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Biosafety and Risky Research: Examining if Science is Outpacing Policy and Safety

Prepared Statement of

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Chair Rodgers and Subcommittee Chair Griffith, Committee Ranking Member Pallone and Subcommittee Ranking Member Castor, and other members of the Committee, thank you for the chance to speak with you today about the issue of *Biosafety and Risky Research: Examining if Science is Outpacing Policy and Safety*. My name is Dr. Gregory D. Koblentz, and I am an associate professor and director of the Biodefense Graduate Program at the Schar School of

Policy and Government at George Mason UniversityThe opinions expressed herein are my own and do not necessarily reflect the views of George Mason University.

I welcome the opportunity to present the latest report of the Global BioLabs Initiative, a project I co-direct with Filippa Lentzos at King's College London. The Global BioLabs Initiative has spent the last two years collecting and analyzing data on high-consequence biological research facilities around the world and the national biorisk management policies that govern these labs. Biorisk management is an integrated approach to addressing the risks associated with the life sciences research enterprise, from accidents and inadvertent actions to deliberate misuse. Our project uses biorisk management as an overarching concept that encompasses biosafety, biosecurity, and the oversight of dual-use research.

The Global BioLabs Initiative, in cooperation with the Bulletin of the Atomic Scientists, created an interactive website GlobalBioLabs.org to document the location and key characteristics of high-consequence biological research facilities (BSL-4 and BSL-3+ labs), improve transparency about these facilities, and educate the public and policy-makers about biosafety, biosecurity, and dual-use research oversight.

Today, I would like to present the key findings from *Global Biolabs Report 2023* which contains our latest research analysis on BSL4 and BSL3+ labs around the world and assessments of the national biorisk management policies in place to ensure that these labs are operated safely, securely, and responsibly.[1] In addition, I will provide recommendations for strengthening global

[1] *Global BioLabs Report 2023* (London and Arlington, VA: King's College London and George Mason University, March 2023),

biorisk management. For more details about our analysis and recommendations, please consult *Global Biolabs Report 2023* available at www.globalbiolabs.org.

Trends and Key Messages

Since its inception in May 2021, the Global BioLabs initiative has identified more than 100 BSL-4 and BSL-3+ labs around the world that conduct high consequence biological research, with more planned and under construction. Europe is home to half of these labs while the United States is home to the single largest concentration of such labs. 11 out of the 20 highest-containment facilities that are planned or under construction are in Asia.

The Global BioLabs Initiative has also identified several trends that raise biosafety and biosecurity concerns given the global boom in construction of these labs, particularly where biorisk management oversight is weak.

BSL-4 Labs

The number of BSL-4 labs is rapidly increasing, with most of the new construction taking place in Asia. In 2021, we identified 59 BSL-4 labs in operation, planned, or under construction in 23 countries. In 2023, there are 69 BSL-4 labs in operation, planned, or under construction in 27 countries. The largest concentration of BSL-4 labs is in Europe with 26 labs, followed by Asia with 20 labs, North America with 15, Australia with three, Africa with three, and South America with one planned lab.

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https://static1.squarespace.com/static/62fa334a3a6fe8320f5dcf7e/t/6412d3120ee69a4f4efbec1f/1678955285754/KCL0680_BioLabs+Report_Digital.pdf

Three-quarters of all BSL4 labs became operational since 2000. This initial building boom was due to the anthrax letter attacks in 2001 and the SARS outbreak in 2003. The COVID-19 pandemic has led to another building boom: 9 countries have announced plans to build 12 new BSL-4 labs since the start of the pandemic. For 5 of these countries, this will be their first BSL-4 lab. Most of these new labs will be built in Asia including in India, Kazakhstan, the Philippines, and Singapore.

