



Biosafety and Biosecurity Practices and Compliance Levels in the DA-RFO CALABARZON Integrated Laboratories Division

Article History:

Initial submission:	21 January 2026
First decision:	28 January 2026
Revision received:	26 May 2026
Accepted for publication:	07 June 2026
Online release:	22 June 2026

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Abstract

Agricultural diagnostic laboratories' biosafety and biosecurity compliance is a relatively unexplored area in the Philippines as research is generally focused on clinical settings. The Integrated Laboratories Division (ILD) of the Department of Agriculture – Regional Field Office IV-A (DA-RFO IV-A) still encounters persistent issues such as irregular protocol implementation, insufficient resources, and fragmented regulatory systems. This study evaluated the biosafety and biosecurity practices and level of compliance of laboratory personnel of ILD-DA RFO IV-A (CALABARZON). The research design used was descriptive-correlational. Purposive sampling of forty (40) technical personnel from the Regional Animal Disease Diagnostic Laboratory (RADDL IV-A). Practices were assessed using a validated structured 5-point Likert-scale questionnaire across five dimensions: training programs, procedures, resource allocation, risk assessment and communication and awareness campaigns. Compliance was measured with five indicators: trainings, standard operating procedures (SOPs), personal protective equipment (PPE), risk assessment and waste management and decontamination. Data were analyzed using descriptive statistics, paired t-test, one-way repeated measures Analysis of Variance (ANOVA) and Pearson correlation. Biosafety and biosecurity practices were rated as “often” implemented (grand mean = 4.10). Procedures scored the highest (M = 4.23) and resource allocation the lowest (M = 3.92). Overall compliance was “mostly compliant” (grand mean = 4.22) and PPE use was rated the highest (M = 4.41). There were no major differences between respondent groups. Correlation analysis indicates a negligible relationship between biosafety and biosecurity practices and the level of compliance ($r = 0.06288$, $p = 0.700$). However, the result is not statistically significant, leading to the acceptance of the null hypothesis. The key challenges were public misinformation (M = 3.82), lack of digital monitoring infrastructure, and fragmented regulatory coordination. The ILD-DA RFO IV-A has a strong foundation for biosafety and biosecurity, but strategic interventions are needed to address the gaps in resource allocation, digital monitoring and inter-agency coordination. A recommended action plan is suggested to reach full and sustainable compliance, covering capacity building, policy harmonization and improved risk communication.

Keywords: biosafety and biosecurity, laboratory compliance, agricultural diagnostic laboratories, resource allocation, risk assessment, regulatory coordination



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INTRODUCTION

Biosafety and biosecurity have become critical concerns in laboratories handling biological materials worldwide. With the increasing risks of zoonotic disease outbreaks, antimicrobial resistance, and accidental pathogen releases, the World Health Organization (2021) has emphasized the need for stringent biosafety and biosecurity measures in laboratory settings. In response, many countries have

developed robust administrative strategies to regulate biosafety practices, particularly in laboratories handling animal diseases, feed analysis, soil testing, and crop protection. However, despite these advancements, laboratory-acquired infections, non-compliance with safety protocols, and biosecurity breaches continue to occur.

In the Philippines, the Department of Agriculture plays a pivotal role in ensuring

biosafety and biosecurity in laboratories that support animal disease diagnostics, feed analysis, and crop protection. The Integrated Laboratories Division (ILD) of DA-IV-A (CALABARZON) is at the forefront of implementing safety and security measures in laboratory operations within CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon).

However, challenges persist, such as inconsistent compliance with biosafety standards, lack of regular training programs, and limitations in resource allocation. The Agriculture and Fisheries Modernization Plan (AFMP) 2023–2028 (Department of Agriculture, 2023) acknowledges these gaps, emphasizing the need for improved administrative strategies to enhance biosafety and biosecurity compliance in government-run laboratories.

Recent studies on biosafety compliance in the Philippines have primarily focused on human health laboratories rather than agricultural and animal health laboratories. For instance, Reyes et al. (2022) investigated biosafety measures in clinical laboratories but did not explore compliance levels in veterinary and agricultural diagnostic facilities. Similarly, De la Cruz and Santos (2021) examined risk assessment strategies in food laboratories but did not assess their effectiveness in disease diagnostic laboratories under DA-IV-A. These studies indicate a research gap in evaluating the effectiveness of administrative strategies for biosafety and biosecurity compliance in government agricultural laboratories.

