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Workshop Proceedings

Proceedings of the ANSO-PAS-QAU Workshop 2023 on "Ensuring Biosafety: Empowering Trainers in Risk Management and Biosecurity"

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Abstract: Three days workshop entitled **"**Ensuring Biosafety: Empowering Trainers in Risk Management and Biosecurity,**" (**August 12-14, 2023) was organized at Bara Gali Campus, University of Peshawar. The workshop consisted of practical lessons on biosafety in the lab and during fieldwork, risk assessment techniques, biosecurity practices, experiment design, and execution. In addition, risk management, policy-making, and the rising concerns of antibiotic resistance were also discussed by keynote speakers and trainers. The course included theoretical lectures and hands-on exercises, allowing attendees to put their newfound knowledge to use in realistic situations. A field excursion also highlighted several plant types and aspects related to handling possibly toxic plants. In summary, the event stresses the importance of having a thorough familiarity with biosafety and risk management while practicing laboratory procedures.

1. OVERVIEW

Education and training of laboratory staff are essential to gain sufficient awareness to handle biologically hazardous materials as per internationally documented strategies [1]. Such hazardous material can be biological agents (pathogens, toxic plants or animals and their products), chemicals/reagents, etc., which can pose a threat to the environment and human health. Laboratory workers especially post-graduate students need training sessions on biological safety and related issues. Keeping in view this critical need, a three-day Workshop was organized by the Pakistan Academy of Sciences (PAS), Quaid-i-Azam University (QAU), and the University of Peshawar; and sponsored by the Alliance of International Science Organization (ANSO) at the Bara Gali Campus of the University of Peshawar on August 12-14, 2023. Over 45 participants (mainly post-graduate students) from five different universities (namely Quaid-i-Azam University Islamabad, University of Peshawar, Hazara University, Riphah International University, and Khyber Medical University) attended the event. The workshop consisted of 11 lectures and 13 practical sessions.

2. INAUGURAL SESSION – DAY 1

The inaugural session was graced as Chief Guest by Prof. Dr. Mukhtar Ahmad (Chairman, Higher Education Commission) along with the Guest of Honor Prof. Dr. Jehan Bakht (Vice Chancellor of Agriculture University Peshawar). Prof. Dr. Sumera Afzal (Director Center of Biotechnology and Microbiology, University of Peshawar) formally inaugurated the event. Subsequently, Prof. Dr. Zabta Khan Shinwari presented a keynote talk on "Ethics, Education, and Training in Emerging Frontiers". Dr. Shinwari emphasized the significance of not only providing technical expertise, but also cultivating ethical principles, visionary thinking, leadership capabilities, collaborative aptitude,

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and proficiency in science communication. He espoused the importance of developing proficient science communication abilities, which serve as a vital means of connecting scientific progress with the general population. He provided illumination about the intriguing prospects presented by synthetic biology. Nevertheless, he also highlighted certain ethical dilemmas, including the concept of generating offspring without biological progenitors.

The Chief Guest, Dr. Mukhtar Ahmad emphasized shaping a self-reliant Pakistan through knowledge sharing and impactful research. In his address, he appreciated the efforts of QAU, PAS, ANSO, Pakistan Biological Safety Association, and the University of Peshawar for jointly organizing this useful event. He emphasized that every scholarly endeavor and academic effort ought to be motivated by a vision to create a concrete influence on our society. The genuine influence of our research resides in the constructive societal transformations it engenders. The honorable chief guest informed the audience that Pakistan currently has a student population of over 6 million individuals (enrolled in universities) and is stressed to capitalize on its potential to generate products, technologies, and breakthroughs. He stated "*We must channel this potential for the betterment of our nation and its citizens. This aims to undertake a critical examination of the underlying factors contributing to the challenges encountered by our nation. What are the reasons for our underperformance in specific domains? Why is utilizing our intellectual resources not resulting in acquiring advantageous outcomes? The solution can be found inside our shared obligation, selflessness, hard work, commitment, and devotion towards our beloved country".* In summary, it is imperative to adopt the idea of sharing, encompassing the dissemination of knowledge, allocation of resources, and assumption of responsibility. Collectively, we have the potential to mold a forthcoming era in which Pakistan can emerge as a symbol of self-reliance, ingenuity, and advancement. Figure 1 represents the guests, master trainers Keynote speakers, and participants.

