

THE ROLE OF EQUITABLE PARTICIPATION AND RESOURCE  
DISTRIBUTION IN MITIGATING BIOLOGICAL RISKS

# Improving Practices in Biosecurity Investment

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# Executive Summary

Biosecurity is inherently a cooperative issue: biothreats readily affect and spread among all communities. Many interrelated axes of inequity abound, including wealth disparity, racial inequalities, and gender discrimination. Heightened vulnerability to biosecurity risks within any community increases the risk for all communities. As a result, equity is a fundamental consideration for effective biosecurity investment.

We analyze inequity through the lenses of biosecurity resource allocation and participation. By analyzing case studies on interventions like the COVID-19 Vaccines Global Access (COVAX) initiative and a comprehensive data review of models about biothreats, it becomes evident that investments in cooperative technology and research yield significant benefits. Retrospective analyses of successful attempts to incorporate diverse leadership engagement and peer-to-peer training programs demonstrate paths forward for equitable biosecurity participation.

To improve equity in biosecurity investments, we recommend that the World Health Organization (WHO) implement explicit compliance mechanisms to bolster technology sharing and reduce the likelihood of misuse. In addition, we recommend that biosecurity funding entities create grants specifically for research elucidating biothreat presentation and treatment in under-researched populations to expand capabilities and reduce dual-use risks. These recommendations are intended to increase the availability and effectiveness of treatments for vulnerable populations and additionally benefit non-vulnerable populations through increased efficiency in resource use.

To improve equity in biosecurity participation, we recommend a new Biological Weapons Convention (BWC) Confidence Building Measure (CBM) promoting equity and urge the inclusion of

equity commitments across international health and biosecurity organizations. These measures from large international and regional biosecurity bodies would result in improved commitment and discussion surrounding the importance of equity. We additionally propose that the BWC expand upon its Sponsorship Programme to include more financially excluded participants. Furthermore, we recommend the uptake of the Implementation Tool of Practical Interventions and Measuring Progress by biosecurity organizations to improve equity practices across the professional sector.

## BACKGROUND

We define systemic inequities in global health security as widespread disparities in health capabilities, resources, infrastructure, and responses both within and between countries. These disparities are largely caused by non-medical factors such as social, political, economic, and environmental conditions.<sup>1</sup> As a result, some regions of the world face heightened vulnerabilities and reduced capacities to prevent, detect, and respond to biological threats. Global biosecurity, which we define as the global effort to minimize accidental or deliberate misuse of biology that causes harm,<sup>2</sup> is a critical component of health security that is particularly weakened by these disparities. Although inequalities affect global biosecurity through various mechanisms, we focus on two key areas where equity investments could significantly reduce biological risks: distribution of biosecurity resources and investments and participation in leadership. First, we examine inequities in the distribution of COVID-19 vaccines to highlight gaps in outbreak responses that could impact the effectiveness of interventions for a biological event regardless of the source. Second, we discuss the systemic underrepresentation in international leadership to illustrate gaps in biosecurity decision-making processes.



The inequitable distribution of resources used for global health security and biosecurity interventions is well-documented at local, national, and international levels.<sup>3</sup> Healthcare spending is closely linked to a country's gross domestic product, and, within countries, access to quality health services often varies significantly across different communities.<sup>4,5</sup> A clear example of global health resource imbalance is seen in the distribution of COVID-19 vaccines. In November 2023, 80 percent of individuals in high-income countries (HICs) had received at least one dose of the vaccine, compared with about 34 percent in low-income countries (LICs).<sup>6</sup> Within LICs, wealthier communities consistently had earlier and better access to vaccines.<sup>7</sup> Disease models indicate that although HICs might benefit from greater COVID-19 immunity in the short term with vaccine inequity, the prolonged pandemic duration and increased likelihood of vaccine-resistance mutations in lower-middle-income countries (LMICs) will ultimately result in more infections and higher mortality rates in HICs over the long term.<sup>8</sup>

Equitable vaccine allocation models, on the other hand, demonstrated significantly reduced spread and decreased variant emergence.<sup>9</sup> Responses to deliberate and accidental releases of infectious biological threats necessitate a similar responsible equity in distribution on local and international levels to prevent catastrophic spread and disease mutation. In conjunction with reducing the potential of pandemic threats regardless of source, vaccine equity plays a crucial role in minimizing biosecurity hazards: resource sharing provides forums to discuss and mechanisms to establish regulations on potential misuse.<sup>10</sup> Furthermore, access to secure and well-controlled mechanisms of conducting research is paramount when investigating tools such as vaccines and treatment—increased funding given to lower resource communities and countries allows them to incorporate cost-prohibitive biosecurity practices and equipment.<sup>11</sup>