This study aims to fill this gap by assessing how administrative strategies, including training programs, procedural enforcement, resource allocation, risk assessment, and communication campaigns, contribute to the biosafety and biosecurity compliance in the Integrated Laboratories Division of DA-RFO IV-A. Through quantitative data collection methods, this research will determine the strengths and weaknesses of existing strategies, identify key challenges encountered by laboratory personnel, and recommend improvements to enhance compliance. By doing so, the study will

provide valuable insights that will support DA-IV-A in refining its administrative approaches to ensure safer and more secure laboratory operations.

Despite existing policies and administrative frameworks, challenges remain in achieving full compliance with biosafety and biosecurity standards. Issues such as inconsistent adherence to safety protocols, gaps in training programs, and limitations in funding and resources have been identified as significant barriers. National Biosafety Authority (2021) highlights the need for more robust administrative strategies to strengthen compliance in government-run laboratories. Additionally, the National Laboratory Biosafety and Biosecurity Action Plan (2021–2025) outlines strategic measures to address these gaps but lacks specific assessments of agricultural diagnostic laboratories. Reports from the Department of Agriculture have also indicated recurring issues related to laboratory safety, further emphasizing the need for effective administrative interventions.

Biosafety regulations and compliance are crucial in preventing laboratory-associated infections and biosecurity breaches. According to World Health Organization (2021), strict biosafety protocols significantly reduce the risk of accidental pathogen releases. Similarly, the Centers for Disease Control and Prevention (2022) emphasizes that biosecurity in agricultural laboratories is essential in mitigating the spread of zoonotic diseases through laboratory settings. In addition, the Global Health Security Agenda (2022) highlights the importance of a multi-sectoral approach in addressing biosafety concerns, ensuring that laboratory safety aligns with international public health standards.

Risk assessment in laboratories plays a pivotal role in identifying potential hazards. Smith et al. (2023) assert that implementing comprehensive risk assessment protocols enhances the ability of laboratories to anticipate and manage biological risks effectively. Training programs for laboratory

personnel have been shown to be integral in maintaining safety standards. Johnson and Lee (2021) found that ongoing biosafety training significantly decreases laboratory incidents and improves compliance levels.

Standard operating procedures (SOPs) ensure consistency and adherence to safety protocols in laboratory environments. Anderson and Clark (2023) argue that SOP implementation fosters a culture of safety among laboratory personnel. Furthermore, administrative strategies play a key role in enforcing biosafety compliance. Harrison (2022) states that well-defined administrative policies and governance structures are necessary to maintain high biosafety standards. This is further supported by Gonzalez et al. (2021) who found that cultivating a biosafety culture within workplaces enhances compliance with safety regulations. Without proper governance, laboratories often face lapses in compliance, leading to heightened risks associated with pathogen handling and exposure.

Government policies on biosafety and biosecurity vary across nations, but comparative studies by Rodriguez and Brown (2023) reveal that international best practices can serve as models for national biosafety programs. Davis and Carter (2021) highlight that laboratory accidents have severe implications on public health, further emphasizing the need for stringent biosafety measures. Moreover, international biosafety guidelines provided by World Health Organization (2021) and Centers for Disease Control and Prevention (2022) outline essential safety measures that laboratories worldwide should implement. These guidelines serve as a framework for biosafety compliance, helping laboratories minimize risks while handling infectious agents.

Biosafety and biosecurity policies in the Philippines have been developed to align with international standards. The Department of Health (2022) has outlined key measures to ensure biosafety in laboratories handling biological materials. Similarly, the Department of Agriculture (2021) assesses the compliance

of agricultural laboratories with biosafety regulations, highlighting areas that require improvement. In addition, the Philippine Biosafety Authority (2021) emphasizes the need for stricter enforcement of laboratory safety measures, providing comprehensive policies to safeguard public health.

Furthermore, the role of Department of Agriculture in implementing biosafety regulations is extensively discussed by Department of Agriculture (2021), which details how government agencies enforce biosafety standards. However, limited funding and inconsistent implementation of policies remain significant barriers to full compliance.

Public health implications of laboratory biosafety are significant in the Philippines. Department of Health (2022) emphasizes that biosafety measures play a crucial role in preventing zoonotic disease transmission. However, resource limitations present challenges to biosafety compliance. Lopez and Rivera (2023) identify funding constraints as a major barrier to the implementation of biosafety measures in Philippine laboratories. Similarly, De la Cruz and Santos (2021) examine the effectiveness of SOPs in Philippine laboratories, noting that inconsistencies in adherence remain a concern. This gap highlights the need for better policy implementation and monitoring to ensure effective biosafety compliance.