We also identified several notable trends regarding specific characteristics of BSL-4 labs. Approximately 75 percent of BSL-4 labs are in cities, where dense populations could exacerbate the impact of an accidental release. Over 60 percent of BSL-4 labs are government-run public health institutions, 15 percent are academic labs, and less than 20 percent are defense-related labs. Most BSL-4 labs are focused on human health. About half of all BSL-4 labs are less than 200 square metres in size, about the size of a tennis court. Only nine BSL-4 labs are more than 1,000 square metres in size.

BSL-3+ Labs

We have identified 57 labs in 28 countries that self-identify as BSL-3+, or BSL-3 enhanced, labs. These are BSL-3 labs that have adopted additional physical and/or operational biosafety and biosecurity precautions for carrying out particularly risky research. Examples of enhancements to BSL-3 labs can include additional training for staff, more rigorous emergency response plans, enhanced respiratory protection for personnel against aerosols, clothing change and shower-out protocols, HEPA filtration of lab exhaust air, effluent decontamination systems, and strengthened access controls and monitoring.

The 57 BSL3+ labs are evenly divided between government-run public health labs and university-based research labs, with 40 percent of labs in each category. 80% of BSL-3+ labs are in urban areas.

The most common pathogen studied in BSL-3+ labs is highly pathogenic avian influenza (HPAI). BSL-3+ labs have also been used to conduct research on novel pathogens such as the reconstruction of the 1918 influenza pandemic virus, as well as to conduct experiments to enhance the virulence or transmissibility of potential pandemic pathogens, more commonly known as 'gain of function' research.

However, there is limited national biosafety guidance, and no international guidance, on what constitutes BSL-3+. In addition, there has been little to no research demonstrating that these enhancements provide an adequate level of additional safety commensurate with the higher risk research conducted in these labs.

Assessing National Biorisk Management Governance

While COVID-19 demonstrated that all countries need a strong public health infrastructure to prepare for and respond to a pandemic, it is important to also ensure that pandemic preparedness activities are carried out safely, securely, and responsibly.

The Global BioLabs Initiative has developed a new method for assessing the strength of biorisk management governance—encompassing biosafety, biosecurity, and dual-use oversight—in each of the 27 countries that has, or plans to have, a BSL-4 lab. In 2022, the WHO endorsed biorisk management as an overarching concept for ensuring the responsible use of the life sciences.

The Global BioLabs Initiative's National Biorisk Management Scorecards are designed to provide concrete, quantifiable indicators of how well countries are implementing this concept. These scores are based primarily on whether a country has laws and regulations in place that address the metrics on our list. The scores cannot and should not be interpreted as evaluating how comprehensively or rigorously a country is implementing those laws and regulations or the level of compliance by labs on their territory. On the other hand, since these scores are based on national governance measures, they cannot capture biorisk management policies at lower levels of government or policies and practices within individual labs that are more stringent than national laws and regulations.

The National Biorisk Management Scorecards are based on 41 metrics: 18 for biosafety, 18 for biosecurity, and five for dual-use research. Our metrics were drawn from six international frameworks for biorisk management. Points for metrics were awarded based on publicly available, statutory measures; points were not awarded for guidance documents or voluntary guidelines. We found that biosafety governance was strongest followed by biosecurity while most countries scored poorly on oversight of dual-use research.

Biosafety

We assessed that 21 out of the 27 countries with BSL4 labs—roughly 80 percent—scored high on biosafety governance (see Table 1 in the appendix). Countries with high scores in biosafety have whole-of-government biosafety systems which includes national legislation, a dedicated entity responsible for enforcing this legislation, a national list of dangerous pathogens, whistleblower protection, comprehensive biosafety regulations, and a national biosafety

association. High-scoring countries also demonstrated a high level of engagement with international biosafety initiatives such as the WHO's Joint External Evaluations (JEE), the International Experts Group of Biosafety and Biosecurity Regulators (IEGBBR), and the Global Health Security Agenda (GHSA) Action Package Prevent-3 (APP3) on Biosafety and Biosecurity. Among the national biosafety regulations we evaluated, the weakest areas were the lack of requirements to maintain an inventory of pathogens and to use personnel protective equipment (PPE).