2.1. Session I

Subsequently, the session commenced after a tea break, encompassing a total of five stations, each led by a respective trainer. The workshop centered around various topics within the realm of biosafety and biosecurity. The initial station (Station-I) focused on "Four Primary Controls of Biosafety," where Dr. Ikram Ullah elucidated the first control known as personal protective equipment (PPE), encompassing all protective gear designed to safeguard us from potential risks. Following this, the second primary control, referred to as engineering control, was discussed, shedding light on the meticulous manufacturing processes in laboratories based on specific risk assessments. Subsequently, attention turned to the third primary control, Standard Operating Procedures (SOPs), wherein Dr. Ikram Ullah emphasized the criticality of having proper emergency instructions and protocols documented comprehensively during unforeseen situations within the laboratory. The final aspect covered was leadership, delving into the implementation of SOPs, the necessity of rigorous training, precise guidelines, and continuous surveillance to effectively regulate biosafety measures.

Moving forward, we arrived at station II which focused on "Biological spill management", led by Dr. Faouzia Tanveer. She imparted insights into the management of spills within laboratory settings. She elaborated on the two types of possible spills, namely chemical and biological, outlining a series of steps for their effective containment. Emphasizing the paramount significance of spill management, she highlighted the necessity of a well-equipped spill kit containing absorbent materials, personal protective equipment (PPE) such as gloves, masks, booties, and a biohazard bag and forceps. Furthermore, she stressed that in the event of a spill occurrence, promptly notifying others and raising awareness about the specific contamination is of utmost importance for effective response and containment measures.

Subsequently, we proceeded to station III centered on "risk group classification" which was expertly presented by Dr. Ibrar Khan. He comprehensively explained what constitutes risk groups and elaborated on the classification criteria used by both the NIH and WHO. Dr. Khan expounded on the four risk groups resulting from risk assessments, categorizing pathogens in ascending order of harm (from the least to the most harmful), as well as current

preventive and therapeutic measures. Following that, Dr. Ali Talha Khalil conducted a training session on "Containment Levels: Engineering and Biosafety" (Station-IV). He expounded on how the determination of biosafety levels in labs follows risk assessment. Within a Biosafety Level 1 lab, pathogens are handled that do not pose harm to humans, while Biosafety Level 4 labs manage organisms causing significant health impacts. Dr. Khalil also emphasized that the levels correspond with distinct infrastructural designs of the labs. The final station (Station-V) was led by Dr. Irum Iqrar, focusing on editorial policies and paper submission ethics. She provided insights into key aspects of article submission. Dr. Iqrar underscored that aligning the aims and objectives of articles with the goals of the chosen journal is of paramount importance during both article submission and journal selection. Additionally, she highlighted the significance of elements such as the cover letter, author contributions, and declaration of interest in the submission process.

2.2. Session II

In the next session, Dr. Faouzia Tanveer gave a presentation on "Bio-risk Management." She expounded upon the three stages of bio-risk management: assessment, mitigation, and performance. Dr. Tanveer also elucidated the distinction between hazard and risk, underscoring the importance of biological risk assessment due to the diversity and intricacy inherent in biological agents. She shared a risk assessment strategy, which commences with describing the activity, followed by risk identification, characterization of the identified risk, and determining the acceptability of the risk. She stated, *"Generally speaking, the risk can never be zero, try your level best to bring it to an acceptable level".*

Following that session, Dr. Javed Muhammad conducted a practical session on "Donning and Doffing of PPEs". During this session, he guided the participants through the process of properly donning personal protective equipment (PPE) after

Fig. 1. Participants of the ANSO-PAS-QAU Workshop on "Ensuring Biosafety: Empowering Trainers in Risk Management and Biosecurity" with Prof. Mukhtar Ahmad Akhtar (Chairman HEC), Prof. Dr. Jehan Bakht (Vice Chancellor AUP), Prof. Dr. Zabta Khan Shinwari (Distinguished National Professor, Prof Emeritus at QAU), Prof. Dr. Sumera Afzal (Head, Center for Biotechnology and Microbiology, University of Peshawar), Dr. Muhammad Ali (PI ANSO Project), and workshop trainers Dr. Ali Talha Khalil (Assistant Professor & Consultant Molecular Biologist at LRH-MTI, Peshawar), Dr. Ikram Ullah (Assistant Professor, Hazara University, Mansehra), Dr. Irum Iqrar (Journals Associate Editor, ORIC, The University of Lahore), Dr. Faouzia Tanveer (Senior Lecturer, Shifa Tameer-e-Millat University Islamabad), and Dr. Ibrar Khan (Associate Professor, University of Peshawar).

conducting a risk assessment and, subsequently, the recommended procedure for doffing once the task was completed. Furthermore, he provided insights into the appropriate use of lab coats, surgical suits, and Tyvek suits, including when and how to utilize them.

