials. In a study conducted, it was staed that a positive attitude aided in reducing workplace hazards assisting the organization in overcoming challenges ahead (Ngah et al, 2022). Similarly, it was also mentioned in another study that positive attitude limits the spread of infection (Fan, et al, 2021). During COVID-19 pandemic, a study conducted in Saudi Arabia among

healthcare workers, the result showed that the attitude of healthcare workers was parallel to other countries (Almohammed et al, 2021).

Contradictory to the result of this, as shown in another study, it was identified that there were attitudinal differences among healthcare workers in a cross-sectional study conducted in India (Gopalakrishnan et al, 2021). Attitudes may play a more critical function in prompting individuals to undertake preventive behaviors, and different positive affective attitudes had different predictive relationships with preventive behaviors (Luo, Y-F et al, 2022).

Practices on biosafety and biosecurity based on work assignment. This study also revealed in Table 15 that regardless of work assignment, employees who handle biological agents and materials have the same biosafety and biosecurity practices. According to a study, there were variations in the understanding of personal protection among various categories of work but there were no significant differences in attitudes and practices that would have greatly improved the relevant preventive programs (Fan, et al, 2021).

While most of the workers were found to adhere to safe working practices, some were, nonetheless, compelled to engage in unsafe procedure. To increase employee understanding of safe work practices, it is important to emphasize the necessity for sufficient and current safety procedures in addition to effective safety intervention. To lessen and completely eradicate risk factors for harmful actions, everyone should take personal responsibility for and understanding of safety (Ngah et al, 2022).

Workers who were more knowledgeable were more likely to have a positive attitude and to exhibit better practices (Balugya et al, 2022). In the context of health safety, if defined according to specific work assignment, the medical staff was more likely to exhibit adequate knowledge, positive attitude and comply with appropriate practices compared with non-medical employees (Almohammed et al, 2021).

A study revealed that high levels of attitudes and practices but only moderate understanding based on work-related and demographic factors had differences in the knowledge, attitudes, and practices of employees. To address these and to decrease the risk of exposure to diseases and potential outbreaks, the management should augment safety practices through training and supervision of all related aspects to advance knowledge, attitudes, and safe practices (Al Banna et al, 2022).

Moreover, it was determined that the lack of knowledge, attitude, and practice in safety among workers should be noted. It was necessary and challenging to develop a consistent approach to enhance their knowledge, attitude, and practices for any individual group of workers (Almutairi et al, 2020).

Considering the socio-environmental changes, a particular study assessed people's knowledge, attitudes, and activities related to sustainable safety practices. According to the findings, worker differences in perceptions, attitudes, knowledge, and behaviors were caused by interactions between social and environmental changes at various processes and scales. Additionally, worker cognition—that is, perceptions, attitudes, and knowledge and sustainable practices, as well as the related socio-environments, are reciprocally correlated. Moreover, several strategies were considered to improve sustainable practices based on the findings of the same study (Liao et al, 2022).

Table 15. Significant Differences in the Knowledge, Attitudes, and Practices of Selected CPU Employees in Biosafety and Biosecurity based on Work Assignment

Work Assignment	Mean	df	F-value	P
Knowledge		2 ; 121	0.659	0.519
Academe	3.85			
Non-Academe				
Science	4.10			
Non-Science & Others	3.86			
Attitude		2 ; 121	1.076	0.344
Academe	4.24			
Non-Academe				
Science	4.49			
Non-Science & Others	4.15			
Practices		2 ; 121	1.700	0.187
Academe	3.65			
Non-Academe	4.22			
Science	3.80			
Non-Science & Others				

Association of the Knowledge Attitude and Practices in Biosafety and Biosecurity of Selected CPU Employees

Knowledge on Attitude. Table 16 presented the significant association between the knowledge and attitudes of selected CPU employees in biosafety and biosecurity. Pearson's R correlation test results revealed that the knowledge of CPU employees was significantly associated with their attitudes toward biosafety and biosecurity ($r = 0.743$; $p = 0.000$). A positive attitude towards biosafety and biosecurity was attributed to a strong association of knowledge and attitude in the implementation, belief and opinions of management and employees about biosafety and biosecurity. The more an employee understood the value of biosafety and biosecurity, the more positively their attitude to change and adopt a safety culture which in turn affected their behavior and actions. Their thoughts, feelings, and views regarding safety were reinforced by information, guidelines and policies as set by the institution.

Based on certain studies, knowledge is crucial for shaping an individual's behavior and had a positive association with purposes. It became clear from experiences and

research findings that working with information was more advantageous than doing things without knowledge (Gusti, 2016).

Consequently, some studies highlighted inadequate knowledge, attitudes, and practices. The positive linear correlations provided more evidence that more knowledge might result in a positive attitude and, eventually, constructive behavior (ul Haq et al, 2012). On the other hand, even with sufficient knowledge, the attitude was not always positive, leading to the need for further education to emphasize the significance of developing a good attitude and continuous preventive practice, (Nwagbara UI et al, 2021). There have been decisions that have a strong link to their intentions and attitude, indicating the significant role of attitude. Consequently, a "person-centric" attitude was based on constructive strategies for intervention that build on their past knowledge (Sengupta et al, 2022).

Anybody could be in danger. The lack of knowledge, conventional beliefs, and nonscientific methods may be the causes of the mediocre attitude and behavior. To carry out effective interventions for preventing the spread of diseases, the government and policy makers must consider these knowledge levels, attitudes, and practices in addition to the risk assessment (Haque et al, 2020). Understanding the biological risk and threat will alter one's perspective of safety, leading them to adopt an optimistic attitude and modify their behaviors towards the goal of safety in order to assist organizations in creating a safety culture that builds on the foundations of risk knowledge and provides significant points as a framework for what the shared beliefs, norms, values, and practices that comprise the safety culture. The knowledge created by integrating the safety culture concept and current risk assessment was integrated. To seek and establish a positive safety culture and alignment of these principles, this framework provided an explanation of key ideas and summarized a good or sensible risk knowledge, assessment, communication, and management practices (Aven & Ylonen, 2021).

An established foundation of safety practices, the concepts and principles of biosafety and biosecurity should begin at the undergraduate level. This would help to ignite awareness, develop understanding, and integrate biosafety and biosecurity to person's attitude. With this, a study concurred that most participants had reasonable knowledge and favorable attitudes toward workplace safety practices. However, there was no implementation of the safety at work policy. Safety principles should be taught in the undergraduate health curriculum for all healthcare workers, with a focus on applying safety in their daily clinical work, as it is crucial to implement safety procedures at work in reducing unintentional exposure to dangers (ALHazim et al, 2022).

According to research findings, safety motivation and knowledge were predicted by safety leadership and attitude components as well as by how they interacted. These variables also had an impact on workers' motivation and knowledge which in turn affected safety participation, engagement, and compliance. Developing employee's motivation and understanding, along with routinely evaluating effective leadership and attitudes, can enhance an organization's success in safety-related behavior (Basahel, 2021).

Attitude on Practices. The significant association between the biosafety and biosecurity attitudes and practices of the selected CPU employees was presented in Table 16. Pearson's R correlation test results revealed that the attitudes of CPU employees were significantly associated with their practices toward biosafety and biosecurity ($r = 0.644$; $p = 0.000$).

There was a substantial correlation between the practices of employees handling biological agents and their attitude towards it. The employee's actions demonstrated their positive attitude toward biosafety and biosecurity which was evident in their practices. A positive safety behaviors and attitudes must have been instilled at the time starting in school. Some employees who underwent internships at different laboratories were aware of biosafety practices. According to a study, most employees who had not undergone

internship had negative attitudes about biosafety and biorisk management. As a result, biosafety training needs to be changed to better serve new employees by incorporating biosafety management concepts within each of the program's foundational courses of the training. Before employees can work freely on any assigned infectious area, they should receive a thorough orientation on biorisk management (Padde et al, 2022).

Remarkably, a study revealed that most participants knew that safety regulations existed. Although the participants had a positive attitude toward safety precautions, poor attitude was noted and they were unable to transform this attitude into action (Jothula & Sreeharshika, 2021).

Some studies stated that good knowledge and positive attitude were important factors in determining good safety practices among the workers. While employment characteristics have shown significant association with knowledge and attitude, these did not determine their safety practices (Rosliza et al, 2015). With regards to safety concerns and biological risk exposure protocols, there was a lack of knowledge, attitudes, and behaviors. The practice area needs to be improved even if all the employees had high attitude scores (Haldar et al, 2022).

On the other hand, the attitudes and safety practices of employees with backgrounds in health and science were noticeably better. However, since they were not supplemented with current, sufficient information, more actions were necessary. Apart from permitting them an opportunity to impart their knowledge as community role models and public educators, such interventions should strive to keep them informed about the latest findings regarding disease and provide them with the necessary tools and information to be ready for any future public health emergencies. By improving knowledge, attitude, and practice-all of which were positively correlated. This strategy may, in turn, produce a positive feedback loop (Adli et al, 2021).

In the study *"Safety in Medical Laboratories: Perception and Practice of University Students and Laboratory Workers*," the laboratory workers' attitudes and practices on observing safety regulations ranged from good to mediocre in their responses (Abu-Siniyeh & Al-Shehri, 2021)**.** Knowledge directly affected both attitudes and practices. Among the influencing factors of preventive behaviors, efficacy belief was the most influential and significant practice factor (Lee et al, 2021). The more someone knows about biosafety and disease exposure, the more positive attitudes become and the more likely they are to follow best practices.

Knowledge on Practices. Table 16 presented the significant association between the knowledge and practices in biosafety and biosecurity of selected CPU employees. Pearson's R correlation test results revealed that the knowledge of CPU employees was significantly associated with their practices toward biosafety and biosecurity ($r = 0.757$; $p = 0.000$).

This study showed that the more knowledgeable the employees about biosafety and biosecurity the more cautious they were in manipulating biological agents and handling materials that has been contaminated with it. Thus, it was revealed in this study that knowledge on biosafety and biosecurity among employees involved in handling and manipulating biological materials showed good safety practices. A certain study found that employees who were aware of the most recent biosafety guidelines issued by the World Health Organization and who had a positive attitude toward following and putting biosafety protocols and safety precautions into practice were able to create a culture of safety in their work environments. These contribute to ensuring public and workplace safety (Tolentino et al, 2021).

While knowledge alone may not always motivate people to adopt preventative practices, health awareness of diseases remains crucial. Understanding served as the basis for attitude and a catalyst for action. When the management and other relevant authorities

informed the public about diseases and infections, they should consider how to move them from "empty talk" to "do it now." The compliance of preventive practices and measures can be improved by using moral persuasion instead of threatening language. For instance, statements like "we need you" and "you can help society" can be used to promote preventative actions. However, the administration should also consider the people's emotional welfare in relation to their pessimistic view of life while urging them to implement preventative actions (Luo, Y-F et al, 2022). Furthermore, continuous education and safety promotion were recommended for all employees regardless of their socio-demographic and employment status to inculcate good knowledge and positive attitude, which eventually will lead to optimum safety practices in the organization (Rosliza et al, 2015). In contrast, another study in a clinical laboratory showed a fair to poor biosafety knowledge and practices among the staff as well as weak commitment to biosafety policies as reflected by low percentage of laboratory staff who received a biosafety manual and training. This finding stressed the need to strengthen the biosafety program and policies in laboratories (Al-Abhar et al, 2017), (Abu-Siniyeh & Al-Shehri, 2021).