Biosecurity

We're doing less well on biosecurity. Only 12 out of the 27 countries with BSL-4 labs scored high, with 9 countries scoring medium, and 6 low (Table 2). Countries with high scores in biosecurity have whole-of-government biosecurity systems which included national legislation, a dedicated entity responsible for enforcing this legislation, a national list of dangerous pathogens, whistleblower protection, and comprehensive biosecurity regulations. High-scoring countries also demonstrated a high level of participation in international biosecurity initiatives such as the Biological Weapons Convention (BWC), United Nations Security Council Resolution 1540, the Australia Group, the Biosecurity Working Group (GP BSWG) of the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, the WHO's JEE, the IEGBBR, and the GHSA's APP3. The biggest gap in biosecurity regulations was in screening DNA orders for sequences related to dangerous pathogens—only two countries have such policies in place. Only 11 countries include cybersecurity in their biosecurity requirements and only 12 countries mandate biosecurity risk assessments.

Dual-Use Research Oversight

The picture is even worse for governance of dual-use research. Only 1 country, Canada, scored high (Table 3). Two others scored medium and the other 24 countries we studied all scored low. Many of the countries with a low score received zero points meaning they have no mandatory or voluntary measures to provide oversight of dual-use research in the life sciences. To achieve a high score, a country needs to have national legislation and a dedicated entity with national oversight responsibilities, conduct sustained awareness-raising activities, offer whistleblower protection, and stakeholders that have adopted voluntary self-governance measures.

Overall Assessment of Biorisk Management

Among the 27 countries with BSL-4 labs in operation or under development, only seven of them scored high on biorisk management overall (Table 4). Five countries scored low on biorisk management overall and the rest fell in the medium range. Many of the countries building new labs, some for the first time, scored poorly on biorisk management (marked in bold in Table 3). However, since these labs have not yet been built, there is still time to strengthen their national laws and regulations on biosafety, biosecurity, and dual-use research to bring them up to international standards.

Governance and Stability

The National Biorisk Management Scorecards provide a snapshot of the status of national legislation and regulations, but they do not provide evidence of how well these measures are being complied with or enforced in each country. To provide a general sense of the ability of countries with BSL-4 labs to effectively implement their biorisk management policies, we created two indexes. The Governance index assesses to what extent a country's political system is effective, equitable, accountable, and independent. The Stability index assesses the level of domestic and international conflict, government repression, terrorism, political stability, and perceived government legitimacy, among other factors. These indexes are based on data generated by the World Bank, Transparency International, Freedom House, and others.

In our report, we combined the Governance and Stability index scores to create a National Context score. As seen in Figure 1 in the appendix, there are significantly more operational BSL-4 labs in countries that have a combined National Context score greater than or equal to 50. However, BSL-4 labs planned or under-construction are disproportionately located in countries that score in the bottom half of the National Context ranking. This raises concerns about the ability of these countries to effectively implement new or existing biorisk management laws and regulations.

Key Recommendations

The following recommendations provide concrete steps that laboratories, national governments, non-governmental entities, and international organisations can take to strengthen biorisk management.

Laboratory Level

All labs, but particularly labs conducting high-consequence research, should cultivate a strong culture of safety, security, and responsible research. This does not just apply to BSL-4 labs; high-consequence work with pathogens is also being conducted at BSL3+ labs, and even lower containment level labs should also be nurturing a culture of safe, secure, and responsible working practices. This dedication to biorisk management should encompass all levels, from students and technicians to principal investigators and laboratory directors. Developing a culture of safe, secure, and responsible working practices is not a one-off event, but a continual effort.