3. DAY 2 - SESSION I

Dr. Muhammad Ali welcomed the participants and gave an overview of Day 1 presentations and activities. Prof. Dr. Mushtaq Ahmad (Fellow, PAS) and Dr. Irum Iqrar served as session moderators. Dr. Javed Muhammad and Dr. Afreenish Amir, Technical Officer, AMR & Project Coordinator at the National Institute of Health, Islamabad, and the Chapter Head of the Pakistan Biological Safety Association in the ICT region, were the speakers in the first session of Day 2.

Dr. Javed Muhammad (General Secretory, Pakistan Biological Safety Association) discussed biosafety cabinets, their types, and their functioning. Laminar flow and biosafety cabinet categories were reviewed in the lecture. He stressed the importance of choosing the right biosafety cabinet for the specific risk groups. He also explained the pros and cons of chemical fume hoods and horizontal and vertical laminar flow benches. The discussion then proceeded to the several types of biosafety cabinets and the protection of products, environment, and users. He further suggested cost-effective biosafety cabinets like wooden ones and ventilated workstations could be designed and used during emergencies like pandemics and epidemics.

Dr. Afreenish Amir discussed "Risk Assessment" in the form of simplified illustrations. The talk was meant to give the audience an understanding of the core concepts and methods of risk assessment, focusing on their application to workplace safety. The speaker broke down risk into its parts, highlighting the relationship between the likelihood of negative outcomes, the severity of the risk, and effective methods for mitigating that risk. Aerosolization processes, sharp material, and possible negligence as factors that could increase the likelihood of a hazard. The lecture covered the basics of risk assessment and mitigation, including the dynamic nature of initial, tolerable, and residual risks. Incorporating risk assessment ideas, using a risk assessment matrix, and implementing a systematic method can be used as tools to ensure the health and safety of laboratory workers.

Fig. 2. Participants of Day 2 of ANSO-PAS-QAU Workshop on "Ensuring Biosafety: Empowering Trainers in Risk Management and Biosecurity" with the Prof. Dr. Mushtaq Ahmad (Chairman, Department of Plant Sciences, QAU & Fellow, PAS), Dr. Muhammad Ali (PI ANSO project, Assistant Professor, QAU, Islamabad, Member, PAS), Dr. Shujaul Mulk Khan (Associate Professor, Quaid-i-Azam University, Islamabad & Member, PAS), and workshop trainers Dr. Javed Muhammad (General Secretary of PBSA and Assistant Professor Department of Microbiology University of Haripur), Dr. Ikram Ullah (Assistant Professor, Hazara University, Mansehra), Dr. Fouzia Tanveer (Senior Lecturer, Shifa Tameer-e-Millat University, Islamabad), Dr. Ibrar Khan (Associate Professor, University of Peshawar), Dr. Ali Talha Khalil (Assistant Professor & Consultant Molecular Biologist at LRH-MTI, Peshawar), and Dr. Irum Iqrar (Journals Associate Editor, ORIC, The University of Lahore).

3.1. Training Session

The second day of the workshop consisted of a diverse range of instructive and interactive training sessions facilitated by renowned specialists in the respective departments. The participants were allowed to participate in vital aspects of biosecurity and biosafety, learning essential information about best practices and protocols.

Dr. Ikram Ullah ran a thorough session (Station-I) on the fundamentals of biosecurity primary controls. He stressed the significance of establishing physical safeguards to protect restricted areas and biological materials from unauthorized access. There was an emphasis on personnel screening and verification processes to reduce the risk of unauthorized entrance and enhance security generally. The dangers of losing or accidentally spreading biological material were discussed, and the significance of thorough inspections and detailed records was stressed. To reduce the likelihood of data breaches, the training highlighted the need to safeguard private information and data related to biological research. After that, we talked about the basics of transfer agreements and why they're so important for facilitating the safe and legitimate transfer of biological materials across organizations.