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The COVID-19 pandemic also revealed that each country responds to biological threats uniquely, highlighting the importance of local input aligned with international frameworks for effective responses. However, LMICs are often underrepresented in leadership roles for both biosecurity and health security research and translation activities,<sup>12</sup> leading to a lack of diverse perspectives and disjointed initiatives. This limited representation could indicate why the unique challenges and needs of LMICs are often inadequately addressed in global biosecurity strategies. The frequent resistance to and violation of WHO's COVID-19 protocols in sub-Saharan African LMICs suggest these measures may not align with people's lived realities.<sup>13</sup> For example, Ghana, recognizing that hunger posed a greater threat to vulnerable people than COVID-19 itself, did not fully adopt WHO protocols and kept urban markets open with strict hygiene controls.<sup>14</sup> If these considerations were integrated into global health leadership, international protocols could have been more effectively implemented at the community level to reduce the impacts of the pandemic.

These considerations are especially important in the response to deliberate biological attacks: an improved understanding of the needs of communities in the face of bioterror provides crucial context for the most informed methods of response. Of further importance, the supplication

of resources and support that fulfills the unique needs of a given community is likely to result in an increased community understanding of risks posed by biological threats and stronger support for preventative measures against deliberate attacks.

## DISCUSSION

Investments in equitable biosecurity encompass various approaches, such as direct resource distribution and biosecurity knowledge sharing. Providing resources to underserved populations can prevent disease spread and mutations, regardless of the source of the outbreaks. This is complemented by training initiatives and sustainable application methods to ensure long-term success.

### Biosecurity Investments

Although not a response to a deliberate biological attack, efforts to close the equity gap in access to risk mitigation resources during the COVID-19 pandemic serve as a notable case study for international collaboration in the face of biological threats. Although WHO's proposed Pandemic Agreement included equity as a guiding principle, significant criticism has been directed at the draft proposals for inadequately addressing true inequity.<sup>15,16</sup> The COVAX initiative led by the Coalition for Epidemic Preparedness Innovations (CEPI); Gavi, the Vaccine Alliance (Gavi); WHO; and the United Nations Children's Fund (UNICEF) aimed to bridge this gap by ensuring equitable vaccine distribution during the COVID-19 pandemic.<sup>17</sup> This alliance was a novel approach to addressing the inequitable distribution of global health resources,<sup>18,19</sup> and sets the stage for collaborative, well-regulated global vaccination efforts. Alongside funding, proactively sharing vaccines and vaccine technology allows global collaborators to set clear safeguards and rules for

research, limiting potential misuse and allowing proper analysis on dual-use potential.<sup>20</sup>

However, the benefits of such collaboration are so far unrealized: critics argue that COVAX failed to tackle the core source of vaccine inequity, because many countries lack the means to produce large numbers of vaccines due to technological and resource monopolies.<sup>21,22,23,24</sup> The demonstrated global impact of pandemic-potential viruses such as SARS-CoV-2 may result in an increased likelihood for the malevolent use of similar agents as weapons. These threats and other catastrophic release scenarios need to be met with an understanding of the necessity of unhindered global resource sharing and collaboration during biothreat responses.

Beyond resource deployment gaps, current scientific research on biothreat detection and response fails to adequately address equity. There is a well-known gender and sex medical research gap,<sup>25</sup> with increasing evidence suggesting high returns on investments in conducting more research on conditions affecting women.<sup>26</sup> Similar gaps exist in the medical research field, with discrimination and socioeconomic disparities leading to differential health outcomes for people of various ethnicities and races.<sup>27,28,29,30</sup> Despite this, the topic of underrepresented populations in biosecurity remains underexplored.<sup>31</sup> Many therapeutics have dosing requirements that ignore factors like sex and disability,<sup>32</sup> leading to potentially adverse or insufficient drug responses.<sup>33</sup> Diversifying research focus to improve understanding of clinical manifestations of biothreats across different sexes and communities would improve the identification of microbes and toxins in an attack or release.<sup>34</sup> Furthermore, it is important to recognize the risks this research might pose if done without appropriate biosafety and biosecurity standards.