A concrete step that labs conducting high-consequence work with pathogens can take to institutionalize the importance of biorisk management is to adopt the international standard for biorisk management known as ISO 35001.[2] This standard provides a template for establishing a management system to identify and mitigate safety and security risks as part of a continual improvement process. Since the standard is more concerned with the risk assessment and mitigation process than specific containment or security measures, it is compatible with existing national biosafety and biosecurity laws and regulations. For labs operating in countries without comprehensive biosafety and biosecurity laws and regulations, it provides a roadmap to best practices in biorisk management. The standard is low-hanging fruit since it has already been negotiated, is sitting on the shelf, and can be adopted by labs relatively quickly.

National Level

[2] "ISO 35001:2019 Biorisk management for laboratories and other related organisations," International Standards Organization, November 2019, https://www.iso.org/standard/71293.html

At the national level, all countries with high consequence biological research facilities should have whole-of-government biorisk management systems, including comprehensive laws, regulations, and institutions that require multidisciplinary risk assessments of proposed research for safety, security, and dual-use implications. The gold standard is a national-level government entity or entities with jurisdiction over public and private facilities that can enforce these laws and regulations.

In adopting, implementing, reviewing, and updating national laws, regulations and other measures on biosafety, biosecurity and dual-use research, states should consider incorporating relevant voluntary global standards on biorisk management including the 2022 WHO Global Guidance Framework for the Responsible Use of the Life Sciences,[3] the 2019 World Organization for Animal Health (WOAH) Guidelines for Responsible Conduct in Veterinary Research,[4] and the Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists.[5]

Standards for field biosafety are much less developed than for laboratory biosafety. Field biosafety policies and practices are designed to prevent researchers from becoming exposed to an infectious disease while collecting biomedical and environmental samples in the field and

[3] World Health Organization, *Global Guidance Framework for the Responsible Use of the Life Sciences: Mitigating Biorisks and Governing Dual-use Research* (Geneva: World Health Organization, 2022), https://apps.who.int/iris/rest/bitstreams/1463719/retrieve

[4] World Organization for Animal Health, *Guidelines for Responsible Conduct in Veterinary Research: Identifying, Assessing, and Managing Dual Use* (Paris: World Organization for Animal Health, 2019). https://www.woah.org/app/uploads/2021/03/a-guidelines-veterinary-research.pdf

[5] *Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists*, https://www.interacademies.org/sites/default/files/2021-07/Tianjin-Biosecurity-Guidelines-Codes-Conduct.pdf

handling wild animals. Few countries have national field biosafety standards and there is no international guidance available on this subject. As the Director of National Intelligence testified to Congress in February, "A lack of global field biosafety standards and protective measures continues to raise concerns of viral spillover worldwide. Increased interest in field sampling and advanced biological research since the onset of the COVID-19 pandemic, poor training, and lack of international inspection and standardized regulatory requirements have all been implicated in contributing to the risk of contamination and/or breaches in biocontainment."[6] Countries should develop field biosafety standards for zoonotic pathogens as a matter of priority.

Countries that do not already have a national biosafety association should encourage and support the creation of one by biosafety and biosecurity professionals. These non-governmental groups can provide valuable support to labs that conduct high-consequence research by providing training and professional certification, sharing best practices, and supporting the expansion of professional networks.

Countries with high consequence research facilities should also provide complete, regular, and transparent reporting as required by the annual confidence building measures of the BWC and under UN Security Council Resolution 1540. While most countries with BSL-4 facilities generally submit these documents, there is no international requirement mandating this information, and countries are not specifically encouraged to submit information on BSL3+ labs. Confidence-building information should be made publicly available by all countries. So far, only nine of the 20 countries with operational BSL-4 labs that submit confidence-building measures

[6] Office of the Director of National Intelligence, "Annual Threat Assessment of the U.S. Intelligence Community," February 6, 2023, https://www.dni.gov/files/ODNI/documents/assessments/ATA-2023-Unclassified-Report.pdf

make these reports public. Only 45 percent of the operational BSL-4 labs provide links to their publications on their institutional websites. It would not be difficult for governments and labs to increase transparency by making BWC CBMs publicly available since the existence of these facilities is not secret and nearly every BSL-4 laboratory has a website. This measure would strengthen international transparency and confidence, and it would assist further research to strengthen global biorisk management governance. Transparency is also the best antidote to disinformation. Such transparency is more important than ever given how biological research labs in multiple countries have become the targets of disinformation in recent years.