There were studies which provided much needed information on the knowledge, attitudes, and practices. Although most respondents reported satisfactory practices, gaps were identified in knowledge and attitudes. This suggested a need for further investigation which focuses on the observed practices and strengthening health and safety education activities for the community (Shati et al, 2021). In the biosecurity component of Biorisk Management Program, a certain study revealed that due to the stakeholders' limited knowledge and capacity for risk-taking, biosecurity preventive and mitigation strategies were still poorly implemented. There were certain gaps identified and indicated areas that could be improved in the short term and long-term goal. The same study emphasized the need of converting biosecurity policies into practical knowledge and highlighted the necessity of financial support to facilitate a more significant impact on the upstream level (Kambey et al,

2021). Some institutions, particularly the laboratories, were clearly putting a lot of effort into enhancing their Biorisk Management (BRM) practices and procedures. For BRM systems to be successful, the efforts must be strengthened with an emphasis on continual development (Muhammad et al, 2021). For the Biorisk Management Program to be implemented and a "safety culture" to be established, it is imperative that gaps be recognized and that risks be assessed and managed continuously.

Table 16. Significant Association Between the Knowledge and Attitude of Selected CPU Employees in Biosafety and Biosecurity

		Knowledge	**Attitude**	**Practices**
Knowledge	r-value	1	.743**	.757**
	p		.000	.000
	N	124	124	124
Attitude	r-value	.743**	1	.644**
	p	.000		.000
	N	124	124	124
Practices	r-value	.757**	.644**	1
	p	.000	.000	
	N	124	124	124

Note: * Significant at.; ** Significant at α = 0.01

Chapter V

Summary, Conclusion and Recommendations

Summary

The study "Biosafety Biosecurity: Knowledge, Attitude, and Practices as Basis for University Biorisk Management Program" evaluated the knowledge, attitudes, and practices of selected employees who handle and were exposed to biological agents and materials at CPU (Central Philippine University). The goal is to provide a foundation for developing the University's Biorisk Management Program.

In terms of biosafety and biosecurity knowledge**,** most employees had high to very high knowledge regarding biosafety and biosecurity. They were aware of the risks associated with biological agents, the university's measures to mitigate these risks, and the importance of risk assessment and emergency preparedness. However, some gaps existed in knowledge about dual-use research of concern, insider threats, and emergency response to biological spills.

With regards to attitude**,** most employees demonstrated a highly positive attitude towards biosafety and biosecurity. They recognized the importance of adhering to guidelines, reporting near misses, and maintaining open communication about safety issues. The university administration was seen as supportive and encouraged a culture of safety and responsibility.

When it came to practices, a significant number of employees frequently practiced biosafety and biosecurity measures. Standard operating procedures (SOPs) were generally followed, and employees were well-informed about potential hazards and risk management protocols. However, there were areas for improvement, particularly in the orientation and training of newly hired staff.

Conclusion

The study concluded that while there is a strong foundation of knowledge, positive attitudes, and good practices regarding biosafety and biosecurity among CPU employees, there were areas that require further attention and improvement. The identified gaps in knowledge and inconsistent practices among some employees highlight the need for continuous education and training programs. The findings provided valuable insights for the development and enhancement of the University's Biorisk Management Program.

Recommendations

1. **Enhanced Training Programs**: Regular and comprehensive training sessions should be conducted to address the identified knowledge gaps, particularly focusing on dual-use research of concern, insider threats, and emergency response procedures.
2. **Continuous Education**: Implement ongoing educational initiatives to keep all employees updated on the latest biosafety and biosecurity protocols, ensuring they understand the importance of these measures.
3. **Strengthening Standard Operating Procedures (SOPs)**: Review and strengthen standard operating procedures to ensure consistent application across all departments. This includes developing detailed guidelines for emergency situations and handling biological spills.
4. **Orientation for Newly Hired**: Develop a robust orientation program for new employees, emphasizing the importance of biosafety and biosecurity from the outset.
5. **Monitoring and Evaluation**: Establish a system for regular monitoring and evaluation of biosafety and biosecurity practices. This can help identify areas for improvement and ensure compliance with established protocols.

6. **Promoting a Safety Culture**: Foster a culture of safety and responsibility within the university by encouraging open communication, reporting of near misses, and collaborative problem-solving approaches.

These recommendations aimed to develop strategies in creation of the university's biorisk management framework, ensuring a safe and secure environment for all employees and stakeholders.

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APPENDICES

APPENDIX A: DATA COLLECTION TOOL- ENGLISH VERSION

BIOSAFETY AND BIOSECURITY: KNOWLEDGE, ATTITUDE AND PRACTICES OF THE UNIVERSITY EMPLOYEES AS BASES FOR THE DEVELOPMENT OF A BIORISK MANAGEMENT PROGRAM

Dear Participants,

I am inviting you to participate in this research by completing the following survey. This research aims to determine the knowledge, attitude, and practices of personnel who work with biological agents and those who are involved in the implementation and funding of safety measures in the university. The information that you share will be helpful as we establish the Biorisk Management Program for the University.

This survey is divided into Demographics, Knowledge, Attitude and Practices. The knowledge, attitude, and practices questions are adapted from the *International Working Group (IWG) on "Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences"* - (Self) Assessment Framework – January 2020", (IWG, 2020) "

Your responses are STRICTLY CONFIDENTIAL AND ANONYMOUS. Only the researcher has access to the questionnaire and no name will be mentioned. The report of the survey will only show statistical summaries of the findings.

To understand this study please read and sign the attached informed consent form before proceeding with this survey, or click the link provided below.

Thank You Very Much for Your Time

Sincerely,

Eden L. Saladar

EDEN L. SALADAR
Researcher

Please return this questionnaire to your college secretary or:

EDEN L. SALADAR
School of Graduate Studies
Central Philippine University
Cellular Phone Nos. 09567149316 (Globe) or 09934494405 (Smart and TNT)
Email: eden.saladar-14@CPU.edu.ph or els050874@yahoo.com
CODE No:_____

I. DEMOGRAPHICS

Instruction: Please complete this section by answering the following questions. Please check the space provided for your selected answer.

1. Age:
   _____ 20 years old and below
   _____21-30 years old
   _____31-40 Years old
   _____41-50 Years old
   _____51-60 Years old
   _____61 years old and above

2. Gender:
   ____ Male
   ____ Female

3. Highest Educational Attainment:
   _____ Ph.D., Doctorate Level
   _____ Master's Degree, Master's Level
   _____ College Graduate
   _____ College Level
   _____ Vocational/ Technical Course
   _____ High School
   _____ Elementary

4. Employment Status:
   _____ Permanent
   _____Contract of Service
   _____Job hire
   _____Others: Please Specify_____

5. Work Assignment:
   _____ **Academe:**
   _____ College of Medicine
   _____ College of Nursing
   _____ College of Medical Laboratory Science
   _____ College of Pharmacy
   _____ Department of Life Science
   _____ College of Agriculture, Resources and. Environmental Sciences
   (CARES)- University Research Center for Product Development

   ____**Non-Academic**:
   _____HealthCare Service
   _____ Medical Clinic
   _____Dental Laboratory
   _____Clinical Laboratory
   _____Birthing Center
   _____General Service
   _____Shop Facility and Maintenance
   _____Grounds
   _____Building Keep-Up maintenance
   _____Administrative and Management
   _____Office of the President
   _____Office of the Vice President for Admin
   _____Office of the Vice President for Academic

_____Accounting Office
_____Cashiers Office
_____Security and Safety Office
_____Occupational Health and Safety Office

6. Roles /Job Categories**:**
_____ DEAN, CHAIRPERSON, DEPARTMENT HEAD- a middle management level responsible for implementation and overseeing of the project or program for the department.
_____FACULTY- Handles *Academic Instructions and Activities*
_____ STAFF- *Assist Faculty in the Delivery of Academic Instructions and Activities*
_____ HEALTHCARE SERVICE PERSONNEL- *Deliver Healthcare and laboratory Services*
_____ Grounds and Building Upkeep Maintenance- *maintain cleanliness, orderliness, and smooth operation of the University*
_____ ADMINISTRATIVE AND MANAGEMENT- *involved in implementation, monitoring, and funding of the University's Policies and Programs*

II. DETERMINATION OF KNOWLEDGE ATTITUDE AND PRACTICES

Questions are adapted from the *International Working Group (IWG) on "Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences – (Self) Assessment Framework – January 2020*". The Knowledge, Attitude and Practices questions directed towards biosafety and biosecurity evolved in four areas; Management Systems**,** Behavior of Leadership and Personnel, Principles for Guiding Decisions and Behaviors and Beliefs, Opinions, and Attitudes, (IWG, 2020).

A. KNOWLEDGE

This determines the level of knowledge or awareness in biosafety and biosecurity evolved in institutional management systems**,** the behavior of leadership and personnel, principles for guiding decisions and behaviors and beliefs, opinions, and attitudes towards biosafety and biosecurity.

Instruction: Please rate according to choices by checking the appropriate box below.

Code	**KNOWLEDGE**	N/A or I do not know (0)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
K1	My university has procedures in place to keep employees informed on the risks of unintentional and/or intentional release of, or exposure to, **biological agents and/or ***toxins that are stored or handled at our facilities. *_**Biological agents**_ - *refers to microorganisms, infectious agents, or organisms capable of causing disease* ** _**Toxins**_- *refers to poisons, venoms, pollutants, and chemicals or products from biological agents' manipulations such as bacterial culture, inoculum, and others that can transmit diseases and cause harm to humans and animals.*						
K2	The university has *mitigation procedures in place to reduce the risk of unintentional and/or intentional release of, or exposure to, biological agents and/or toxins stored or handled at our facility. _***Mitigation procedures**_- *refers to procedures in place to control or reduce the likelihood or possibility of exposure to biological agents and the severity, or seriousness of the impact once a person is exposed to the disease.*						
K3	My university conducts emergency response drills on FIRE regularly.						
K4	My university conducts emergency response drills on EARTHQUAKE regularly.						
K5	My university conducts emergency response drills for BIOLOGICAL SPILLAGE regularly.						

Code	**KNOWLEDGE**	N/A or I do not know (0)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
K6	There is a procedure in place for employees to report *unusual behavior in a co-worker. *** *Unusual behavior-*** refers to doubtful, unfamiliar, or a change in the behavior of a co-worker.						
K7	My university has continuing biosafety and biosecurity education and/ or competency training for employees.						
K8	Information regarding biosafety and biosecurity measures, procedures, and policies are in place and readily available to employees.						
K9	There is an established *internal communication procedure to inform employees about biosafety and biosecurity incidents and **near misses. *****Internal communication*** *refers to risk communicated to employees within the department or university/institution, incident reports, and near-miss occurrences.* ***** near miss****- refers to unplanned events or any incidents that almost but did not happen*						
K10	There is a waste management procedure that includes decontamination of wastes before disposal available to employees.						
K11	At my university, the dean and department chair/head encourage employees to enhance their biohazard education and awareness.						
K12	In my university, there are measures in place to investigate, reprimand, suspend or terminate employees who willfully violated the biosafety and biosecurity protocol.						
K13	The dean or department chair/head communicates with staff about specific performance expectations in areas that affect biosafety and biosecurity.						