Aguilar and Cruz (2023) discuss how stringent biosafety measures help protect the country's agricultural industries from biological threats. Strengthening biosafety protocols in agricultural laboratories is essential in mitigating risks associated with zoonotic disease transmission.

An analysis of biological safety and security arrangements by Nelson (2022) reviewed existing biosafety protocols and policies to provide recommendations for improving laboratory safety. The study highlighted the need for mobilizing resources and international cooperation to strengthen biosafety standards and prevent laboratory-acquired infections.

Efforts to enhance laboratory safety at the Centers for Disease Control and Prevention (2022) were explored in a study by Williams and Scott (2023). The study reviewed internal safety protocols and ongoing improvements in CDC laboratories, emphasizing the importance of continuous refinement of safety measures. It concluded that maintaining laboratory safety requires a dynamic approach with constant evaluations and updates.

Similarly, Tolentino (2021) conducted a study to evaluate the knowledge, attitudes, and practices on biosafety among Filipino registered medical technologists working in public and private clinical laboratories. Using surveys, the study found that while the majority exhibited good biosafety knowledge and commendable attitudes, there were still areas needing improvement, particularly in consistent application of biosafety protocols. The researchers recommended continuous education and training programs to enhance compliance with biosafety measures.

The reviewed literature and studies provide a strong foundation for the present research, which seeks to assess biosafety and biosecurity practices and compliance in the Integrated Laboratories Division of DA-IV-A. The similarities in findings validate the need for structured training programs, proper risk assessment protocols, and adequate resource allocation to enhance compliance. The differences, particularly in terms of policy enforcement and technological gaps, highlight areas requiring local intervention and adaptation of global best practices.

METHODS

This study utilized a descriptive-correlational research design, aiming to assess biosafety and biosecurity practices, as well as the level of compliance within the Integrated Laboratories Division (ILD) of the Department of Agriculture – Regional Field Office IV-A (DA-RFO IV-A). This design was chosen as it allows the researcher to systematically describe the existing practices and compliance levels, while also

investigating the relationships between these practices and compliance, without manipulating the conditions of the study. Descriptive analysis provided insights into the extent of implementation of practices such as training programs, procedures, resource allocation, and risk assessment, while the correlational aspect examined the relationship between these practices and compliance levels.

The study involved 40 technical personnel from the Regional Animal Disease Diagnostic Laboratory (RADDL IV-A), all of whom are directly engaged in biosafety and biosecurity activities. Participants were selected using purposive sampling to ensure that only individuals with relevant experience and knowledge of laboratory biosafety and biosecurity were included. Demographic data, such as sex, age, position, and length of service, were collected for descriptive purposes but were not used to directly influence the analysis.

Data were collected using a structured survey questionnaire, developed based on established biosafety and biosecurity guidelines, and validated by experts in the field. The questionnaire consisted of sections that captured participants' assessments of biosafety and biosecurity practices and their level of compliance with protocols. The survey also included items identifying challenges faced in implementing these practices. The reliability and validity of the instrument were confirmed through content validation by experts and a pilot test conducted with laboratory personnel outside the ILD.

The data collection process involved distributing the questionnaire both in print and online, with adequate time allocated for completion and follow-up reminders to maximize response rates. Upon retrieval, the completed questionnaires were reviewed for completeness and accuracy, and data were encoded for statistical analysis.

Descriptive statistics, including mean and standard deviation, were used to summarize demographic data and the extent of

implementation of biosafety and biosecurity practices. Inferential statistics, such as the one-way repeated measures ANOVA and Pearson Product-Moment Correlation Coefficient, were employed to test for significant differences and relationships between the variables. The statistical analyses were conducted using appropriate software to ensure the reliability and accuracy of the results.

The study adhered to ethical standards, with informed consent obtained from all participants. The anonymity and confidentiality of respondents were maintained throughout the research process. The study was designed to provide insights into the existing biosafety practices and compliance levels, identify areas for improvement, and propose evidence-based recommendations for enhancing biosafety and biosecurity within the ILD of DA-RFO IV-A.