## Biosecurity Participation

Increased community participation and knowledge sharing with underrepresented groups support sustainable interventions and provide unique perspectives on biorisk prevention.<sup>35</sup> These perspectives could serve to inform biosecurity research focused on identifying systems of best practices in improving organizational and nation biosecurity. For example, Stanford's Bio.Polis and the Nuclear Threat Initiative's Visibility Initiative for Responsible Science project engaged a diverse set of international biorisk experts to generate important insights into current best practices and potential improvements, but its focus on case studies on organizations based in HICs leaves space for further research related to applicable practices in resource-limited areas.<sup>36</sup>

Overall, increasing community buy-in, incorporating diverse perspectives for solution ideation,<sup>37</sup> and ensuring equitable representation in global health leadership are crucial for enhancing biosecurity programs related to threat identification and research risk communication. These advances alongside resource equitability lead to improvements in data sharing,<sup>38</sup> risk reduction activities,<sup>39</sup> and education.<sup>40</sup> For example, in 2022, the Australian Government convened the Aboriginal and Torres Strait Islander Advisory Group on COVID-19 to provide insight into pandemic preparedness and response. This ensured that the implementation of national-level actions to address the emerging threat was locally led and culturally safe, with community acceptance and agreement.<sup>41</sup> The measures overseen by this group were effective in protecting Australian Indigenous peoples from adverse outcomes compared to Indigenous communities globally, who were disproportionately affected by the pandemic.<sup>42,43,44</sup>

Biosecurity organizational structures and intervention programs have demonstrated success by partnering with communities to develop

technology and expertise.<sup>45</sup> Organizations such as the Africa Centres for Disease Control have multiple programs that focus on meeting Member State needs at regional levels.<sup>46,47,48</sup> Professional-level initiatives such as the International Federation of Biosafety Associations' (IFBA) Global Mentorship Program, a south-to-south biosecurity peer mentoring program, highlight professional mobilization opportunities for women.<sup>49</sup> Mentorship programs like these have been demonstrated to increase the uptake of biosafety and pathogen accounting practices.<sup>50</sup> Additionally, these programs connect national and subnational laboratories with international entities such as the BWC, Global Health Security Initiative (GHSI), and the WHO, providing opportunities for improved bidirectional communication.<sup>51</sup> These international entities can support commitment to these programs by explicitly stating their commitment to improving equity in biosecurity.