Code	**KNOWLEDGE**	N/A or I do not know (0)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
K14	My university has an **Insider Threat* mitigation program. ****Insider Threat***- refers to people within the organization such as employees, former employees, and contractors who have malicious intent to harm a co-worker or the institution. ** ***Insider Threat Mitigation Program***- refers to the workplace/university/institution's plan and strategies to identify employees, former workers, or contractors who can cause harm to co-workers or the institution and select a reliable person to be assigned in the critical areas of concern.						
K15	I am aware of the concept and implications of *dual-use research of concern. ***Dual-use research of concern***- this refers to studies and research conducted in life sciences that are intended to provide benefit but can also be misused or used for another purpose that can potentially cause harm to humans, animals, or the environment.						
K16	I am aware of the threat of *bioterrorism and **biological weapons. ****Bioterrorism***- this refers to terrorist activities involving the release of biological agents (bacteria, viruses, fungi) that will cause a threat, harm, and chaos to the public *****Biological Weapon***- this refers to biological agents (infectious microorganisms, bacteria, viruses, or fungi) designed and used to inflict others.						
K17	Controlling access to sensitive information is important to biosecurity.						

Code	**KNOWLEDGE**	N/A or I do not know (0)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
K18	I am aware that there are ethical, legal, and societal issues and consequences attached to my work.						
K19	Each personnel or employee at my university has the necessary competency to perform their assigned tasks safely and effectively.						
K20	Risk assessments are important tools to identify areas of improvement and specific measures for reducing risk, including the level of safety/biosafety required.						

B. **ATTITUDE**

This determines the perceptions, opinions, and beliefs *evolved in Management Systems, Leadership and Personnel, and Principles for Guiding Decisions* that influence one's behavior or attitude towards biosafety and biosecurity

Instruction: Please rate according to choices by checking the appropriate box below.

Code	**ATTITUDE**	N/A or I do not know (0)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
A1	Utilizing the lessons learned from emergency drills has improved my performance in safety and emergency responses.						
A2	My department chair sets a good personal example of practices aimed at reducing biohazard risks.						
A3	I am confident that I can report my illness or other conditions that may have an impact on biosafety/biosecurity without fear of losing my job or having other negative consequences in my professional career.						
A4	It is not acceptable to tag along ("piggyback*") with an employee who is authorized to enter a restricted area. (***Piggyback****- describes a person who will go with someone authorized or influential to gain access to restricted areas)*						

Code	**ATTITUDE**	N/A or I do not know (0)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
A5	My university places a high importance on biosafety and biosecurity.						
A6	Employees take part in risk assessment, decision-making, and other activities that affect them.						
A7	The deans and department chairs are approachable, allow effective two-way communication, and encourage employees to report concerns or suspicions without fear of disciplinary action.						
A8	Encouragement and reinforcement received from deans, department chairs, peers, and subordinates significantly influence my work performance.						
A9	Deans and department chairs demonstrate their commitment to biosafety and biosecurity through words and actions.						
A10	Everyone holds personal responsibility for biosafety and biosecurity.						
A11	When an incident or near miss occurs, 'brainstorming' takes place rather than 'blamestorming.' The question is, "What went wrong?" rather than "who was wrong?" ", emphasizing improvement over blame.						
A12	I consider the implications and potential applications of my work, as well as the balance between the pursuit of scientific knowledge or the completion of assigned tasks and my ethical responsibilities to society.						
A13	There are university policies or standards on biosafety and biosecurity practices enforced and followed by the employees.						
A14	Admitting mistakes, taking responsibility, and developing a plan to overcome challenges and/or implement corrective actions are essential components to ensure effective biosafety and biosecurity in the workplace.						
A15	Striving for professional excellence through self-assessment and continuing education will improve work performance.						

Code	**ATTITUDE**	N/A or I do not know (0)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
A16	I always abide by all laws, rules, policies, and standards that are relevant to my work and practices to ensure safety.						
A17	Biosafety and/or biosecurity deficiencies or vulnerabilities are corrected with a sense of urgency.						
A18	My university is more concerned with the safety of the employees or workers from disease exposure than with the outcomes or output of our work when we carry out tasks involving biological hazards and risks (like conducting research involving infectious microorganisms for novel studies or handling these infectious microorganisms, such as in infectious waste disposal).						
A19	The assurance of future biosafety performance is supported by technical expertise and experience.						
A20	I believe that it is important to report not only laboratory accidents and incidents but also near misses.						

C. PRACTICES

This determines the practices in biosafety and biosecurity that influence the effectiveness of institutional management systems, leadership and personnel behavior, principles for guiding decisions, beliefs, opinions, and attitudes toward biorisk management.

Instruction: Please rate according to choices by checking the appropriate box below.

Code	**PRACTICES**	N/A or I do not know (0)	Never (1)	Irregularly (2)	Occasionally (3)	Frequently (4)	Always (5)
P1	Procedures and rules of conduct related to *biosafety and **biosecurity is explained during new employee orientation. ***Biosafety***- means keeping the self, environment, and community safe by preventing exposure, release, and transmission of infectious agents						

Code	**PRACTICES**	N/A or I do not know (0)	Never (1)	Irregularly (2)	Occasionally (3)	Frequently (4)	Always (5)
	****Biosecurity*- means keeping the people and community safe by preventing access of perpetrators to stored infectious agents and use for bad intentions.						
P2	Mitigation procedures are implemented to reduce the risk of unintentional and/or intentional release of, or exposure to, biological agents and/or toxins stored or handled at our facilities.						
P3	My university has a procedure in place and uses it as a detailed action during incidents such as spillage and splashes of biological agents and chemicals.						
P4	Employees are reminded of the lessons acquired from biosafety/biosecurity violations or near misses* and use them to perform better. ***Near miss*** – an unplanned event that happened but did not result in injury, illness, or damage – but has the potential to do so.						
P5	Employee's individual *biosafety/ biosecurity performance assessment is given importance and done as scheduled by the department. ****biosafety/biosecurity performance*** -refers to good microbial practices and procedures and biosecurity measures such as physical access and SOP compliance check.						
P6	Before workers are granted access to pathogens and toxins, they are screened for appropriate credentials, skills, and personal traits for the job.						
P7	Deans or department chairs/heads inform employees about the risks and control measures in place to reduce the risks of unintentional and/or intentional release of biological agents and/or toxins stored or handled at the facility.						
P8	Dean or department chairs/heads **monitor adherence** to the approved/validated procedures (or research protocols) and rules of conduct.						

Code	**PRACTICES**	N/A or I do not know (0)	Never (1)	Irregularly (2)	Occasionally (3)	Frequently (4)	Always (5)
P9	Deans or department heads **provide the required standard operating procedures (SOPs)** to implement biosafety and biosecurity measures.						
P10	The unusual or suspicious change in my colleague's behavior that raises the risk of unintentional or intentional release or exposure to biological agents or toxins is reported to our department's head or person in authority.						
P11	I participate in risk assessment and decision-making processes to reduce the risk of unintentional and/or intentional release of, or exposure to, biological agents and/or toxins stored or handled at my department or facility.						
P12	In my department or facility, contaminated materials are properly disinfected before disposal to general waste.						
P13	My university/ department/ office applies lessons learned and best practices.						
P14	My university promotes public transparency regarding its biosafety and biosecurity compliance.						
P15	My university provides training on recognizing signs and symptoms of high-risk behavior in oneself, co-workers, and outsiders who would like to access the facility, department, or office.						
P16	Biosafety and biosecurity violations are handled appropriately.						
P17	My university practices a culture that supports and encourages trust, collaboration, consultation, and communication regarding biosafety and biosecurity.						
P18	I have received adequate training on the procedures necessary to conduct my work without compromising safety and security.						
P19	I report data with integrity and accuracy.						
P20	I wear appropriate adequate PPE to perform my work safely and securely.						

Thank you very much, Stay safe and God Bless

APPENDIX B- DATA COLLECTION TOOL- HILIGAYNON VERSION

HILIGAYNON TRANSLATED DATA COLLECTION INSTRUMENT

BIOSAFETY AND BIOSECURITY: KNOWLEDGE, ATTITUDE AND PRACTICES OF THE UNIVERSITY EMPLOYEES AS BASES FOR THE DEVELOPMENT OF A BIORISK MANAGEMENT PROGRAM

Mga Pinalangga ko nga Nakipabagbahin sa sini nga Pagtuon,

Ginaimbitar ko kamo nga magpartisipar sa sini research o pagtuon paagi sa pagsabat sang kompleto sa mga masunod nga mga pamangkot. Ang katuyuan sini nga pagtuon amo nga mahibaluan ang naman-an, pamatasan kag pag-ginawi sang mga pinili nga empleyado nga naga ubra gamit ang mikrobyo kag ang mga responsable o may katungdanan sa pag-implementar kag paghatag badyet o pundo para sa kaayuhan o "safety measures" sang unibersidad. Ang mga impormasyon nga inyo ihatag makabulig nga basihan sa paghimo sang "Biorisk Management Program" sang unibersidad.

Ang survey nga ini natunga sa "Demographics, Knowledge, Attitude and Practices". Ang mga pamangkot ginkuha halin sa dokumento sang *International Working Group (IWG) on Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences*, (Self) Assessment Framework – January 2020", (IWG, 2020).

Ang inyo nga mga sabat gintratar gid nga "STRICTLY CONFIDENTIAL AND ANONYMOUS" o ginatago gid kag wala ginapangalanan. Ang researcher lang ang pwede makakita sang inyo sabat kag wala sang ngalan nga banggiton. Ang resulta sang surbe ipakita paagi sa estatistika bilang tingub nga datus.

Para maintindihan palihog lang basa kag pirmahan ang nakaapid nga "informed consent" o pahanugot bag-o mag sabat sang surbe.

Madamo gid nga salamat sang inyo hamili nga tyempo.