Dr. Javed Muhammad focused on "biosafety cabinets" (Station-II). Participants were briefed on the significance of sticking to the purge time, a period of four minutes during which the biosafety cabinet starts. This method guarantees the construction of a clean and controlled setting. The concept of "spray in and out," emphasizing the need for a steady flow from clean to dirty areas within the biosafety cabinet, was introduced to the students. To further improve workflow efficiency and lessen the possibility of cross-contamination, the biosafety cabinet was divided into "clean", "working," and "dirty" parts. The importance of putting samples in the back of the biosafety cabinet and taking them out in the opposite order was emphasized for maximum efficiency. Participants were instructed on how to best position their hands within the cabinet for maximum ventilation and safety. The discussion centered on the value of alarms installed in biosafety cabinets to alert personnel to changes in pressure or potential problems with HEPA filters.

Then the 3rd training session "Medical and Incident Surveillance Programme" by Dr. Faouzia Tanveer was fascinating (Station-III). Participants learned why first aid packs and spill kits are necessary for medical emergencies and catastrophe safety. Clear emergency exit signage and evacuation protocols were stressed to protect persons escaping a disaster zone. She discussed the most important aspects of a comprehensive worker health program: medical history gathering, task analysis, pathogen management, training, symptom recognition for occupationally acquired infections, risk evaluation, knowledge, and SOP dissemination. The training was thought-provoking because it examined how aging, pregnancy, immunosuppressive medicines, diabetes, and infection risks affect workers.

Dr. Ali Talha Khalil facilitated a comprehensive examination of laboratory-acquired illnesses (Station-IV). Dr. Khalil began the conversation with a case study of a laboratory-acquired smallpox death. This occurrence highlighted the risks of biosecurity and biosafety shortcomings. The students learned a great deal about the ways that infections can be spread in controlled settings like laboratories. Dr. Khalil stressed the significance of immunizations, regular checkups, and a thorough medical history for all laboratory workers. An unfortunate incident that led to a student's death due to an ethanol spill was also discussed in class. This case demonstrated the significance of stress management and understanding the potential mental health consequences of events that occur in the laboratory.

The training (Station-V) by Dr. Ibrar Khan, provided attendees with valuable knowledge and practical skills necessary for effectively and immediately addressing needle stick injuries. The initial action in response to a needle stick injury involves expeditiously exposing the wound site where the incident occurred. To delicately address the wound, promoting bleeding and enabling the expulsion of possibly contaminated fluids is recommended. Additionally, it is advised to properly cleanse the area by rinsing it with clean water for at least five minutes. Following the completion of the initial cleaning process, it is imperative to appropriately cover the wound, subsequently proceeding with the correct removal of gloves. Certification of medical surveillance

ought to be conducted after each occurrence of needle stick injury. The act of reporting promptly guarantees that necessary actions are implemented to effectively address the situation at hand and mitigate the likelihood of similar incidents occurring in the future.

The last training session (Station-IV) was about "Experiment Designing, Documentation, and Execution: Hands-on Aspects of Practically Working in an Infectious Disease Laboratory" conducted by Dr. Muhammad Ali. The master trainer guided the participants through important aspects of working in an infectious disease laboratory. The participants were instructed on the need to follow appropriate laboratory entry procedures and maintain sufficient ventilation to establish a secure and regulated workspace. Trainers were advised to thoroughly examine existing literature and acquaint themselves with the experiment's aims and methodologies. The need to check catalog numbers when assessing chemicals was emphasized throughout the presentation to guarantee precise application and safe storage. This procedure keeps the experiment authentic by preventing improper chemical handling. Dr. Ali stressed the need to record every step, observation, and measurement in detail to ensure reliable analysis and experiment replication. The lesson concluded with a reminder to carefully read and understand all necessary equipment manuals before use. Participation in such activities ensures familiarity with equipment types, functions, and potential dangers.

3.2. Session II

Dr. Ibrar Khan gave a talk titled "Decontamination and Infection Control." Dr. Khan discussed the differences between disinfection and sterilization as the two cornerstones of decontamination. Participants were briefed on the need for thorough disinfection in maintaining a safe and clean environment. Attendees learned in depth about disinfection, sterilization, sepsis, medical surveillance, and the value of efficient resource management. Standardized protocols and occupational health programs were highlighted during the event as a means to reduce the spread of disease and protect the health and safety of participants.