RESULT AND DISCUSSION

Table 1 presents a summary of the respondents' assessment of biosafety and biosecurity practices in the Integrated Laboratories Division of DA-IV-A across five key dimensions: training programs, procedures, resource allocation, risk assessment, and communication and awareness campaigns. The grand mean of 4.102, verbally interpreted as "Often," indicates that respondents generally perceive the overall implementation of biosafety and biosecurity practices as frequent and satisfactory. Among the dimensions, procedures received the highest weighted mean of 4.23 (SD = 0.71), suggesting that staff consistently adhere to standard operating procedures, proper waste management, and decontamination protocols. Training programs (WM = 4.14, SD = 0.71) and communication and awareness campaigns (WM = 4.17, SD = 0.67) were also rated highly, highlighting the effectiveness of structured training and information dissemination in reinforcing safe practices. Risk assessment (WM = 4.05, SD = 0.68) reflects active identification, evaluation, and management of laboratory hazards, while resource allocation (WM = 3.92, SD = 0.71)

received the lowest rating, indicating that financial or material constraints may sometimes limit the full implementation of safety measures.

Table 1
Summary of the Respondents' Assessment of Biosafety and Biosecurity Practices in Integrated Laboratories Division of DA-IV-A

Indicators	Computed Mean	Standard Deviation	Verbal Interpretation
1.Training Programs	4.14	0.71	Often
2.Procedures	4.23	0.71	Often
3.Resource Allocation	3.92	0.71	Often
4.Risk Assessment	4.05	0.68	Often
5.Communication and Awareness Campaign	4.17	0.67	Often
Grand Mean	4.102	0.70	Often

These findings are supported by Gonzalez et al. (2021), who emphasized that structured training, clear procedural guidelines, and sufficient resource provision are crucial for ensuring compliance with biosafety standards in laboratories. Similarly, Anderson and Clark (2023) highlighted that continuous training, proper communication of safety protocols, and institutional support significantly enhance the overall laboratory safety culture. Collectively, these studies corroborate the results of Table 1, reinforcing that the consistent application of training, procedures, risk management, and communication strategies, alongside adequate resources, is essential in fostering a robust culture of biosafety and biosecurity in laboratory environments.

Table 2
ANOVA Significant Difference in the Respondents' Assessment of Biosafety and Biosecurity Practices in the Integrated Laboratories Division of DA-IV-A

Sources of Variation	Sum of Square	df	Mean Square	F value	P value	F critical value	Decision	Description
Between Group	1.12	4	0.28					
Within Group	89.67	156	0.57	0.49	0.744	2.43	Accept Ho	Not Significant
Total	90.79	160	-					

The one-way ANOVA results in Table 2 showed that there was no significant difference in the respondents' evaluation of biosafety and biosecurity practices in the Integrated Laboratories Division of DA-IV-A in the five dimensions, namely training programs,

procedures, resource allocation, risk assessment, and communication and awareness campaigns. The calculated F-value of 0.49 is far less than the F-critical value of 2.43 at degrees of freedom (4, 156). The p-value of 0.744 is also much greater than the 0.05 significance level. This results in the null hypothesis (Ho) being accepted. The sum of squares between groups was 1.12, which was significantly less than the sum of squares within groups, which was 89.67. The total sum of squares was 90.79. This means that the variation in the assessments of the respondents was mainly due to differences between individuals and not due to differences between groups. These results suggest that regardless of the form of organization, the organization of the laboratory staff shares a common and consistent understanding of biosafety and biosecurity practices. This reflects the widespread dissemination and internalization of the Division's safety procedures and administrative policies throughout the entire staff.

As shown in Table 2, the ANOVA results confirm the consistent perception by respondents on the implementation of biosafety and biosecurity practices across the five dimensions (training programs, procedures, resource allocation, risk assessment, and communication and awareness campaigns) with no significant differences among groups ($F = 0.49, p = 0.744$), leading to the acceptance of the null hypothesis. This consistency of perception is an indication of a well-standardized and equitably implemented approach to biosafety and biosecurity in the Integrated Laboratories Division of DA-IV-A, which means that all laboratory personnel, regardless of position, length of service or designation, are experiencing comparable levels of institutional support, procedural guidance and safety training. Gonzalez et al., (2022) provide compelling support for these findings, reporting that laboratories with structured and mandatory biosafety training programs consistently demonstrated lower incidences of safety violations, which they attributed to the cohesive safety culture cultivated by consistent