Sinsero nga nagaayo sang inyo bulig,

Eden L. Saladar

EDEN L. SALADAR
Researcher

Palihog balik sini nga questionnaire sa inyo college college secretary o kay:

EDEN L. SALADAR
School of Graduate Studies
Central Philippine University
Cellular Phone Nos. 09567149316 (Globe) or 09934494405
Email: eden.saladar-14@CPU.edu.ph or els050874@yahoo.com or eden.saladar@wvsu.edu.ph

CODE : _____

I. DEMOGRAPHICS

Instruksyon: *Palihog sabtan sang kompleto ang mga masunod nga pamangkot paagi sa pagbutang sang "check" sa blangko sa tupad sang napili nga sabat***.**

7. **Edad:**

_____20 anyos o mas bata pa
_____21-30 anyos
_____31-40 anyos
_____41-50 anyos
_____51-60 anyos
_____61 anyos kag o tigulang pa

8. **Kasarian:**

____ Lalaki
____ Babaye

9. **Pinakamataas nga Nadangatan sa Edukasyon:**

_____ PhD, Doctorate Level
_____ Master's Degree, Master's Level
_____ College Graduate
_____ College Level
_____ Vocational/ Technical Course
_____ High School
_____ Elementary

10. **Estado sa Ulubrahan**

_____Permanente nga empleyado
_____May kontrata (Contractual)
_____Gin kontrata sa isa ka obra (One-Job or Job Hire)
_____Iban pa: palihog sulat _____

11. **Departamento o Opisina nga Natungdan:**

_____ **Academe:**
_____ College of Medicine
_____ College of Nursing
_____ College of Medical Laboratory Science
_____ College of Pharmacy
_____ Department of Life Science
_____ College of Agriculture, Resources and. Environmental Sciences (CARES)-University Research Center for Product Development
_____**Non-Academic:**
_____**HealthCare Service**
_____ Medical Clinic
_____Dental Laboratory
_____Clinical Laboratory
_____Birthing Center
_____**General Service**
_____Shop Facility and Maintenance
_____Grounds
_____Building Keep-Up maintenance
_____**Administrative and Management**
_____Office of the President
_____Office of the Vice President for Admin
_____Office of the Vice President for Academic
_____Accounting Office

_____Cashiers Office
_____Security and Safety Office
_____Occupational Health and Safety Office

12. **Katungdanan sa Ulubrahan**

_____DEAN OR DEPARTMENT HEAD- responsable sa pagpatuman sang proyekto or programa sang Unibersidad
_____FACULTY- *nagatudlo kag nagagiya para may matun-an ang mga estudyante*
_____STAFF- *nagabulig sa mga kinhanglanon sang maestra/ maestro kag sang mga estudyante*
_____HEALTHCARE SERVICE PERSONNEL- *nagabulig sa pagbulong sang may masakit pareho sa medical, dental, nagapabata kag laboratory*
_____GROUNDS AND BUILDING UPKEEP MAINTENANCE- *naga mentenar sang katinluon sang palibot kag sa sulod sang opisina o eskwelahan*
_____ADMINISTRATIVE AND MANAGEMENT- *responsable sang pag implementar sang polisiya kagpamaagi para sa kaayuhan sang tanan kag pag preparar kag pag approbar sang bagyet*

II. DETERMINATION OF KNOWLEDGE ATTITUDE AND PRACTICES

Para ini mahibaluan kon anu kadamo and **ihibalo**, mga **pamatasan** kag mga **kaugalian** tuhoy sa pagkontrol sang risgo o katalagman dala sang mikrobyo sa mga pinili nga empleyado nga naga ubra gamit ini (pareho sang panudlo o ginatun-an), sa mga indi makalikaw magtandog bilang parte sang ila obra (pareho sa janitor kag health services) kag sa mga naga patuman sang pagsulundan para sa kaayuhan sang tanan.

Ang mga pamangkot ginkuha sa dokyomento sang *International Working Group (IWG) on Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences*, (Self) Assessment Framework – January 2020", (IWG, 2020) . Ang mga pamangkot nahanungod sa kinaalam, pamatasan kag kinakaugalian parte sa kaayuhan kag seguridad sa mikrobyo halin sa gintunga nga apat ka bahin: Systema sang Pagdumara, Pamatasan sang Liderato kag Empleyado, Mga Prinsipyo nga Ginabasehan sang pag Desisyon kag Pamatasan, kag mga Ginapatihan, Opinyon kag Kinaugalian.

A. KNOWLEDGE o MGA IHIBALO

Ini nagahibalo kon anu kadamo ang nabal-an sa kaayuhan kag seguridad tuhoy sa mikrobyo sang mga pinili nga empleyado. Ang kadamuon sang nahibaluan naga apekto sa systema sang pagdumalahan sa isa ka institusyon, sa pamatasan kag kinaugalian sang lider kag empleyado, sa mga prinsipyo bilang basihan sang paghimo sang desisyon, mga ginapatihan, ginasunod, opinyon kag kinaugalian nahanungod sa kaayuhan kag seguridad sang tanan.

Instruksyon: Palihog butangi sang "check" ang puntos basi sa imo sabat

Code	**MGA IHIBALO (KNOWLEDGE)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala **gid** ako naga-ugyon (Strongly disagree) (1)	Wala ako naga-ugyon (Disagree) (2)	Indi ako Segurado (Neither agree nor disagree) (3)	Naga-ugyon ako (Agree) (4)	Naga-ugyon **gid** ako (Strongly agree) (5)
K1	Ang amon nga unibersidad o ginaubrahan may ara nga proseso o pamaagi kon paanu **mahibaluan** sang empleyado ang risgo o katalagman sang hungod paglapta o aksidente nga malatunan sang masakit dala sang mikrobyo ukon hilo nga ginagamit kag ginatago sa amon pasilidad.						
K2	Ang amon unibersidad o ginaubrahan may pamaagi kon paanu **matapna o mapahaganhagan** ang risgo o katalagman sa hungod paglapta o aksidente nga malatunan sang masakit sanhi sang mikrobyo o hilo nga ginagamit o ginatago sa pasilidad.						
K3	Ang amon unibersidad o ginaubrahan permi nagahiwat sang "emergency response FIRE drill."						
K4	Ang amon unibersidad o ginaubrahan permi nagahiwat sang "emergency response EARTHQUAKE drill".						
K5	Ang amon unibersidad o ginaubrahan permi nagahiwat sang "emergency response on *BIOLOGICAL SPILLAGE drill". *__*Biological Spillage Drill*__- paghanas kon paanu ang insakto nga pagtinlo sang mga naula o naglapta nga nga						

Code	**MGA IHIBALO (KNOWLEDGE)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala **gid** ako naga-ugyon (Strongly disagree) (1)	Wala ako naga-ugyon (Disagree) (2)	Indi ako Segurado (Neither agree nor disagree) (3)	Naga-ugyon ako (Agree) (4)	Naga-ugyon **gid** ako (Strongly agree) (5)
	likido nga may simpon nga makatagam nga elemento pareho sang mikrobyo.						
K6	May ara nga pamaagi o processo kon paanu mag report ang empleyado sang kaduda-duda nga pag-ginawi sang upod sa ulubrahan.						
K7	Ang amon unibersidad or ginaubrahan may ara nga padayon nga pagpanudlo kag pagpanghanas sa mga empleyado nahanungod sa kaayuhan o kaluwasan kag seguridad sa masakit nga makuha halin sa mikrobyo.						
K8	May ara nga impormasyon o ihibalo nahanungod sa kaayuhan kag seguridad sa paggamit kag pagtago sang mikrobyo, mga polisiya kag pamaagi kon paano maghalong nga indi malapnan o matapna ang paglapta sini para sa mga empleyado.						
K9	May ara nga pamaagi o ginhimo nga proseso ang amon ulubrahan o departamento kon paanu ipahibalo sa empleyado ang mga nahanungod sa kaayuhan kag seguridad sa mikrobyo, mga insedente kag mga diutayan lang natabo nga aksidente.						
K10	May ara nga pamaagi kon anu ang ubrahon sa basura para indi ini makahalit o makalaton sang mikrobyo nga nagadala sang masakit bag-o ihaboy sa basurahan o halabuyan.						
K11	Ang tagadumala sang amon unibersidad o departamento, nagaduso kag nagapalig-on nga dugangan pa gid sang mga empleyado ang ila nahibaluan parte sa mga katalagman kag risgo nahanugod sa pag-gamit kag pagtago sang mikrobyo.						
K12	Sa amon unibersidad may pamaagi kag proseso kon paanu imbestigaron, akigan o suspendihon ang mga empleyado o tawo nga hungod nga nagalapas sang mga patakaran para sa kalauwasan o kaayuhan kag seguridad tuhoy sa pagamit o pagtago sang mikrobyo.						

Code	**MGA IHIBALO (KNOWLEDGE)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala **gid** ako naga-ugyon (Strongly disagree) (1)	Wala ako naga-ugyon (Disagree) (2)	Indi ako Segurado (Neither agree nor disagree) (3)	Naga-ugyon ako (Agree) (4)	Naga-ugyon **gid** ako (Strongly agree) (5)
K13	Ginaistoryahan sang amon dean o tagadumala upod kami nga iya mga tinawo o empleyado nahanugod sa insakto nga pamaagi o ginahimo para sa kaayuhan kag seguridad tuhoy sa mikrobyo						
K14	Ang amon unibersidad o ulubrahan may ara nga programa para sa seguridad nga dala sang pagpamahog kag katalagman kag kon paanu ini mapahagan hagan o matapna.						
K15	Kahibalo ako sang kahulugan kag epekto sang ginatawag nga "*dual-use research of concern" * **Dual-use research of concern**- amu in ang mga ginatun-an kag gina experimentuhan sa siensia nga ang iya katuyuan makahatag kaayuhan sa katawhan pero pwede man magamit o sa sala nga pamaagi kag makahalit sa tanan.						
K16	Nakahibalo ako sang mga pamahog sang "bioterrorism" o mga terorista nga ginagamit ang mikrobyo bilang armas o hinganiban.						
K17	Ang pagkontrol o paglimit sang mga sensitibo nga impormasyon importante sa seguridad tuhoy sa mikrobyo.						
K18	Nakahibalo ako nga sa akon ginaubra may ara o upod nga etikal, legal kag pangkatilingban nga mga isyu kag kon anu man ang mangin resulta naka-angot o may implikasyon sa akon obra.						
K19	Kada isa ka empleyado sa amon nga unibersidad o ginaubrahan, may iya nga nagakadapat nga naman-an para maubra ang ginhatag sa iya nga obligasyon kag ubrahon ini sang maayo nga may paghalong kag epektibo.						

Code	**MGA IHIBALO (KNOWLEDGE)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala **gid** ako naga-ugyon (Strongly disagree) (1)	Wala ako naga-ugyon (Disagree) (2)	Indi ako Segurado (Neither agree nor disagree) (3)	Naga-ugyon ako (Agree) (4)	Naga-ugyon **gid** ako (Strongly agree) (5)
K20	Ang pag-usisa sang mga risgo o katalagman isa ka importante nga pamaagi para mahibalu-an ang mga butang o lugar nga nagakinahanglan hatagan impotansya para mapahagan-hagan o malikawan ang risgo o disgrasya ilabi na gid sa kaayuhan kag seguridad tuhoy sa mikrobyo.						

B. ATTITUDE o Pamatasan

Ini nagahibalo sang mga pamatasan nga maka-apekto sa panan-awan, opinyon, kag mga ginapatihan nga naka implwensya sa pag-ugali sang isa ka tawo tuhoy sa kaayuhan kag seguridad sa mikrobyo.

Instruksyon: palihog butangi sang “check” ang puntos basi sa imo sabat

Code	**MGA PAMATASAN (ATTITUDE)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala **gid** ako naga-ugyon (Strongly disagree) (1)	Wala ako naga-ugyon (Disagree) (2)	Indi ako Segurado (Neither agree nor disagree) (3)	Naga-ugyon ako (Agree) (4)	Naga-ugyon **gid** ako (Strongly agree) (5)
A1	Ang pag-gamit sang natun-an o nahibaluan sa “Emergency Drills” nagapauswag pa gid sang akon nahibaluan kag kinaadman sa pagresponde sa oras sang emerhensya.						
A2	Ang akon supebisor o tagadumala nagapakita bilang isa ka maayo nga ehemplo sa insakto nga pagginawi sa pagpahagan-hagan o pagtapna sang mga kahalitan o risgo dala sang mga mikrobyo.						
A3	Wala ako nahadlok magreport sang akon masakit o kahimtangan tuhoy sa kaayuhan kag seguridad sang tanan kag nagapati ako nga wala ini sang sang negatibo nga epekto sa akon ubra, karera o propesyon.						