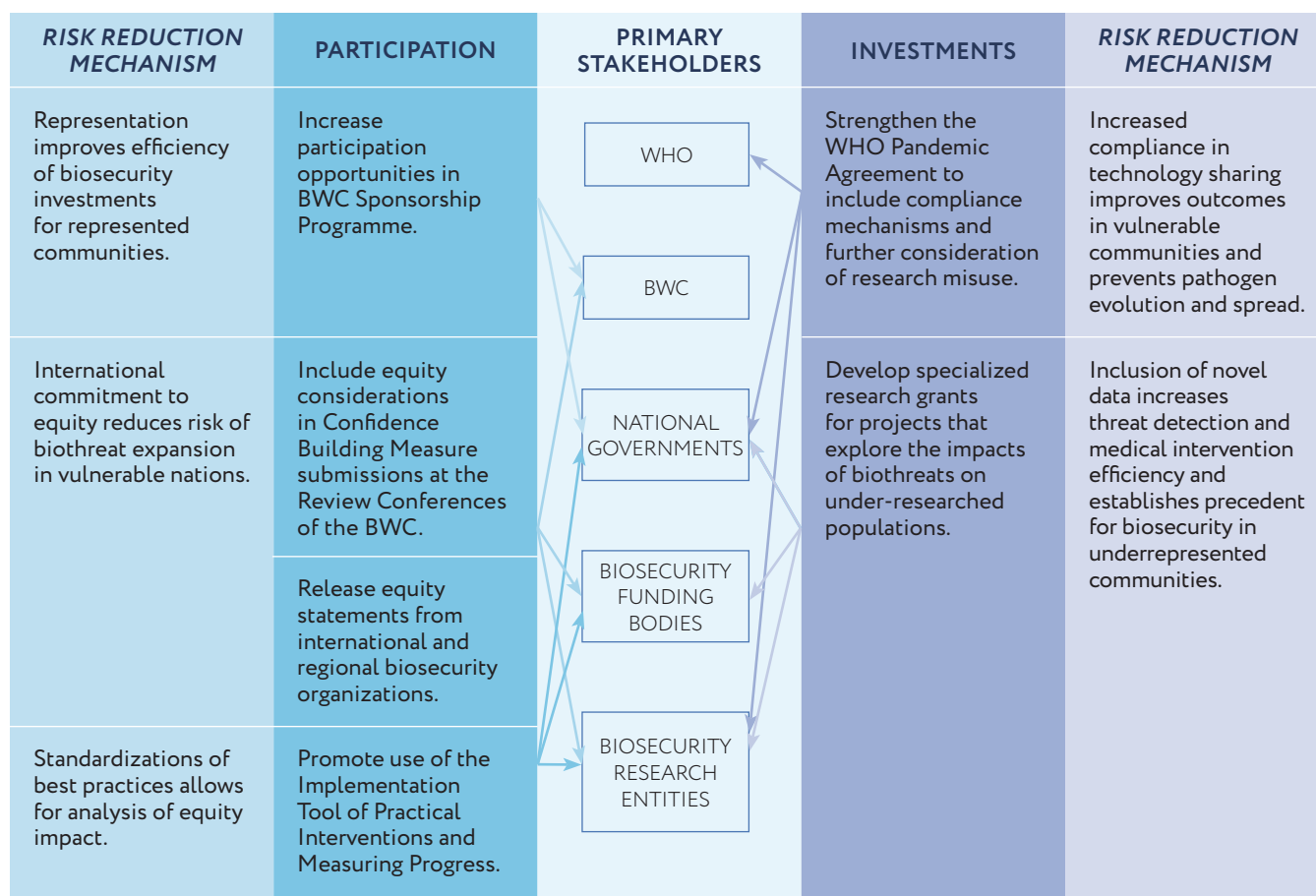
## RECOMMENDATIONS

Equitable biosecurity investments can be implemented across various sectors and stages of risk reduction. We outline six recommendations, categorized into improved participation and improved interventions, for international organizations, national governments, and funding bodies. Figure 1 depicts a summary of these recommendations.

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**Figure 1.** Summary of recommendations and identification of primary stakeholders and acting entities.

## To Improve Participation

### Expand Confidence Building Measure for the BWC

Strengthening inclusive dialogue is critical for developing diversified and competent security and health programs.<sup>52,53,54</sup> The BWC is an influential international biosecurity organization that coordinates a system of CBMs. This standardized set of outcomes is intended to promote transparency and coordination between countries.<sup>55</sup>

**We recommend including an expanded CBM requirement: the declaration of measures for the promotion of diversity, equity, and inclusion.** This

initiative would underscore the BWC's dedication to equity, fostering inclusive international dialogue on inequities. Acknowledging the existing shortcomings of the current CBM form, including limited submission rates from some States Parties, and the added difficulty a further CBM requirement would bring, we propose that these are outweighed by the potential benefits, and that including equity considerations may even incentivize further submissions. It would broaden perspectives essential for biosecurity, highlight research opportunities, and lay the foundation for future international guidelines by identifying existing equity measures and information gaps.

## Strengthened International Statements from Leaders in Biosecurity

Biosecurity stakeholders must prioritize equity as an international norm to drive lasting change. This effort should be spearheaded by clear, resolute international collaborative statements affirming equity as a priority. Political declarations have proven effective in other areas of global health and have been successful in advancing inclusion and equity in nuclear security.<sup>56,57,58</sup> **We propose further calls from leading bodies for commitment to equity and its relevance in biosecurity.** These should come from international partnerships such as the GHSI and Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, along with regional bodies that have yet to make statements, such as the European Centre for Disease Prevention and Control. These calls should urge member nations and organizations to diversify the biosecurity workforce, setting clear targets for equitable hiring and education. Promoting equity as a fundamental pillar in international biosecurity is essential for maintaining momentum in implementing inclusive strategies going forward.

## Promote the Use of the IFBA Implementation Tool

Global guidance is essential to establish clear, standardized methods and benchmarks for advancing equity in biosecurity participation, as seen in other fields.<sup>59,60,61,62</sup> **We encourage increased worldwide use of the Implementation Tool of Practical Interventions and Measuring Progress,** created by IFBA in collaboration with international experts. Tailored for organizations dealing with hazardous biological materials, this tool sets specific, measurable equity targets and indicators pertinent to the biosecurity context. Embracing this tool on a global scale can foster inclusive biosecurity participation and effective practice.

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## Expand the BWC Sponsorship Programme

Active participation at the international level is pivotal for promoting equity in biosecurity initiatives. The BWC has encountered challenges in embracing diverse perspectives, with limited attendance and CBM submissions from developing states. To address this issue, the BWC Sponsorship Programme provides financial support from States Parties to facilitate the attendance of participants from developing countries at review conferences and intersessional meetings.<sup>63</sup> **We propose the expansion of the BWC Sponsorship Programme to include participants from all States Parties that are precluded from attendance due to financial constraints for each meeting.** This expansion would depend on fiscal investment of voluntary contributions mainly from HICs, who should recognize the benefit to both investors and included participants. By broadening access to these crucial gatherings, the expansion would foster greater representation from diverse stakeholders, thereby enriching discussions and decision-making processes. It acknowledges the inherent interdependence of nations in combating biological threats and recognizes that meaningful engagement from diverse actors is essential for crafting comprehensive and effective strategies.



