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Fortifying Biosafety in Nigeria: Insights and Transformative Practices from the SNL-NIBSA Bio-risk Management Course

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Abstract
This study highlights the critical role of biosafety and biosecurity in scientific advancement and public health protection. It stresses responsible research conduct and risk mitigation. Biorisk management systematically identifies, assesses, and mitigates biohazard risks, ensuring safety for personnel and the environment. Collaboration between Sandia National Laboratories (SNL) and the Nigerian Biological Safety Association (NiBSA) boosts international cooperation and biosafety standards. The SNL-NiBSA Biorisk Management Course in Lagos addresses Nigerian challenges with practical solutions. Key learnings emphasize risk assessment, lab practices, protective gear use, and waste management. Identified challenges prompt education enhancement, resource optimization, and international collaboration. Potential outcomes include replicated training programs, local guidance documents, policy advocacy, and regional cooperation. Overall, SNL-NiBSA collaboration elevates biosafety, promotes responsible research, and enhances global health security.

Keywords: Bio-risk management, Biosafety, Biosecurity, Nigeria, Risk assessment

Main text

In the pursuit of scientific progress, biosafety and biosecurity are vital. They protect against accidental releases and intentional misuse of biological agents, ensuring public health and global security (1). Biorisk management is crucial in labs, managing risks associated with biological materials (2). It involves identifying, assessing, and mitigating risks, and safeguarding personnel and the environment (1, 3). The partnership between Sandia National Laboratories (SNL) and the Nigeria Biological Safety Association (NiBSA) strengthens biosafety practices (4). By leveraging SNL's expertise and NiBSA's influence, they enhance biosafety in Nigeria and beyond (5). This paper highlights biosafety practices in Nigeria, emphasizing local adaptations. It draws from the authors' experiences in the SNL-NiBSA Biorisk Management Course, emphasizing practical applications and insights.

The workshop employed modules from the Global Biorisk Management Curriculum Library (GBRMC), integrating interactive lectures, group discussions, hands-on exercises, and case studies. Attendees hailed from various research institutions and disciplines, promoting interdisciplinary collaboration and the exchange of knowledge. Modules covered a range of topics essential for bio-risk management, such as developing and validating Standard Operating Procedures (SOP), hazards and risk assessment *cum* communication in the laboratory, Good Laboratory Work Practices (GLWP), Personal Protective Equipment (PPE), biological waste disposal, engineering controls, and laboratory equipment (www.sandia.gov).

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Key Learnings from the Course Modules

1. Bio-risk Assessment and Communication: Participants learned the Assessment Mitigation and Performance (AMP) model for thorough bio-risk assessments and effective risk communication, promoting a safe work environment.
2. Good Laboratory Work Practices (GLWP): The AMP model guided GLWP implementation, stressing hand hygiene, PPE use, and laboratory cleanliness.
3. Personal Protective Equipment (PPE): Training focused on PPE selection and usage based on risk assessments, emphasizing risk mitigation.
4. Biological Waste Disposal: Participants explored proper waste management despite Nigeria's resource challenges.
5. Engineering Controls: Understanding biosafety cabinets and ventilation systems aided in optimal risk containment.

Workshop Insights: Revelations and Knowledge Acquisition

1. Comprehensive Risk Assessment: Beyond biosafety levels, the course stressed considering biological agents, host characteristics, and potential outcomes, enhancing bio-risk management understanding.
2. Adapting Solutions: Learning the United States' containment practices highlighted the need for tailored, cost-effective strategies in Nigeria's resource-constrained environment, fostering creativity.
3. Stakeholder Engagement: Effective communication and collaboration among researchers, policymakers, and communities are crucial for biosafety, motivating future stakeholder involvement.
4. Continuous Learning: The course emphasized ongoing professional development and staying updated on biosafety advancements, recognizing the importance of training at all levels.

Some Case Scenarios Shared During the Course

The SNL-NIBSA Biorisk Management Course effectively utilized hypothetical scenarios and real-world examples to illustrate theoretical concepts and highlight the practical application of best practices. Here are some examples within the context of Nigerian biosafety.

Practical Scenarios Discussed

1. Accidental Release Management: Explored handling biosafety incidents in low-resource labs, emphasizing resourcefulness and adaptability, relevant to Nigeria's context.
2. Community Engagement in Research: Focused on genetically modified organisms (GMO) project transparency and community involvement, crucial for building trust in scientific endeavours, particularly pertinent in Nigeria.

Identified Challenges

1. Limited Awareness and Infrastructure: Lack of biosafety awareness and inadequate infrastructure hinder implementation.
2. Resource Constraints: Financial limits restrict PPE, training, and infrastructure allocation.
3. Compliance Complexities: Navigating conflicting regulations poses challenges.
4. Human Error Potential: Despite training, errors can compromise safety.
5. Evolving Threats: Adaptation is essential against emerging infectious diseases.

Proposed Solutions

1. Enhanced Education: Programs on risk assessment, safe handling, and PPE usage will boost awareness and skills.
2. Resource Optimization: Prioritize budget allocation, explore cost-effective solutions, and seek international support for resource constraints.
3. Regulatory Collaboration: Streamline regulations across nations to simplify compliance efforts.
4. Technological Integration: Automation minimizes errors, enhancing safety in specimen handling and data management.
5. Research and Development Focus: Continuous research on pathogens and diagnostic tools is vital for biosafety improvement.
6. International Collaboration: Share best practices and resources internationally to benefit nations with similar challenges (6).

Potential Outcomes of SNL-NiBSA Workshop

1. Replicating Training Programs: Expanding reach to researchers, lab personnel, and stakeholders enhances national biosafety and biosecurity.
2. Developing Local Guidance: Collaborating on guidelines strengthens existing protocols.
3. Advocating for Policy and Funding: Leveraging networks drives progress in infrastructure and capacity building.
4. Fostering Global Collaborations: Connecting with international experts strengthens Nigeria's biosafety framework.

Conclusion

The collaborative Biorisk Management workshop by Sandia National Laboratories (SNL) and the Nigerian Biosafety Association (NIBSA) in Lagos, Nigeria, significantly advances biosafety practices. GBRMC modules hands-on learning and interactive lectures. Participants acquire

skills in risk assessment, lab practices, waste management, and protective gear use, enabling them to champion biosafety and biosecurity. Challenges like resource constraints persist, urging ongoing education and international partnerships. The workshop catalyzes positive change, raising standards and fostering a sustainable biosafety culture. Its legacy promotes safer research in Nigeria and global health security, exemplified through participants' actions.

List of Abbreviations

BRM: Biorisk Management
GBRMC: Global Biorisk Management Curriculum
GMO: Genetically Modified Organisms
NiBSA: Nigerian Biological Safety Association
PPE: Personal Protective Equipment
SNL: Sandia National Laboratories

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EIL led the conceptualization and research design, with both authors contributing to data collection and analysis. EIL drafted the manuscript, and JAW provided comprehensive review and editing, both approving the final version.

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