training delivery to all levels of personnel. This is further supported by the work of Anderson and Clark (2023) who demonstrated that the availability and consistent application of standard operating procedures is critical to ensuring biosafety compliance, as clear procedural guidelines reduce ambiguity and promote uniform adherence among laboratory staff. In addition, Harrison (2022) discussed how systematic institutional oversight by biosafety committees and routine protocol reviews may enhance compliance with biosafety regulations among the entire workforce, thereby supporting the argument that organizational-level interventions are crucial for the development of uniform safety perceptions. Williams and Scott (2021) also noted that effective biosafety communication strategies, like structured awareness programs and clear communication of institutional policies, are important for reducing errors in laboratories and creating uniform compliance. This is directly reflected in this study where the dimension of communication and awareness presents consistent ratings. Collectively, these studies validate that consistency of biosafety and biosecurity practices across the Division is attributed to the sustained commitment to standard training, procedure enforcement, risk management, and institutional communication and that the continuation of these administrative approaches is critical to sustaining a cohesive and resilient laboratory safety culture.

Table 3
Summary of the Respondents' Assessment in the Level of Compliance with Biosafety and Biosecurity in the Integrated Laboratories Division of DA-IV-A

Indicators	Computed Mean	Standard Deviation	Verbal Interpretation
1.Training	4.07	0.67	Mostly Compliant
2.Standard Operating Procedure	4.13	0.65	Mostly Compliant
3.Personal Protective Equipment	4.41	0.71	Mostly Compliant
4.Risk Assessment	4.14	0.68	Mostly Compliant
5.Waste Management and Decontamination Compliance	4.35	0.64	Mostly Compliant
Grand Mean	4.22	0.67	Mostly Compliant

Table 3 presents a summary of the respondents' assessment of their level of compliance with

biosafety and biosecurity practices in the Integrated Laboratories Division of DA-IV-A across five key dimensions: training, Standard Operating Procedures (SOPs), Personal Protective Equipment (PPE), risk assessment, and waste management and decontamination compliance. The grand mean of 4.22, verbally interpreted as “Mostly Compliant,” indicates that respondents generally comply with established biosafety and biosecurity protocols, demonstrating a satisfactory level of adherence across all assessed areas. Among the dimensions, PPE received the highest computed mean of 4.41 (SD = 0.71), reflecting strong compliance with the use, maintenance, and disposal of protective equipment. Waste management and decontamination also scored high (WM = 4.35, SD = 0.64), indicating consistent adherence to proper segregation and decontamination procedures. Compliance with risk assessment (WM = 4.14, SD = 0.68), SOPs (WM = 4.13, SD = 0.65), and training (WM = 4.07, SD = 0.67) were also favorable, demonstrating that staff not only participate in safety programs but actively apply the outcomes in their daily laboratory operations.

These findings are supported by Ramirez et al. (2023), who examined biosafety culture in diagnostic laboratories and emphasized that high compliance across training, procedural adherence, PPE usage, risk assessment, and waste management is crucial for sustaining a safe laboratory environment. Ramirez et al. (2023) highlighted that fostering a culture of safety requires continuous training, proper resources, active reporting, and strict adherence to protocols. Similarly, Williams and Scott (2023) noted that compliance in operational procedures and decontamination significantly reduces laboratory-acquired risks and strengthens overall biosafety practices. Collectively, these studies corroborate the results of Table 3, indicating that the Integrated Laboratories Division demonstrates a commendable level of compliance with biosafety and biosecurity practices, promoting both staff safety and effective laboratory operations.

Table 4 shows the results of the one-way ANOVA that revealed no significant difference in the respondents’ assessment on the level of compliance with the biosafety and biosecurity practices in the Integrated Laboratories Division of DAIV-A in the five dimensions of compliance, which are trainings, standard operating procedures, personal protective equipment, risk assessment and waste management and decontamination. The calculated F-value (0.60) is much smaller than the corrected F-critical value (2.43) for the degrees of freedom (4, 156), with a p-value of 0.663 well above the 0.05 significance level, thus accepting the null hypothesis (Ho). The between-groups sum of squares of 1.33 was much smaller than the within-groups sum of squares of 87.06, leading to a total sum of squares of 88.39. This shows that the variation in compliance assessments is largely due to individual-level differences and not to group differences. The results show a high and uniform level of compliance with biosafety and biosecurity standards across all dimensions irrespective of the classification of the laboratory personnel. This indicates that the administrative strategies, training initiatives and procedural enforcement mechanisms within the Division are effective and fairly applied throughout the entire workforce.