International Level

At the international level, current biorisk management efforts are fragmented across regulatory, public health, and nonproliferation domains with wide variation in the levels of resources and attention devoted to biosafety, biosecurity, and dual-use research oversight. There are few legally binding requirements in any of these three fields and even fewer mechanisms for ensuring compliance with such requirements.

We recommend a two-pronged strategy for strengthening global biological risk management: reinforcing multilateral institutions such as the WHO and the BWC while also capitalizing on the activities of less formal international groups active in this domain.

WHO's role in global biorisk management could be strengthened in at least three ways. First, WHO should use its convening and standard-setting powers to lead an effort to develop guidance on BSL3+ labs to ensure that the physical and procedural safety measures adopted by these labs are evidence-based and commensurate with the level of risk associated with the research they

conduct. Given the number of BSL3+ labs already in operation, the almost complete lack of national guidance on the type of enhancements that such labs need, and the lack of evidence-based research evaluating whether these enhancements provide increased protection commensurate with the level of risk of the research performed at these labs, we sorely need an international effort to specify the BSL-3+ category more clearly.

Second, the safe collection of samples from wild and domesticated animals that may be infected with a zoonotic pathogen is an underdeveloped component of biosafety. There is a great need for better guidance on field biosafety given ongoing and planned large-scale efforts to collect thousands of viral samples to identify novel zoonotic, and potentially pandemic, pathogens. WHO should lead an international effort to develop guidance for field biosafety applicable to Risk Group 4 pathogens and their most common animal reservoirs, hosts, and vectors. This guidance should be incorporated into the next edition of the WHO's Laboratory Biosafety Manual.

Third, WHO should establish collaborating centers for biorisk management in Africa, Southeast Asia, the Eastern Mediterranean, and the Western Pacific so that every WHO region has at least one such center. The purpose of these centers would be to conduct and sponsor applied research in field and laboratory biosafety and laboratory biosecurity, develop biorisk management policies and practices, provide training on biorisk management, assist with capacity-building programs, and serve as forums for exchanging information and sharing lessons learned among the key stakeholders. Together, these centers could form the basis for a WHO-supported 'Global Network for Biorisk Management' which could oversee the process of implementing the WHO's Global Guidance Framework for the Responsible Use of the Life Sciences at the individual, institutional, and national levels.

The BWC can also be leveraged to enhance biorisk management through increased transparency. Once WHO has provided guidance on the criteria for what constitutes a BSL3+ lab, the standard forms for submitting confidence building measures under the BWC should be amended to require declaration of these labs since they are capable of conducting high-consequence research and there is minimal transparency about them. The forms should also be amended to include whether declared labs comply with ISO 35001 or equivalent international standards related to biorisk management, what biorisk management policies are in place at the facility, and whether they have codes of conduct. The CBM forms should also be amended to include declaration of legislation, regulations and other measures relating to oversight of dual-use research as described in the WHO Global Guidance Framework for the Responsible Use of the Life Sciences. In addition, states should be required to provide a description of how they administer and enforce the full range of national implementation measures listed on the CBM forms.

Today's biological threats are too diverse, urgent, and complex to be held hostage by geopolitics and rigid diplomatic rules. The international community can supplement the traditional multilateralism embodied by WHO and the BWC with a minilateral approach.[7] Minilateralism is a collective action strategy that brings together the smallest number of countries that can have the greatest impact on an issue. Minilateralism seeks to create a 'coalition of the willing' with the capability and motivation to take substantive actions that multilateral institutions cannot or will not undertake because of political, legal, or resource constraints. By starting with a small core group of dedicated states, such a coalition can reach agreements on shared objectives more quickly and avoid problems posed by spoiler states and lowest common denominator outcomes.