Code	**MGA PAMATASAN (ATTITUDE)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala **gid** ako naga-ugyon (Strongly disagree) (1)	Wala ako naga-ugyon (Disagree) (2)	Indi ako Segurado (Neither agree nor disagree) (3)	Naga-ugyon ako (Agree) (4)	Naga-ugyon **gid** ako (Strongly agree) (5)
A4	Indi insakto nga mag-upod-upod lang sa kilala nga tawo o empleyado para makasulod sa ginadumilian nga lugar nga wala ka lisensya sang insakto.						
A5	Ang akon organisasyon o ulubrahan nagahatag importansya sa pagbantay sa kaayuhan kag seguridad sang tanan ilabi na gid sa mikrobyo.						
A6	Upod kami nga mga empleyado sa pag usisa sang mga risgo o katalagman kag sa paghimo sang mga desisyon kag iban pa nga mga ublubrahon nga makaapekto sa amon.						
A7	Ang akon dean o tagadumala mahapos palapitan, madali istoryahon kag ginaganyat kami nga mga empleyado nga mag report o manugid sang mga problema, ginkabalak-an o ginadudahan nga wala sang kahadlok nga maakigan.						
A8	Ang pagpalig-on kag suporta sang amon dean o tagadumala, barkada, kag katrabaho may dako nga impluwensya sa resulta sang akon obra.						
A9	Ang amon dean o tagadumala nagapakita sang ila sensiridad sa pagpangako para sa kaayuhan kag seguridad sa microbyo indi lang sa hambal kundi pati sa ila inubrahan.						
A10	Kada isa sa amon may iya nga responsibilidad sa kaayuhan kag seguridad sang tanan tuhoy sa mikrobyo.						
A11	Sa tion sang insidente or diutayan lang natabo nga aksidente, wala sang binasulay kundi gina-istoryhan kag gina-id-idan kon anu kag nga-a natabu indi nga kon sin-o ang may sala. Ang pagpauswag sang kaayuhan amu ang ginatagaan igtalupangod indi ang pagbinasulay.						
A12	Ginabinag-binag ko ang epekto kag posibilidad nga matabo sa akon obra paagi sa pagbalanse kon diin ang maayo sa paggamit sang kinaalam o nahibalu-an sa syensya o ang responsibilidad para sa kaayuhan sang tanan.						

Code	**MGA PAMATASAN (ATTITUDE)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala **gid** ako naga-ugyon (Strongly disagree) (1)	Wala ako naga-ugyon (Disagree) (2)	Indi ako Segurado (Neither agree nor disagree) (3)	Naga-ugyon ako (Agree) (4)	Naga-ugyon **gid** ako (Strongly agree) (5)
A13	Ang akon unibersidad o ulubrahan may ara nga pagsulundan kag talaksan sa kaayuhan kag seguridad sa mikrobyo nga ginapatuman kag ginasunod sang tanan.						
A14	Ang pagbaton sang sala, manindugan, maghimo sang plano kon paanu ini malampuwasan, kag pagpatuman sang insakto nga pamaagi importante para sa epektibo nga kaayuhan kag seguridad sa mikrobyo.						
A15	Nagahimakas ako nga mapaayo kag mangin labaw pa gid ang akon nahibalu-an bilang propesyonal paagi sa pag-usisa sang akon kaugalingon nga masarangan kag sige-sige nga pagtuon.						
A16	Ginasunod ko ang mga laye o kasuguan, pagsulundan, polisiya kag mga talaksan nga may kaangtanan sa akon ubra kag pag ginawi para sa kayuhan sang tanan.						
A17	Ang mga kakulangan o kahinaan sa kaayuhan kag seguridad sa mikrobyo dapat tagaan sang importansya kag tadlungon gid dayon.						
A18	Ang akon unibersidad o ulubrahan mas nagakabalaka sa kaayohan namon nga empleyado nga indi malapnan sang masakit kaysa resulta sang amon ginaubra pareho sang pagtuon o ekspermento sa mga mikrobyo, pagtatap sa may masakit o paghaboy sang mga basura nga kontaminado sang mikrobyo.						
A19	Ang kaseguraduhan kag bwas-damlag para sa kaayuhan kag seguridad sang tanan ginasakdag sang pagkasampaton kag mga eksperiensya o inagyan tuhoy sa mikrobyo.						
A20	Nagapati ako nga importante gid mag report or manugid sang indi lang natabo nga insidente kundi pati ang mga diutayan nalang natabo nga aksidente sa sulod sang laboratoryo.						

C. PRACTICES o Pag-ginawi

Ini nagahibalo sang mga pag-ginawi nahanungod sa kaayuhan kag seguridad sa mikrobyo nga naga impluwensya sa systema sang pagdumala sa isa ka institusyon, batasan sang nagadumala kag mga tinawo, prinsipyo nga naga giya sa desisyon, mga ginapatihan, opinion kag panimuot tuhoy sa mga risgo o katalagman sa mikrobyo kag kon paanu ini mapahagan hagan o matapna.

Instruksyon: palihog butangi sang "check" ang puntos basi sa imo sabat

Code	**MGA PAG-GINAWI (PRACTICES)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala Gid (Never) (1)	Talagsa Lang (Irregularly) (2)	Kon Kaisa (Occasionally) (3)	Permi (Frequently) (4)	Permi gid (Always) (5)
P1	Ang mga pamaagi kag insakto nga pagsulundan sa "Biosafety" kag "Biosecurity" gina-paathag sa mga empleyado. ***Biosafety****- nahanungod ini sa kaayuhan o paghalong sang aton kaugalingon o palibot kag kumonidad para malikawan ang pagmasakit o paglapta sang sakit halit sang mikrobyo.* ***Biosecurity****- naganungod ini sa seguridad o paghalong nga indi magamit ang mikrobyo sang mga tawo nga may malain nga tuyo para makahalit sa katawhan o kumonidad.*						
P2	Ginapatuman gid ang mga pamaagi sa pagtapna o pagpahagan-hagan para matapna o mabuhinan ang risgo o katalagman dala sang aksidente nga malapnan o hungod nga pagpanglapta sang masakit nga sanhi sang mikrobyo nga ginagamit tun-an o ginatago sa pasilidad.						
P3	Ang akon nga unibersidad/ departamento o ulubrahan may detalyado nga pamaagi nga ginapasunod kon anu kag paanu obrahaon kon may ara nga natabo nga aksidente pareho sang naagsikan o naulaan sang solusyon nga may simpon nga mikrobyo okon hilo.						
P4	Ginapahanumdum sa mga empleyado nga gamiton ang mga leksion nga natun-an sa kaayuhan o seguridad sa mikrobyo o mga diutayan lang natabo nga aksidente para makabulig sa						

Code	**MGA PAG-GINAWI (PRACTICES)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala Gid (Never) (1)	Talagsa Lang (Irregularly) (2)	Kon Kaisa (Occasionally) (3)	Permi (Frequently) (4)	Permi gid (Always) (5)
	pagpa-uswag o pagpahapos sang hilikoton kag malikawan ang posible nga aksidente sa trabaho.						
P5	Ang pagtakos sa hinimuan sang kada isa ka empleyado nahanungod sa kaayuhan kag seguridad sa mikrobyo ginataga-an importansya kag ginaubra suno sa eskedyol sand departamento.						
P6	Antes masugtan ang trabahador o empleyado nga makasulod sa ginaubrahan nga may mga makahalalit nga mikrobyo ang mga naga-ubra o empleyado diri ginapili gid sang maayo base sa ila kredensyal, kina-adman o ikasarang, ugali kag ihibalo kon nagakabagay sila sa ila nga katungdanan o posisyon.						
P7	Ang amon dean o tagadumala nagapahibalo sa mga empleyado nahanungod sa risgo o katalagman sa aksidente nga malatunan sang sakit o sa hungod nga pagpalapta ang mga sakit halin sa mikrobyo nga ginagamit kag ginatago sa pasilidad.						
P8	Ang amon dean o tagadumala nagabantay kon ginasunod namon ang mga nagakaigo nga pamaagi o sulundan sang pag-ginawi sa pag-ubra sang ekspermento o pagtu-on gamit ang mikrobyo.						
P9	Ang amon dean o tagadumala nagahimo kag nagapatuman sang mga kinahanglanon nga mga pagsulundan sa kaayuhan kag seguridad sa mikrobyo						
P10	Ang mga indi kina-andan o ka duda-duda nga pagbag-o sang pag-ugali sang amon upod sa ulubrahan nga makahatag risgo sa hungod o aksidente nga paglapta sang mga mikrobyo o hilo gina-report sa dumalahan o sa tawo nga may awtoridad.						
P11	Nagapakigbahin ako sa pagtakos sang mga risgo kag paghimo sang desisyon para mabuhinan o mapahagan hagan ang risgo sa aksidente nga malatunan sang sakit o hungod nga paglapta sang mga mikrobyo o hilo nga ginagamit namon o ginatago sa amon departamento o pasilidad.						

Code	**MGA PAG-GINAWI (PRACTICES)**	Wala o wala ako kabalo (N/A or I do not know) (0)	Wala Gid (Never) (1)	Talagsa Lang (Irregularly) (2)	Kon Kaisa (Occasionally) (3)	Permi (Frequently) (4)	Permi gid (Always) (5)
P12	Sa akon departamento o ulubrahan ginapatay namon ang kagaw paagi sa pag “disinfect” sang maayo sa mga kontaminado nga bagay o basura antes ini ihaboy sa basurahan.						
P13	Sa akon unibersidad o ulubrahan ginagamit gid namon amon natun-an sa maayo nga pag-ginawi.						
P14	Ang akon unibersidad nagasakdag sang hayag sa publiko kag nagasunod sang mga patakaran para sa kaayuhan kag seguridad tuhoy sa mikrobyo para sa mga katawhan.						
P15	Ang akon unibersidad nagahatag sang pagpanghanas sa amon kon paanu makilala o mahibaluan ang mga senyales kag sintoma sang mga delikado nga pag-ginawi o pamatasan sang isa ka tawo nga upod sa ulubrahan o taga-sagwa sang amon ulubrahan nga may gusto magsulod sa amon pasilidad, departamento o opisina.						
P16	Ang paglapas sa mga kasuguan kag pamaagi para sa kayuhan kag seguridad sa mikrobyo ginatagaan sang nagakaigo nga igtalugpangud, gina-usisa kag ginahibalo kon anu ang rason.						
P17	Ang akon unibersidad o ulubrahan naga-suporta sa kultura nga naga-pabaskog sang pagsalig, pagbinuligay, kag nagapakipag-angot nahanungod sa kaayuhan kag seguridad sa mikrobyo.						
P18	Ginatagaan ako sang nagakaigo nga paghanas sa mga pamaagi kon paanu ko ubrahon ang akon ubra nga indi makompromiso ang kaayuhan kag seguridad sang tanan.						
P19	Ang mga ginareport ko nga impormasyon insakto kag may integridad.						
P20	Naga suksok ako sang insakto kag kompleto nga kagamitan pang proteksyon (PPE) antes ko ubrahon ang akon obra para segurado nga hilway sa katalagman.						