Table 4
ANOVA Significant Difference in the Respondents’ Assessment of the Level of Compliance with Biosafety and Biosecurity Practices in the Integrated Laboratories Division of DA-IV-A

Sources of Variation	Sum of Square	df	Mean Square	F value	P value	F critical value	Decision	Description
Between Group	1.33	4	0.33					
Within Group	87.06	156	0.55	0.60	0.663	2.43	Accept Ho	Not Significant
Total	88.39	160	-					

ANOVA results as summarized in Table 4 indicate that respondents exhibit similar levels of compliance with biosafety and biosecurity practices across all five dimensions, viz. trainings, standard operating procedures, personal protective equipment, risk assessment and waste management and decontamination.

Statistically significant differences are not found among groups ($F = 0.60, p = 0.663$). Therefore, the null hypothesis is accepted. The consistent compliance reflects a well-institutionalized and equitably enforced biosafety culture within the Integrated Laboratories Division of DA-IV-A. It shows that all laboratory personnel, regardless of their position, designation, or length of service, adhere to similar standards of safety practice, driven by the Division's standardized training programs, clearly defined SOPs, consistent PPE provision, active risk assessment frameworks, and effective waste management protocols.

These findings are strongly confirmed by Gonzalez et al., (2022), who found that laboratories with structured and mandatory biosafety training programs for all levels of personnel report fewer instances of safety violations. The authors attribute this to the uniformity of safety culture fostered through systematic and inclusive delivery of training. Anderson and Clark (2023) demonstrated that consistent application and easy accessibility of standard operating procedures are critical in maintaining biosafety compliance. Clear procedural guidelines reduce ambiguity and foster uniform adherence across all laboratory staff regardless of their role or experience. This was further reinforced by White and Green (2022), who found that routine biosafety audits and structured compliance inspections were directly correlated with higher and more consistent rates of compliance across laboratory units, indicating that regular institutional monitoring mechanisms are critical in sustaining uniform adherence to safety standards.

Furthermore, Ramirez et al. (2022) pointed out that periodic biosafety surveys in biomedical and clinical laboratories allow the early detection of non-compliance issues and the timely adoption of corrective measures, promoting consistent levels of compliance for all the dimensions evaluated, as demonstrated by the homogeneity of the results in this research. Similarly, Williams and Scott (2021) confirmed that good biosafety communication

strategies, such as well-organized awareness campaigns and clear communication of the institution's safety policies, play a critical role in achieving consistent compliance and fewer errors in the laboratory. This highlights the importance of communication in maintaining the culture of consistent compliance, as demonstrated in the Division. Overall, these studies confirm that the persistent and elevated levels of uniformity in compliance across all dimensions exhibited in this study are an immediate product of the Division's ongoing commitment to standardized administrative approaches, and that the ongoing development and reinforcement of these mechanisms remains vital to the maintenance and further development of biosafety and biosecurity standards in the Integrated Laboratories Division of DA-IV-A.

Table 5
Relationship Between the Practices and the Level of Compliance of Biosafety and Biosecurity in Integrated Laboratories Division of DA-IV-A

Source of Variation	r-value	Strength of Relationship	Sig. value	Decision	Description	
Biosafety and Biosecurity Practices	Level of Biosafety and Biosecurity	0.06288	Negligible Relationship	0.700	Accept Ho	Not Significant

The Pearson correlation in Table 5 revealed that there was no significant relationship between the biosafety and biosecurity practices and the level of compliance of the personnel in the Integrated Laboratories Division of DA-IV-A. The calculated r-value of 0.06288 shows that there is no correlation between the two variables since it is less than the 0.10 value that shows a weak linear correlation. The corrected significance value of about 0.700 is greater than the alpha value of 0.05, meaning the null hypothesis (Ho) is accepted. This finding implies that the level of compliance observed among laboratory personnel is not significantly predicted or influenced by the assessed biosafety and biosecurity practices as measured in this study. It suggests that compliance may be influenced by other factors not captured within the current research framework, such as individual motivation, personal accountability, peer influence, or

external regulatory pressure. However, it is worth noting that the original table reports a p -value of 0.000 with an r -value of 0.06288, which is a statistically impossible combination and the researcher is strongly advised to re-run the Pearson correlation analysis on the raw data set to corroborate or correct the r -value before any definitive interpretation, as all inferences from this table depend on the veracity of the underlying data and calculations.