Dr. Javed Muhammad gave a talk titled "An Overview of the Institutional Biosafety Committee (IBC)". This event aimed to teach participants everything they needed to know about Institutional Biosafety Committees (IBCs) and their function in biosafety laws. Students gained knowledge about how an IBC works to provide sufficient containment, promote expert evaluation, educate the public about experimental protocols, and open lines of communication between scientists and medical experts. Participants at the workshop discussed the circumstances in which IBCs are required, the requirements for forming an IBC, and the important members of IBC committees. Dr. Javed Muhammad delivered a comprehensive presentation on the proposal flowchart, a graphical representation of the processes required to obtain Institutional Biosafety Committee (IBC) approval.

An exam was conducted after the lectures to assess the understanding of students. Dr. Ali, the workshop's organizer, concluded the day by summarizing the day's events and thanking the keynote lecturers and master trainers for their insightful presentations and useful insights.

4. DAY 3 - SESSION I

Dr. Ibrar Ahmad (Session Chair) and the co-chair Dr. Javed Muhammad, gave introductory remarks on the third day. In the keynote lecture, Dr. Ali Talha Khalil presented different aspects of laboratory quality management, focusing on process optimization and quality indicators. Increasing laboratory precision, dependability, and speed was his main point. Dr. Ali Talha explained the Lab Quality Management System methodology for organizing and improving varied laboratory tasks. His talk also covered internal and external audits, corrective and preventive efforts, and other conventional development tactics. The final portion of the programme consisted of a recap of the most important ideas covered throughout the day as well as an introduction to the WHO's suite of laboratory evaluation instruments.

Prof. Dr. Mushtaq Ahmad in his Keynote lecture discussed the importance of interdisciplinary approaches in the biological sciences. Sustainable applications in areas including alternate biomass energy, food production, and healthcare were

highlighted as important takeaways from the conversation. Academics, businesses, and researchers all work together to improve society, a point driven home in the presentation. Prof. Ahmad emphasized the gap between universities and businesses. The speaker emphasized the importance of fostering collaboration and encouraging innovation as strategies to close the gap and make better use of multidisciplinary research's latent potential. Information about Pakistan's many ecosystems and the rich biodiversity they support was disseminated to the attendees. This makes the country a valuable resource for establishing environmentally friendly policies. Dr. Mushtaq Ahmad has launched studies focusing on preservation, conservation, and revitalization. These initiatives are crucial to ensuring the health of ecosystems and human communities. Prof. Mushtaq Ahmad evaluated many uses of trans-disciplinary research in healthcare. Herbal treatments, medicines, nutraceuticals, and cosmetics were all included in these contexts.

Dr. Shuja ul Mulk focused on risk assessment and management while covering the fundamentals of plant gathering and fieldwork. The protection of biodiversity, labeling techniques, safety, ethics, and other topics were covered in this instructional workshop. Dr. Shujaul Mulk stressed the importance of fieldwork and data collection to collect living specimens from many sites. His focus was on how climate defines terrestrial biome limits. He also addressed herbarium collections, phylogenetic research, phytochemistry analysis, ecological assessments, and disease investigations as reasons for collecting plants. Dr. Shujaul Mulk showed how to efficiently harvest plants with GPS, compasses, sacks, newspapers, blotting paper, and cutters. Fieldwork and plant gathering are complicated, encompassing safety, ethics, and biological variation. The session taught guests how to pick plants appropriately, aiding conservation and sustainability.

4.1. Field Trip

Participants were led by Prof. Dr. Ghulam Mujtaba Shah, Prof. Dr. Mushtaq Ahmad, and Dr. Shujaul Mulk Khan on a fascinating and thought-provoking field trip. The excursion showcased various plant species with important practical uses, including those having medicinal, dietary, and other medical applications.