[7] Gregory D. Koblentz and Filippa Lentzos, "A Plan B to Strengthen Biosafety and Biosecurity," *Think Global Health*, November 15, 2022, https://www.thinkglobalhealth.org/article/plan-b-strengthen-biosafety-and-biosecurity

As progress is made, such initiatives can expand in scope, raise their standards, and invite new members to join. These groups complement— rather than replace— multilateral regimes, such as the BWC and WHO.

Existing minilateral initiatives on biorisk management, including the International Experts Group of Biosafety and Biosecurity Regulators (IEGBBR), the Biosafety Level 4 Zoonotic Laboratory Network (BSL4ZNET), the European Research Infrastructure on Highly Pathogenic Agents (ERINHA), the Australia Group, the Global Health Security Agenda (GHSA), the Biological Security Working Group (BSWG) of the Global Partnership Against Weapons of Mass Destruction, and the International Federation of Biosafety Associations (IFBA), could advance widespread adoption of ISO 35001 by integrating implementation of the standard into their missions. To do so, these groups will need increased resources, revised mandates, and/or expanded authorities. It will also be necessary to improve coordination among these groups, and with multilateral institutions, in order to ensure that investments in biorisk management are properly prioritized.

To maximize the potential of ISO 35001, which like all ISO standards is designed to be validated by an outside entity, there should be an international mechanism to ensure compliance. While national regulators could act as the third-party, this would have limited credibility internationally, especially for jurisdictions without proven track records for transparency and accountability. Given its regulatory expertise, IEGBBR could take on the mission of auditing laboratory compliance with ISO 35001 using a peer-review model. Peer review is the systematic evaluation of the performance of a state by other states for the purpose of helping the reviewed state improve its policies and practices and comply with established international standards. IEGBBR would be able to sponsor not only in-depth reviews of national biorisk management

legislation, regulations, and institutions, but also laboratory-level management systems, policies, and practices as outlined in ISO 35001. A coordinated approach to enhancing global biorisk management that harnesses these minilateral groups to promote adoption and implementation of ISO 35001 would have a powerful synergistic effect.

Conclusion

The biological risk landscape is rapidly evolving and presents significant new challenges to preventing the accidental, reckless, or malicious misuse of biology. At the same time, oversight systems to ensure that life sciences research is conducted safely, securely, and responsibly are falling behind. An urgent overhaul to realign biorisk management with contemporary risks is needed.[8]

The recommendations offered here, and in greater detail in *Global Biolabs Report 2023*, are consistent with the goals of the 2018 National Biodefense Strategy issued by the Trump Administration and with the 2022 National Biodefense Strategy issued by the Biden Administration. Both of these strategies highlighted the need to strengthen biosafety and biosecurity and promote the responsible conduct of biological research to reduce the risks posed by advances in the life sciences and biotechnology.[9] Furthermore, these recommendations are

[8] Filippa Lentzos, Gregory D. Koblentz, and Joseph Rodgers, "The Urgent Need for an Overhaul of Global Biorisk Management," *CTC Sentinel*, Vol. 15, No. 4 (April 2022): 23-29, https://ctc.westpoint.edu/the-urgent-need-for-an-overhaul-of-global-biorisk-management/

[9] *National Biodefense Strategy* (Washington, DC: White House, 2018), 14-15; and *National Biodefense Strategy and Implementation Plan* (Washington, DC: White House, 2022), 10, viii-ix.

consistent with Executive Order 14081, "Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe and Secure American Bioeconomy," that was issued on September 12, 2022.[10] This executive order directed the Department of Health and Human Services to establish a Biosafety and Biosecurity Innovation Initiative that would oversee an interagency effort to "elevate biological risk management as a cornerstone of the life cycle of biotechnology and biomanufacturing R&D, including by providing for research and investment in applied biosafety and biosecurity innovation." At the international level, EO 14081 pledged the United States to work with other countries to develop and promote "biosafety and biosecurity best practices, tools, and resources bilaterally and multilaterally to facilitate appropriate oversight for life sciences, dual-use research of concern, and research involving potentially pandemic and other high-consequence pathogens, and to enhance sound risk management of biotechnology- and biomanufacturing-related R&D globally."