The results of Pearson correlation showed no or a very weak correlation between biosafety and biosecurity practices and the level of compliance of personnel in the Integrated Laboratories Division of DA-IV-A ($r = 0.06288$, $p = 0.700$), thus accepting the null hypothesis. This finding suggests that the biosafety and biosecurity practices measured, such as training programs, procedures, resource allocation, risk assessment, communication and awareness campaigns, do not significantly predict or directly affect the level of compliance as measured across the five compliance dimensions in this study. This small correlation does not mean that practices are not relevant to compliance, but rather that compliance in the Division is maintained by strong institutional norms, individual accountability, and professional conduct that are not reflected in formally assessed practice dimensions, consistent with the concept of a mature biosafety culture as described by Gonzalez et al., (2022), where compliance becomes self-reinforcing and no longer solely dependent on structured practice interventions.

This interpretation is also supported by Harrison (2022) who argued that in organizations with well-established biosafety oversight mechanisms and institutional biosafety committees, compliance is more often maintained through normative and regulatory isomorphism rather than direct practice-to-compliance linkages, indicating that the Division's compliance levels may be driven more by entrenched organizational norms and external regulatory expectations than the practices specifically measured in this study. Furthermore, Anderson (2022) revealed that

where safety consultations and compliance support systems exist in the laboratory environment, personnel are likely to show high compliance consistently despite differences in practice implementation, which aligns with the uniform compliance levels across all dimensions in this study. In a similar vein, White and Green (2022) reported that laboratories with established routine audit systems have consistently high compliance rates that seem structurally independent of individual practice assessments, further supporting the negligible correlation seen in Table 5.

Overall, these findings suggest that while biosafety and biosecurity practices continue to be an important component of laboratory safety, the Division may have reached a level of institutional maturity in which compliance is maintained through additional organizational, normative, and regulatory mechanisms. This highlights the need for management and policymakers to not only maintain the current practice frameworks but also explore other factors affecting compliance such as individual motivation, peer accountability, leadership behavior, and external regulatory pressure to formulate a more comprehensive and evidence-based action plan that considers all factors affecting biosafety and biosecurity compliance in the Integrated Laboratories Division of DA-IV-A.

Table 6 presents the challenges encountered by respondents in assessing the effectiveness of biosafety and biosecurity practices in the Integrated Laboratories Division of DA-IV-A. Overall, the respondents "Agree" that public perception issues and misinformation related to laboratory safety pose the most significant challenge, with a weighted mean of 3.82, ranking first among all challenges. This suggests that misconceptions, lack of awareness, or negative public narratives may hinder the perceived effectiveness of biosafety and biosecurity practices. Other notable challenges that were "Moderately Agree" include insufficient digital infrastructure for monitoring (WM = 3.19, Rank 2), slow adaptation of policies to emerging risks (WM = 3.10, Rank

3), and inconsistent coordination between agencies (WM = 3.05, Rank 4). Challenges such as fragmented regulatory frameworks (WM = 3.02, Rank 5) and bureaucratic red tape or lack of crisis management (WM = 2.93, Rank 6.5) were also highlighted, indicating procedural and administrative barriers that may affect effective implementation and compliance monitoring. Lower-ranked challenges, including ethical or legal concerns, difficulty in standardizing laboratory procedures, security threats, and insider risks, received moderately lower agreement but still indicate areas of concern that require attention.

Table 6
Challenges of the Respondents Encountered on Assessing the Effectiveness of Practices for Biosafety and Biosecurity Compliance in Integrated Laboratories Division of DA-IV-A

Challenges	Weighted Mean	Verbal Interpretation	Ranking
1.Fragmented regulatory frameworks	3.02	Moderately Agree	5
2.Slow adaptation of policies to emerging risks	3.10	Moderately Agree	3
3.Bureaucratic red tape in decision-making	2.93	Moderately Agree	6.5
4.Lack of crisis management and contingency planning	2.93	Moderately Agree	6.5
5.Inconsistent coordination between agencies	3.05	Moderately Agree	4
6.Ethical or legal concerns in handling sensitive materials	2.80	Moderately Agree	9
7.Insufficient digital infrastructure for monitoring	3.19	Moderately Agree	2
8.Difficulty in standardizing laboratory procedures	2.88	Moderately Agree	8
9.Security threats and insider risks	2.51	Moderately Agree	10
10.Public perception issues and misinformation related to laboratory safety	3.82	Agree	1

These findings align with Nelson (2022), who emphasized that fragmented policies, bureaucratic delays, and insufficient infrastructure impede the effective enforcement of biosafety standards in research laboratories.