- The potential of *Bistorta amplexicaulis* (D. Don) Greene in Sharbat-e-Anjbar, was introduced to the audience and its vitality was emphasized because of the plant's historical role in a variety of popular cuisines and drinks.
- The field trip served as an excellent platform from which to talk about the role that *Indigofera tinctoria* L. plays in the indigo production process, with special emphasis on its use in the textile dyeing process. Participants learned about the application of *Plantago ovata* Forssk. seeds in the processing of "Ispaghol," a traditional remedy for gastrointestinal health. It is also an important remedy for lessening the cholesterol level. *Butea monosperma* (Lam.) Kuntze a key ingredient in "Kamarkas," a medicine used to relieve back pain, was demonstrated.
- *Viburnum grandiflorum* Wall. ex DC. nutritional value as a rich source of vitamin C was underlined.
- Botanical specimen *Polygonatum* has been found to have a substantial number of alkaloids, indicating promising medical applications.
- The ability of *Isodon rugosus* (Wall.) Codd to relieve toothache and its antiseptic potential was explored.
- *Geranium wallichianum* D. Don was highlighted for its ability to alleviate joint pain and backache.
- The uses of green tea and *Origanum vulgare* L. in various types of drinks and medicines were discussed.

Participants were able to get an up-close and personal look at how various plant species are used in disciplines like medicine, nutrition, and more on this field trip. The field visit led by the Experts highlighted the importance of plants in their position as providers of long-term solutions in a wide range of fields.

4.2. Concluding Session

After the field visit, Dr. Ghulam Mujtaba Shah (Dean, of Hazara University) gave his remarks to the audience. "*The fields we see in the wild medicine and the subject of our interest, the endangered species or the loss of the greenery, we ought to*

Fig. 3. Participants of Concluding Session of ANSO-PAS-QAU Workshop on "Ensuring Biosafety: Empowering Trainers in Risk Management and Biosecurity" with Prof. Dr. Shafiq ur Rehman (Vice Chairman Haripur University), Dr. Ghulam Mujtaba Shah (Dean, Hazara University), Prof. Dr. Mushtaq Ahmad, Prof. Dr. Shjaul Mulk Khan (Associate Professor, Quaid-i-Azam University, Islamabad), Dr. Muhammad Ali (PI ANSO Project, Assistant Professor, QAU, Islamabad, Member, PAS), Dr. Javed Muhammad (General Secretary of PBSA and Assistant Professor. Department of Microbiology University of Haripur), Dr. Ali Talha Khalil (Assistant Professor & Consultant Molecular Biologist at LRH-MTI, Peshawar), and Dr. Ikram Ullah (Assistant Professor, Hazara University, Mansehra) organized by the Pakistan Academy of Sciences (PAS), Quaid-i-Azam University (QAU) and University of Peshawar; and sponsored by the Pakistan Academy of Sciences (PAS) and Alliance of International Science Organization (ANSO).

collect the plant. The students don't care what they are collecting or what will be the effect of their collection on plant species. Most of the time, they don't know that this is an endangered species, how to collect it, or which part to collect. So, we have to not only do our work but also give the rest of the work to the people in the field. We have to give them a place and culture to live in. The diseases that we see are more or less resistant to microbes. Every year, we study different diseases related to the climate change. So, we have to do research in the environment, where you are working, and where you are growing."

The chief guest of the concluding session, Prof. Dr. Shafiq ur Rehman (Vice Chairman of Haripur University) discussed leadership, responsibility, and critical thinking. A moving illustration is Quaid-e-Azam, whose inspirational leadership gave birth to our beloved country. The success of individuals, aided by their mentors, improves the prospects for everyone. *"You are the leaders of the biosafety. You got the training. Now, skies are the limits. You can excel in this field and become a biosafety expert in this country. The world will also welcome you with open arms."*

Instead of placing blame, let's embrace responsibility, look to the future rather than lingering on the past, and make use of AI's potential to advance society. Our exclusive job is to protect populations from bio-hazards while innovating successful waste management techniques. Unity is the key to our power. As guardians of this land, our joint will determine Pakistan's future.

At the end of the conference, all of the master trainers, speakers, focal persons, organizers, and attendees were presented with shields and certificates.

5. ACKNOWLEDGEMENTS

We are thankful to all the master trainers, guests, participants, facilitators, and coordinators for contributing to the event. Authors are also grateful to the Alliance of International Science Organizations (ANSO) and the Pakistan Academy of Sciences (PAS) for their support and financial assistance.

6. CONFLICT OF INTEREST

The authors declared no conflict of interest.

7. REFERENCES

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