More countries are building high and maximum containment laboratories, developing dual-use biotechnologies, and conducting potentially risky research with pathogens. The dangers posed by an accidental or deliberate release of a pandemic-capable pathogen means that strengthening international oversight of high-consequence life sciences is critical. Given the growing complexity of the biorisk landscape and the geopolitical constraints on adopting a robust multilateral response, a concerted effort to harness existing informal international mechanisms, while laying the groundwork for future multilateral initiatives, offers the best chance to advance

[10] Executive Order 14081, "Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy," September 12, 2022, https://www.whitehouse.gov/briefing-room/presidential-actions/2022/09/12/executive-order-on-advancing-biotechnology-and-biomanufacturing-innovation-for-a-sustainable-safe-and-secure-american-bioeconomy/

collective action on ensuring that life sciences research around the world is conducted safely, securely, and responsibly. Achieving these objectives will require strong and active U.S. leadership.

Thank you for the opportunity to speak to you today and I would be pleased to answer any questions you may have.

APPENDIX

Table 1. Biosafety scores by country

Biosafety (% of 20 possible points)			
Country	Score	Country	Score
Australia	100	Kazakhstan	80
Canada	100	South Africa	80
France	95	Switzerland	80
Germany	95	Hungary	75
Japan	95	Republic of Korea	75
United States	95	Russian Federation	75
Brazil	90	Belarus	70
China	90	Czech Republic	55
Italy	90	Philippines	35
Singapore	90	India	25
Spain	90	Côte D'Ivoire	15
Taiwan	90	Gabon	15
United Kingdom	90	Saudi Arabia	5
Sweden	85		

Table 2. Biosecurity scores by country

Biosecurity (% of 18 possible points)			
Country	Score	Country	Score
France	100	Sweden	67
United States	100	Czech Republic	61
Australia	94	Belarus	50
Canada	94	Brazil	50
Japan	94	Germany	50
United Kingdom	94	Italy	33
China	83	Switzerland	33
Taiwan	78	India	28
Kazakhstan	72	Philippines	22
Republic of Korea	72	South Africa	22
Singapore	72	Saudi Arabia	11
Spain	72	Côte D'Ivoire	6
Hungary	67	Gabon	6
Russian Federation	67		

Table 3. Dual-use research oversight scores by country

Dual Use Research (% of 10 possible points)			
Country	Score	Country	Score
Canada	90	Kazakhstan	10
United Kingdom	50	Republic of Korea	10
United States	50	South Africa	10
Germany	40	Sweden	10
Australia	30	Belarus	0
Taiwan	30	China	0
Hungary	20	Czech Republic	0
Italy	20	Gabon	0
Japan	20	Philippines	0
Switzerland	20	Russian Federation	0
Brazil	10	Saudi Arabia	0
Côte D'Ivoire	10	Singapore	0
France	10	Spain	0
India	10		

Table 4. Overall biorisk management score by country

Overall Biorisk Management Score (% of 48 possible points)			
Country	Score	Country	Score
Canada	96	Republic of Korea	60
United States	88	**Brazil**	58
Australia	83	Russian Federation	56
United Kingdom	83	Italy	54
France	79	Switzerland	50
Japan	79	Belarus	48
Taiwan	73	Czech Republic	46
China	69	South Africa	44
Germany	67	India	23
Singapore	65	**Philippines**	23
Spain	65	**Côte D'Ivoire**	10
Kazakhstan	63	Gabon	8
Sweden	63	**Saudi Arabia**	6
Hungary	60		

Figure 1. Comparison of biorisk management scores with national context