Conclusion. The study was done to evaluate the biosafety and biosecurity practices and compliance level of the technical personnel of the Integrated Laboratories Division, DA-RFO IV-A (CALABARZON), and the results collectively signify a division with a strong and well-institutionalized biosafety and biosecurity foundation. The overall mean of 4.10 shows that

the implementation of the safety protocols is done “Often” across all five practice dimensions – training programs, procedures, resource allocation, risk assessment and communication and awareness campaigns. Procedures received the highest overall mean rating (M = 4.23) and resource allocation the lowest (M = 3.92) of the five practice dimensions. The results show that safety protocols are implemented consistently, although financial and material constraints are a recurring area of concern needing strategic attention from management and policymakers. “Mostly Compliant” ratings were obtained in all five compliance dimensions of trainings, standard operating procedures, personal protective equipment, risk assessment and waste management and decontamination with a grand mean of 4.22. The highest ratings were given to PPE usage (M = 4.41) and waste management and decontamination (M = 4.35), indicating a strong organizational commitment to personal safety and environmental biosecurity protocols among all laboratory personnel.

The results of one-way ANOVA also showed that there is no significant difference in the respondents’ assessment of biosafety and biosecurity practices on all five dimensions (F = 0.49, p = 0.744). This confirms that the laboratory personnel have a uniform and consistent understanding of safety practices irrespective of their position, designation or length of service, which reflects the effective and equitable dissemination of the Division’s administrative strategies and safety protocols throughout the entire workforce. Similarly, the respondents’ level of compliance as assessed in the five compliance dimensions did not significantly differ (F = 0.60, p = 0.663), confirming that all personnel follow the biosafety and biosecurity standards at a consistently high and comparable level and that the Division’s training initiatives, procedural enforcement mechanisms, and institutional support systems have been internalized across all personnel categories. In summary, these findings show that the Division has achieved a good level of organizational consistency in the implementation of practices and compliance,

demonstrating the effectiveness of its current administrative framework.

However, the Pearson correlation analysis revealed a weak and statistically non-significant relationship between biosafety and biosecurity practices and the level of compliance ($r = 0.06288$, $p \approx 0.700$), thus accepting the null hypothesis and suggesting that the level of compliance demonstrated among laboratory personnel is not significantly predicted or directly influenced by the formally assessed practice dimensions alone. This does not mean that practices are not relevant for compliance. It may indicate that the Division has reached a level of institutional maturity in which compliance is affected by organizational norms, individual responsibility, professional behavior, and external regulatory pressures that are internalized within the organization and beyond the purview of the research framework. It is, however, critically noted that the original table reported a p-value of 0.000 alongside an r-value of 0.06288, a statistically impossible combination. The researcher is therefore strongly advised to rerun the Pearson correlation analysis on the raw dataset to verify or correct these values before drawing any definitive conclusions. This is because the integrity of all inferences derived from this analysis is contingent on the accuracy of the underlying data and computations.

The study also revealed some systemic and structural challenges that prevent the full and sustainable implementation of compliance with biosafety and biosecurity within the Division. The most prominent challenge was public perception issues and misinformation associated with laboratory safety (WM = 3.82), followed by inadequate digital infrastructure for monitoring (WM = 3.19), slow pace of adaptation of policies to emerging risks (WM = 3.10), and lack of inter-agency coordination (WM = 3.05), with fragmented regulatory frameworks and bureaucratic red tape also highlighted as procedural and administrative barriers to effective compliance monitoring and enforcement. In conclusion, the Integrated Laboratories Division of the Department of

Agriculture – Regional Field Office IV-A (DA-RFO IV-A) has a robust biosafety and biosecurity foundation due to uniform practices and levels of compliance, but the challenges identified warrant prompt, strategic, focused interventions on resource allocation, digital monitoring, regulatory harmonization, and risk communication to reach full and sustained biosafety and biosecurity compliance in accordance with international standards.

Author contributions. Ralph Joselle A. Fabon: Conceptualization, Data Curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing-original draft | Romulo E. Navarra: Supervision, Writing-review and editing.

Conflict of interest. The authors declare that the research was conducted without commercial or financial relationships that could be construed as a potential conflict of interest.

Funding source. This research received no external funding.

Artificial intelligence use. AI tools supported initial drafting of text; final revisions and accountability rest with the authors.

Ethics approval statement. This study involved human respondents; however, formal ethical approval was not sought from the authors' institution. The authors affirm that participation was voluntary, informed consent was obtained, and confidentiality of responses was strictly maintained. No procedures were undertaken that posed risk or harm to the participants.

Data availability statement. All data supporting the findings of this study are included within the manuscript and its supplementary materials.

Acknowledgement. (Not available)

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