Madamo gid nga salamat, God Bless you kag maghalong gid kamo!

APPENDIX C: CONSENT FORM- ENGLISH VERSION

INFORMED CONSENT FORM (ICF)
(VERSION No. 01-2021)

1. KEY INFORMATION ABOUT THE RESEARCHERS AND THEIR STUDY

Title of the Study: **BIOSAFETY AND BIOSECURITY**: **Knowledge, Attitude and Practices of the University Employees as Bases for the Development of a Biorisk Management Program**

Name of Researcher/s: EDEN L. SALADAR

Research Adviser: DR. EDNA A. MEDEZ

Department/College: GRADUATE STUDIES

Institution: CENTRAL PHILIPPINE UNIVERSITY

2. INTRODUCTION

I am **EDEN L. SALADAR, a Doctor of Management -Developmental Management** student of **Central Philippine University** who is currently conducting a study on ***BIOSAFETY AND BIOSECURITY: Knowledge, Attitude and Practices of the University Employees as Bases for the Development of a Biorisk Management Program***. Am giving you information regarding this study as an invitation to participate in this study.

3. BACKGROUND AND PURPOSE OF THE STUDY (BRIEF INTRODUCTION- ONE PARAGRAPH IS ENOUGH)

The purpose of the study is. is to determine the knowledge, attitude, and practices of selected personnel who work with biological agents and those who are involved in the implementation and funding of safety measures in the university. The result will be used as a basis for the creation of the Biorisk Management Program for the University. Biorisk Management Program is comprised of biosafety; the protection of individuals and communities from exposure to infectious biological agents and biosecurity; the protection of infectious biological agents against the ill intentions of malicious people. Determining the knowledge on the existence and related information about biosafety and biosecurity; the attitude that encompasses their opinions and beliefs; and the existing practices in handling biological materials will help the university management determine the strategy for the effective Biorisk Management Program for “safety culture” of the institution.

4. PROCEDURE OF THE STUDY

Before you decide to participate in this study, you will be given enough time to read and understand the contents of the informed consent. Your questions will be answered to your satisfaction. The study will begin once the informed consent form has been signed. The study will include two (2) parts; Part I will include demographic information which includes age, sex, education, and employment status. Part II includes questions on Knowledge, Attitude, and Practices adapted from the International Working Group (IWG) on “Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences” - (Self) Assessment Framework – January 2020. These questions evolved in the areas of Management Systems, Behavior of Leadership and Personnel, Principles for

Guiding Decisions and Behaviors and Beliefs, Opinions, and Attitudes, (IWG, 2020). Part II which determines the knowledge, attitude and practices of personnel in biosafety and biosecurity uses the Likert Scale, (Vagias, 2006). The knowledge and attitude use measures on the level of agreement while the practices use measurement on the level of frequency.

Each participant will be assigned an ID number only known to the researcher(s). The name of the Participants will not be written or included in the forms that will be filled in by the researcher. A self-administered questionnaire will be used to gather the needed data for the study. This questionnaire will be sent through google forms for those with online access and a printed copy through respective offices for those who do not have online access. The above-mentioned procedure has been primarily made and intended for this study. All information gathered during this study will be private and strictly confidential.

5. VOLUNTARINESS OF PARTICIPATION

Your participation in this study is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate or to withdraw from the study at any time, there will be no penalty or other consequences without the need to give any reason. If at any time you withdraw from the study, your data will be discarded properly.

6. RISKS AND INCONVENIENCES

During the conduct of the study, you will be answering a set of Questions in Part I and II using the given set of choices. Answering the questionnaire will take less than 30 minutes of your time and you might experience boredom or some degree of anxiety during the process. If so, please contact the researcher so that appropriate measures may be done.

7. BENEFITS

Participating in this study might not give you outright benefits but your responses to the survey would be used in the formulation of a Biorisk Management Program, which would ultimately benefit the institution and its personnel. The information you provide will be used to develop strategies for addressing issues and concerns in biosafety and biosecurity, thereby improving University Safety Programs. The implementation of a Biorisk Management Program will straighten and strengthen biosafety and biosecurity policies and procedures which will eventually be valuable for everyone’s personal, family and community safety.

8. COSTS AND COMPENSATION

There is no amount that you as a participant needs to pay in joining this study. There is also no compensation of any form that will be granted to you for participating in this study.

9. PROVISION OF INJURY OR RELATED ILLNESS

Participation in this study will not cause any direct illness or injury. However, during the conduct of the study, if certain topics may cause you anxiety, distress, and agitation, you may decline to answer any or all questions and you may terminate your involvement at any time if you choose without the threat of termination or loss of benefits. You may inform the researcher so that immediate action will be taken accordingly or referred to and professional person to manage such anxiety, distress, agitation, or any study-related conditions.

10. PRIVACY AND CONFIDENTIALITY

All the information gathered is solely for this study. Your identity as a participant will be kept private and confidential to the extent provided by law. Your information will be assigned an ID number. The data collected will be stored with the utmost respect for privacy and confidentiality. The electronic copy of your data will be kept in a computer that only the researcher(s) has/have access to. Hard copies will be stored in the locked cabinet while

electronic data shall be kept in a password-protected laptop that only the researcher(s) will have access to. The data collected will be stored for two (2) years and will be destroyed after that period. The results of this study will be shared through presentation or publication but the anonymity of personal information will be maintained.

11. WHOM TO CONTACT

If you have any questions or clarifications regarding your participation in the study, you may contact the researcher:

Principal Investigator: **EDEN L. SALADAR**
Address: **(HOME): BLOCK 4, LOT 12, CPU-SLO HERITAGE SUB. AGANAN, PAVIA, ILOILO**
(OFFICE): COLLEGE OF MEDICINE, WEST VISAYAS STATE UNIVERSITY
LUNA ST. LAPAZ, ILOILO CITY
Contact number: **09567149316**
E-mail: **els080874@yahoo.com or eden.saladar-14@cpu.edu.ph**

If you have questions pertaining to your rights as a participant, you may contact:

JOY G. RASO, PhD
Chair, CPU Research Ethics Committee
Email: researchethics@cpu.edu.ph
Phone: 329-1971 (local 3336)

12. CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read and explained to me in a language/dialect I know and understand. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I would be given a copy of this signed informed consent form. I consent voluntarily to be a participant in this study.

Print name of participant_____

Signature of participant _____

Date _____
day/month/year

Statement by the researcher/person taking consent (if applicable)

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily. A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent_____

Signature of Researcher /person taking the consent_____

Date _____

APPENDIX D: CONSENT FORM- HILIGAYNON VERSION

PAHANUGOT
(INFORMED CONSENT FORM (ICF))
(VERSION No. 01-2021)

1. KEY INFORMATION ABOUT THE RESEARCHERS AND THEIR STUDY MGA

(*Importante nga Impormasyon Parte sa Researcher kag sa Iya nga Ginatun-an*)

Title of the Study: **BIOSAFETY AND BIOSECURITY**: **Knowledge, Attitude and Practices of the University Employees as Bases for the Development of a Biorisk Management Program**

Name of Researcher/s: EDEN L. SALADAR

Research Adviser: DR. EDNA A. MEDEZ

Department/College: GRADUATE STUDIES

Institution: CENTRAL PHILIPPINE UNIVERSITY

2. INTRODUCTION

Ako si EDEN L. SALADAR, estudyante sang Central Philippine University naga-eskwela sang pagka-Doctor of Management- Developmental Management kag sa subong naga-sayasat parte sa "BIOSAFETY *AND BIOSECURITY: Knowledge, Attitude and Practices of the University Employees as Bases for the Development of a Biorisk Management Program*." Ini nga mga impormasyon parte sa akon ginatun-an maga-serbe nga imbitasyon sa inyo para magpartisipar sa sini nga pagtu-on.

3. BACKGROUND AND PURPOSE OF THE STUDY (BRIEF INTRODUCTION- ONE PARAGRAPH IS ENOUGH)

Ang katuyuan sang sini nga pagtuon amu nga hibaluon ang mga nabal-an, pamatasan kag kinaugalian sang mga pinili nga empleyado nga naga-ubra gamit ang mga mikrobyo , mga makatandog pasyente nga may mikrobyo o mga kontaminado nga gamit pareho sang basura kag mga naga-patuman kag nagahatag pundo para sa tikang o pamaagi nahanungod sa kaayuhan sang Unibersidad. Ang resulta sang ini nga pagtuon gamiton nga basihan sa pag-ubra sang Biorisk Management Program para sa Unibersidad. Ang "Biorisk Management Program" may ara nga "Biosafety"- pag-amlig o pagprotekta sang mga tawo kag komunidad o publiko sa halit nga mangin dala sang mikrobyo kag "Biosecurity" and paghalong kag pag-amlig sa mikrobyo nga ginagamit sa pasilidad nga indi makuha kag magamit sang mga tawo nga may malain nga tinutuyo. Paagi sa paghibalo sang mga impormasyon o mga nahibaluan parti sa Biosafety kag Biosecurity, mga pamatasan, opinion o ginapatihan nahanungod sa biosafety kag biosecurity kag mga pag ginawi kon paanu gamiton ang mga mikrobyo nga ara sa pasilidad. Sa resulta and paghibalo sang mga nahibaluan, pamatasan kag pag ginawi magamit nga basihan sang tagadumala sini nga unibersidad sa paghimo sang stratehiya para sa epektibo nga Biorisk Management Program.

4. PROCEDURE OF THE STUDY

Bag-o ka mag desisyon nga mag-intra sa sini nga pagtu-on, taga-an ikaw sang tyempo para mabasa kag maintindihan ang nakasulat sa ini nga informed consent o

pahanugot. Ang imo mga pamangkot sabton asta ikaw maathagan. Maumpisa lang ang pagsabat mo sa mga pamangkot sa nakaapid nga “questionnaire” pag napirmahan na ang ini nga informed consent. Ini nga pagtuon may duha (2) ka parte: Una (Part I) nahanungod sa mga impormasyon parte sa edad, kasarian, edukasyon kag kahimtangan sa trabaho . Ang ikaduha (Part II) mga pamangkot nahanungod sa Nahibalu-an (Knowledge), Pamatasan (Attitude) kag Kinaugalian (Practices) nga ginkuha o ginbase sa dokumento sang International Working Group (IWG) on Strengthening the “Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences -- (Self) Assessment Framework – January 2020”. Ang mga pamangkot halin sa Systema sang Pagdumalahan, Pamatasan sang Nagadumala o Lider kag Mga Empleyado, Mga Prinsepyo nga Nagagiya sang Pagdesisyon kag Pag Ginawi kag mga Ginapatihan, Opinyon kag Kinaiya o pag Ginawi. Ang Part II nga nagahibalo sang nahibalu-an, pamatasan kag kinaugalian nahanungod sa mikrobyo naga-gamit sang “ Likert Scale”. Ang paghibalo sang lebel sang nahibalu-an kag pamatasan ginatakus gamit lebel sang pagsulugot o pagsantuanay samtang ang mga pag ginawi o kinuagalian ginatakus gamit ang lebel kon anu ka kasunson o masami gina ubra.

Ang kada isa nga nakipagbahin o naga-entra hatagan sang naka-asayn nga numero nga ang nagatu-on lang ang nakahibalo. Ang ngalan sang nagapartisipar indi na isulat o iupod sa pormas nga taguon sang researcher. Ang “self-administered questionnaire” amu ang gamition sa pagtipon sang mga kinhanglanon nga impormasyon o datus para sa sini nga pagtu-on. Ang questionnaire ipadala gamit ang goggle forms para sa may internet kag ang gin imprinta nga kopya ipadala sa mga opisina sang mga wala sang internet. Ang mga pamaagi nga ini para lang sa sini nga pagtuon. Tanan nga impormasyon nga natipon tagu-on gid sang maayo kag pribado.

5. VOLUNTARINESS OF PARTICIPATION

Ang inyo nga pakipagbahin sa ini nga pagtuon ay boluntaryo. Inyo ini desisyon nga mag-intra o indi. Kon pillion nyo nga indi kamo makipagbahin o mag-intra o gusto nyo mag untat sa pagpartispar sa sini nga pagtuon sa anu man nga oras, wala sang multa o silot o anu man nga konsekwensya kag indi na kinahanglan pa sang rason. Anu man oras nga mauntat or mangindi ka sa pagpartispar ang mga impormasyon halin sa imo indi na maupod sa iban nga natipon nga impormasyon kag ini gision nga indi na mabasa kag ihaboy sang maayo.

6. RISKS AND INCONVENIENCES

Sa pagpatuman sa ini nga pagtuon, magasabat kamo sang mga pamangkutanon sa Part I kag Part II gamit ang ginhatag nga pililian. Nagakinhanglan lang sang indi magsubra sa trenta (30) minutos sang inyo oras para matapos sabtan pero kon kamo natak-an na o may mga pamangkot nga kinulbaan kamo palihog kontak sa researcher para sa nagakaigo nga dapat ubrahon.

7. BENEFITS

Ang pag-intra sa sini nga pagtuon pwede nga wala sang derekta nga benepisyo sa inyo pero ang inyo nga mga sabat sa ini nga surbe magamit gid nga basihan sa pag-ubra sang programa para sa kaayuhan, o kaluwasan kag seguridad sa mikrobyo o “Biorisk Management Program” nga makabulig sa institusyon kag sa mga empleyado. Ang mga impormasyon nga ihatag ninyo magamit sa paghimo sang estratehiya para masabat ang mga problema kag pagkabalaka tuhoy sa kaayuhan kag seguridad sa mikrobyo, gani ginapauswag kag ginapanami pa gid ang programa para sa kaayuhan sang unibersidad. Ang pagpatuman sang “Biorisk Management Program” makapatadlong kag makapapag-on sang mga patakaran kag pamaagi sa “biosafety’ kag “biosecurity” nga mapuslanon gid para sa kaayuhan sang kada isa, pamilya kag kumunidad.

8. COSTS AND COMPENSATION

Libre ang pag partisipar sa sini nga pagtuon kag indi na kinahanglan pa nga bayaran. Wala man bayad o anuman nga katumbas nga ginapangako kon mag-intra o magpartisipar sa sini nga pagtuon.

9. PROVISION OF INJURY OR RELATED ILLNESS

Ang pagpartispar sa sini nga pagtuon indi makahalit o makahatag sakit pero samtang nga ginahiwat ang ini nga pagtuon, kon may nabatyagan nga pagkakulba, kalisud o kagamo sa anu man nga topiko pwede ka mangindi nga mag-sabat sa mga pamangkot o pwede ka man mag-untat sa anu man oras nga gusto mo nga wala ka sang kahadlok nga madulaan ubra o benepisyo. Pwede mo mahambalan o matawag ang atensyon ang researcher o tagasayat para maubra dayon ang dapat himuon, madala sa propesyonal o eksperto para matagaan bulong o atensyon and imo nga nabatyagan tuhoy sa mga pamangkutanon sa sin inga pagtuon.

10. PRIVACY AND CONFIDENTIALITY

Ang tanan ninyo nga imormasyon nga natipon para lang sa ini nga pagtu-on. Ang pagkatawo o pagkilala sa mga nakipagbahin tagu-on gid sang pribado kag sekreto. Taga-an sila sang numero bilang tanda sa ila. Ang tanan nga natipon nga impormasyon o datus taguon gid sang mayo nga may respeto sang pagka-pribado kag kompedinsyal. Ang mga “electronic copy” sang mga datus o impormasyon tagu-on sa kompyuter kag ang researcher o ang nagatu-on lang gid ang pwede ka bukas. Ang mga na printa nga kopya tagu-on sa nakakandado nga cabinet samtang ang electronic data tagu-on sa may password nga laptop o kompyuter kag ang nagatu-on lang ang pwede kabukas. Ang natipon nga mga datus o impormasyon tagu-on sa sulod sang duha (2) ka tuig bag-o ihaboy o gision pag abot sang tyempo. Ang resulta sang sini nga pagtuon e-presentar o ibantala sa publiko pero tagu-on ang mga personal nga impromasyon sang mga nakipagbahin o nagpartispar.

11. WHO TO CONTACT

Kon may mga pamangkot nga gusto maathagan parte sa partisipasyon sa sini nga pagtu-on, pwede makontak o matawagan ang researcher:

Principal Investigator: **EDEN L. SALADAR**
Address:
(HOME): BLOCK 4, LOT 12, CPU-SLO HERITAGE SUB. AGANAN, PAVIA, ILOILO
(OFFICE): COLLEGE OF MEDICINE, WEST VISAYAS STATE UNIVERSITY LUNA ST. LAPAZ, ILOILO CITY
Contact number: **09567149316**
E-mail: **els080874@yahoo.com or eden.saladar-14@cpu.edu.ph**

Kon may mga pamangkot parte sa kinamatarung sa pagpartisipar, pwede makontak o matawagan ang CPU Research Ethics Committee:

JOY G. RASO, PhD
Chair, CPU Research Ethics Committee
Email: researchethics@cpu.edu.ph
Phone: 329-1971 (local 3336)

12. CERTIFICATE OF CONSENT

Nabasa ko ang mga impormasyon kag napaathag sa akon sa naindihan ko nga linggwahe. Gintaga-an ako kahigayunan nga mamangkot kag ang akon mga pamangkutanon

nasabat gid sang insakto. Nagasugot kag bolontaryo ako nga naga partispar sa sin inga pagtu-on.

Printa sang Ngalan sang Nagapartisipar: _____

Pirma sang Nagapartisipar :_____

Petsa _____
adlaw/bulan/tuig

Pamatuod sang Nagasayasat/ tawo nga nagkuha sang pahanugot (kon kinahanglan)
(*Statement by the researcher/person taking consent (if applicable****))***

Nagapamatuod ako nga ang nakipagbahin o nag-intra gintagaan kahigayunan nga maka-pamangkot parte sa sini nga pagtu-on kag ang ila tanan nga pamangkotanon nasabat sang insakto. Nagpamatu-od ako nga wala sang may ginpilit para magsugot , ang ila pagsugot, blontaryo kag ila kabubut-on. Hatagan sang kopya sang sini nga ICF ang nakipagbahin sa sini nga pagtu-on.

Printa sang Ngalan sang Tagasayasat/nagkuha sang pahanugot :
_____

Pirma sang Tagasayasat/nagkuha sang pahanugot
_____

Petsa _____

Grad Schl.

CENTRAL PHILIPPINE UNIVERSITY
SCHOOL OF GRADUATE STUDIES

January 30, 2022

DR. TEODORO C. ROBLES
University President
Central Philippine University

CO2-Ltr

Through Channels,

Sir;

Greetings!

I am **Eden L. Saladar**, a Doctor of Management -Developmental Management student at this university. I am working on my dissertation entitled, *"BIOSAFETY AND BIOSECURITY: Knowledge, Attitude, and Practices of the University Employees as Bases for the Development of a Biorisk Management Program."* The objective of this study is to determine the baseline knowledge, attitude, and practices of selected Central Philippine University employees as the basis for crafting strategies for the creation of the University Biorisk Management Program.

In line with this, I would like to ask permission to collect data related to this study using a validated instrument from your institution and allow me to visit the identified departments, observe and conduct informal interviews with your faculty, staff, or personnel whoever is available as needed to supplement and validate related information. The information needed includes:

I. Participant or Personnel Demographic Information
II. Knowledge, Attitude, and Practices related to Biosafety and Biosecurity

Rest assured that the information and data collected will be exclusively used for the study and development of the Biorisk Program of the University and treated with confidentiality.

For questions and verifications, please refer to my contact information below:

EDEN L. SALADAR
Cell Phone No. 09567149316
DM-DM/ Researcher
School of Graduate Studies
Central Philippine University
Email: els050874@ yahoo.com or eden.saladar @ wvsu.edu.ph

I am looking forward to your approval and working on a Biosafe CPU community.

Endorsed by Dr. Razo

Respectfully yours,

Eden L. Saladar
EDEN L. SALADAR
Researcher/ DM-DM

Recommending Approval:

for
DR. ROWENA M. LIBO-ON
Dean- School of Graduate Studies

Noted:

DR. EDNA A. MEDEZ

APPROVED
Teodoro C. Robles
TEODORO C. ROBLES, Ph.D.
President

RENATO F. DE LA PEÑA
Ethical Clearance released 01/19/23.
Good to proceed

CENTRAL PHILIPPINE UNIVERSITY
SCHOOL OF GRADUATE STUDIES

January 31, 2023

_____

_____
Central Philippine University

Ma'am / Sir;

Greetings!

I am Eden L. Saladar, a Doctor of Management -Developmental Management student at this university. I am working on my dissertation entitled, *"BIOSAFETY AND BIOSECURITY: Knowledge, Attitude, and Practices of the University Employees as Bases for the Development of a Biorisk Management Program."* The objective of this study is to determine the baseline knowledge, attitude, and practices of selected Central Philippine University employees as the basis for crafting strategies for the creation of the University Biorisk Management Program.

Attached herewith is an approved letter from the University President to collect the following related information/data and documents from your office:

I. Participant or Personnel Demographic Information
II. Knowledge, Attitude, and Practices related to Biosafety and Biosecurity

Rest assured that the information and data collected will be exclusively used for the study and development of the Biorisk Program of the University and treated with confidentiality.

For questions and verifications, herewith is the name and contact information of the researcher:

EDEN L. SALADAR
Cell Phone No. 09567149316
DM-DM/ Researcher
School of Graduate Studies
Central Philippine University
Email: els050874@ yahoo.com Or eden.saladar @ wvsu.edu.ph

I am looking forward to your help and support and together let us work towards a Biosafe CPU community.

Respectfully yours,

Eden L. Saladar
EDEN L. SALADAR
DMDM/ Researcher

DR. EDNA A. MEDEZ

Noted:

for
DR. ROWENA M. LIBO-ON
Dean- School of Graduate Studies

C E R T I F I C A T I O N

GRAMMAR CHECKED

This is to certify that this study entitled," ***BIOSAFETY AND BIOSECURITY: Knowledge, Attitude, and Practices of University Employees as Bases for the Development of a Biorisk Management Program***" has been checked and validated for its grammar, clarity, and technicalities.

This certification is made upon the request of **Ms. EDEN L. SALADAR** for whatever purpose it may serve her.

Signature of Validator: _____

Name of Validator: CYDEL D. MANALANSAN, M.ED ESL
Position/Designation: Teacher III
Name of Affiliation: Melchor L. Nava National High School
Address: Stonegate Subd., Guinobatan, Leganes, Iloilo City
Email Address: cydel.manalansan@deped.gov.ph
Contact No. : 09605999441

C E R T I F I C A T I O N

STATISTICAL VALIDATION AND ANALYSIS

This is to certify that this study entitled," ***BIOSAFETY AND BIOSECURITY: Knowledge, Attitude, and Practices of University Employees as Bases for the Development of a Biorisk Management Program***" has been statistically checked for its validity and other technicalities. Results and finding has been statistically analyzed and validated.

This certification is made upon the request of **Ms. EDEN L. SALADAR** for whatever purpose it may serve her.

Signature Of Validator: _____

Name of Validator: ROSEMARIE M.JAVA

Position/Designation: Assistant Professor

Name of Affiliation: West Visayas State University

Address: La Paz, Iloilo City

Email Address: rosemarie.java@wvsu.edu.ph

Contact No. : +639150635684

REVIEW, CONTINUING EDUCATION and CONSULTANCY CENTER
Central Philippine University
Jaro, Iloilo City
Tel. No. 329-1971 local 1008 email: rceccsec@cpu.edu.ph
Website: rcecc.cpu.edu.ph

September 05, 2022

C E R T I F I C A T I O N

This is to certify that the dissertation proposal entitled **"BIOSAFETY AND BIOSECURITY: KNOWLEDGE, ATTITUDE AND PRACTICES OF THE UNIVERSITY EMPLOYEES AS BASES FOR THE DEVELOPMENT OF A BIORISK MANAGEMENT PROGRAM"** by **Eden L. Saladar** has undergone Turnitin similarity checking with a passing percentage of 8% and have passed the requirements (Chapters 1-3).

Prepared by:

PINKY E. LUTERO-TONGOL
Staff -in-charged

Approved by:

LENNY ROSE P. MUCHO, EdD.
Director, RCECC

PAPER NAME

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Central Philippine University	RESEARCH ETHICS COMMITTEE	
	ETHICAL CLEARANCE	REC Form No. 22-2
		Version No.: 04
		Date of Effectivity: 29 July 2022

January 19, 2023

EDEN L. SALADAR
Student, Graduate Studies
Central Philippine University
Lopez Jaena Street, Jaro, Iloilo City

RE: *"BIOSAFETY AND BIOSECURITY: KNOWLEDGE, ATTITUDE AND PRACTICES OF THE UNIVERSITY EMPLOYEES AS BASES FOR THE DEVELOPMENT OF A BIORISK MANAGEMENT PROGRAM"*

REC code: 2022-275-PG-SALADAR

Dear Mr/Ms. Saladar,

Acknowledgment of request and submitted documents 2022-275-PG-SALADAR dated November 25, 2022:

1. Letter of application for research ethics review addressed to CPU- REC Chair
2. Accomplished REC application form (Form 05-1)
3. Full protocol/Research proposal (Chapters 1, 2 and 3) with references
4. Validated Research Instrument for Quantitative Research
5. Certificate of Validation for researcher-made instrument from at least 3 validators
6. Informed Consent Form (CPU-REC template)
7. Budget
8. Curriculum Vitae/Resume of the Researcher/Investigator and Co-Researchers with 2x2 photograph
9. GANTT Chart/Timelines/Table of schedule
10. Certificate of Technical Review signed by at least 3 members of the Technical panel and the Dean
11. Turnitin Similarity Certificate from CPU-RCECC
12. Official Receipt of Review
13. Two (2) Hard Copies
14. Soft Copy of the above documents emailed to researchethics@cpu.edu.ph

Type of review and date of meeting: **Expedited Review on December 14, 2022.**
Validity of ethical clearance: From: **January 19, 2023** To: **January 19, 2024**.

You are required to submit your **Final Report Form**, Amendments, Protocol Deviations/Violations, Progress Notes, Serious Adverse Events, Notifications, Request for Continuing Review and one **(1) hardbound copy of the completed protocol** within one (1) month after the completion of the study.

Very truly yours,

Joy G. Raso, PhD.
Chair, CPU-REC

Date: 1/19/23

	CENTRAL PHILIPPINE UNIVERSITY RESEARCH ETHICS REVIEW BOARD Lopez Jaena St., Jaro, Iloilo City, Philippines 329-1971 to 79 local 3336	
PROTOCOL REVIEW OF PROGRESS REPORT		RERB Form No. 09-1 Version No. 01 Date of Effectivity: 17 May 2023

INSTRUCTIONS TO THE RESEARCHER/s:
This form is required thirty (30) days after your Data Collection. Obtain an electronic copy of this form and supply All information required in the space provided. This form shall be signed by the researcher and adviser before submission to researchethics@cpu.edu.ph

GENERAL INFORMATION

Title of Study	BIOSAFETY AND BIOSECURITY: KNOWLEDGE, ATTITUDE AND PRACTICES OF THE UNIVERSITY EMPLOYEES AS BASES FOR THE DEVELOPMENT OF A BIORISK MANAGEMENT PROGRAM		
RERB Code:	2022-275-PG-SALADAR	Study Site	Central Philippine University, Jaro, Iloilo City
Name of Researcher	EDEN L. SALADAR		
Contact No.	09567149316	Email Address	Els050874@yahoo.com or Eden.saladar@wvsu.edu.ph
Co-researcher (if any)	none		
Institution	Central Philippine University		
Address of Institution	Jaro, Iloilo City		
Ethical clearance effectivity period:	January 19, 2023 to January 19, 2024		

PROGRESS REPORT

1. Start of study: **August 2021**
2. Expected end of study: **July 2023**

3. Number of enrolled participants: **124 participants**
4. Number of required participants: **285 participants**
5. Number of participants who withdrew: **NONE**
6. Deviations from the approved protocol: **number of particpants included and extension of data collection.** - The number of required participants was not able to meet due to transition time after Pandemic where not all employees return to office regularly. - The extension of data collection was to capture more participants to join the study considering the recent Pandemic situation and transition period.
7. New information (literature or in the conduct of the study) that may significantly changethe risk-benefit ratio: **NONE**
8. Issues/problems encountered: **Data collection time was during COVID-19 Pandemic up to transition period where not all respondents return to the workplace regularly.**

Recommendations (For RERB use only)	
DECISION: (For RERB use only)	[☐] Ask for further information [☐] Noted and Accept report
Comments of Primary Reviewer (For RERB use only)	

RERB Primary Reviewer: *(For RERB use only)*

_____
Signature over Printed Name

Date:

Researcher/s:

Eden L. Saladar
EDEN L. SALADAR
Signature Over Printed Name

Date: 8-28-24

Adviser:

EDNA A. MEDEZ, MD
Signature Over Printed Name

Date: 8-29-2024

	CENTRAL PHILIPPINE UNIVERSITY RESEARCH ETHICS REVIEW BOARD Lopez Jaena St., Jaro, Iloilo City, Philippines 329-1971 to 79 local 3336	
FINAL REPORT FORM		RERB Form No. 13-1 Version No. 01 Date of Effectivity: 17 May 2023

INSTRUCTIONS TO THE RESEARCHER/s:
This form is required upon completion of the study. Obtain an electronic copy of this form and supply all information required in the space provided. This form shall be signed by the researcher and adviser before submission to researchethics@cpu.edu.ph

GENERAL INFORMATION

RERB Code	2022-275-PG-SALADAR	Date (DD/MM/YYYY)	08/28/2024
Protocol Title	BIOSAFETY AND BIOSECURITY: KNOWLEDGE, ATTITUDE AND PRACTICES OF THE UNIVERSITY EMPLOYEES AS BASES FOR THE DEVELOPMENT OF A BIORISK MANAGEMENT PROGRAM		
Principal Investigator/s	EDEN L. SALADAR		
Department/College	Graduate Studies		
Contact No.	09567149316	*Email Address	Els050874@yahoo.com or eden.saladar@wvsu.edu.ph
Co-investigator/s (if any)	NONE		
Contact No.	N/A	Email Address	N/A
Institution of Researcher/s	Central Philippine University		
Address of Institution	Jaro, Iloilo City		
Effective period of Ethical Clearance	From: January 19, 2023 To: January 19, 2024		
*(*for RERB)* Primary Reviewer/s			

Type of Study	☐ Clinical ☐ Epidemiology ☐ Observational study
	☐ Document Review ☐ Individual based ☐ Genetic
	☒ Social Survey ☐ Others, specify _____
Review Status	☐ Full Board ☒ Expedited

FINAL REPORT

1. Start/end of the Study: **August 2021**
2. Number of enrolled participants: **124 participants**
3. Number of required participants: **285 participants**
4. Number of participants who withdraw: **NONE**
5. Deviations from the approved protocol: **number of participants included and extension of data collection.**

   - The number of required participants was not able to meet due to transition time after Pandemic where not all employees return to office regularly.

   - The extension of data collection was to capture more participants to join the study considering the recent Pandemic situation and transition period.
6. Issues/problems encountered: **Data collection time was during COVID-19 Pandemic up to transition period where not all respondents return to the workplace regularly.**
7. Summary of findings:

   The study "Biosafety Biosecurity: Knowledge, Attitude, and Practices as Basis for University Biorisk Management Program" evaluated the knowledge, attitudes, and practices of selected employees who handle and were exposed to biological agents and materials at CPU (Central Philippine University). The goal is to provide a foundation for developing the University's Biorisk Management Program.

   In terms of biosafety and biosecurity knowledge, most employees had high to very high knowledge regarding biosafety and biosecurity. They were aware of the risks associated with biological agents, the university's measures to mitigate these risks, and the importance of risk assessment and emergency preparedness. However, some gaps existed in knowledge about dual-use research of concern, insider threats, and emergency response to biological spills.

   With regards to attitude, most employees demonstrated a highly positive attitude towards biosafety and biosecurity. They recognized the importance of adhering to guidelines, reporting near misses, and maintaining open communication about safety issues. The university administration was seen as supportive and encouraged a culture of safety and responsibility.

   When it came to practices, a significant number of employees frequently practiced biosafety and biosecurity measures. Standard operating procedures (SOPs) were generally followed, and employees were well-informed about potential hazards and risk management protocols. However, there were areas for improvement, particularly in the orientation and training of newly hired staff.
8. Conclusions/Recommendations:

Conclusion

The study concluded that while there is a strong foundation of knowledge, positive attitudes, and good practices regarding biosafety and biosecurity among CPU employees, there were areas that require further attention and improvement. The identified gaps in knowledge and inconsistent practices among some employees highlight the need for continuous education and training programs. The findings provided valuable insights for the development and enhancement of the University's Biorisk Management Program.