## To Improve Investments

### Fund Systems for Medical Countermeasure Research Data Gaps

**We recommend that national governments and funding bodies interested in biosecurity develop specialized research grants and opportunities for projects that explore the impacts of medical countermeasures and known biothreats on under-researched populations.** These grants should provide funding earmarked for projects that expand upon current understandings of biothreat disease presentation and response in women, communities of various races, pregnant people, older and younger people, and people with disabilities. This research represents a high-yield investment for parties interested in lowering biorisk because studies could be conducted exploring existing treatments and diagnostic devices in novel populations. Directly testing potentially dangerous pathogens and toxins in humans would pose a significant biosecurity risk; grants can focus on proxy models or identifying conversion factors between existing data sets and underrepresented populations. These grants represent a substantial opportunity to fund biosecurity research that adheres to international biosafety and biosecurity standards and should include all efforts to identify and mitigate potential dual-use risks. Regulations related to the success of such medical countermeasures have not thus far been standardized—novel research spurred by interest and funding focused on equity brings the additional benefit of bolstering security and safety capacities.

The benefits of establishing such grants are multifold. First, the generated data can be used to improve biosurveillance and diagnostic capabilities through increased likelihood of early identification in vulnerable populations. Second, treatment specification guidelines can be revised to be more tailored to patients of different populations, reducing the risk factors

associated with over- or under-dosing as well as incorrect therapeutic selection. Third, supporting researchers interested in work elucidating data on underrepresented communities is likely to promote equity from a bottom-up perspective: members of underrepresented populations are positioned to be experts in engagement and research for their own communities. This emphasis on supporting research will bolster the abilities of scientists from a diversity of demographics to advocate for their own communities. Finally, this support will foster an understanding of biosecurity standards within these scientific communities, lowering the risk of research misuse. Access to the funds required to responsibly investigate biological response mechanisms coupled with firm communication on the biosecurity implications and regulations of such research will set the precedent of future research conducted by and for these community members.

### Strengthen the WHO Pandemic Agreement

The World Health Assembly has yet to pass an official WHO Pandemic Agreement; however, much of the currently drafted text for the agreement directly addresses equity achieved through technology sharing, transparency, cross-national training, and resource pooling.<sup>64</sup> As currently proposed, this system is fraught with ambiguity, remains lacking in specific accountability mechanisms and obligations, and hence is likely to fall short of becoming effective in reducing the targeted inequities.<sup>65,66,67</sup> Inbuilt enforcement mechanisms are the only proven factor to improve the success of an international treaty.<sup>68,69</sup> Although we agree that passing a unified committed agreement as soon as possible will improve international health security, **we recommend that WHO member states strengthen the agreement's language related to direct technology and information availability to include specified compliance mechanisms alongside systems to prevent technology misuse.** Current

iterations of the agreement leave extended room for technology developers and member states to ignore knowledge sharing to protect profitability from patent ownership and licensing. The lack of a firm stance highlighting the need for rapid, fully structured technology sharing severely weakens the agreement's potential to empower vulnerable member states with necessary means of diagnostic and countermeasure production.<sup>70</sup> Proactive knowledge sharing and international capacity building through a central body poses the additional benefit of allowing member states to set responsible guidelines together for preventing misuse and safeguarding research. It is vital that lifesaving technology is accessible: in the face of dual-use risks, trust between research communities, governments, and citizens has to be established by actively demonstrating a commitment to safely and equitably providing medical resources.

## CONCLUSION

Persistent systemic inequities weaken the optimal prioritization and effective implementation of biosecurity interventions. As equity considerations gain momentum in shaping biosecurity investments, it becomes imperative to address the participation of marginalized groups in decision-making processes, along with appropriately distributing biosecurity and biosafety resources. However, strategies at the international, national, and organizational levels have met with varied success, and insufficiencies persist. Inequitable access to biosecurity technology remains the norm, diminishing overall global security.

To address these challenges, we promote a dual approach, comprising six measures that strengthen the engagement of marginalized and underrepresented groups within organizational frameworks while promoting equitable implementation of biosecurity practices. This approach offers a comprehensive strategy to address systemic inequities. To foster inclusive organizational cultures, we advocate for facilitating international dialogue and establishing standardized guidelines. Additionally, validated funding mechanisms and robust accountability frameworks are crucial for ensuring equitable resource allocation.

Leadership at the international level is essential for sustainable change. Leveraging its central position in the biosecurity domain, we recommend the BWC should spearhead efforts to promote inclusive investment. This can be achieved through initiatives such as expanding its Sponsorship Programme and designating parties accountable for equitable practice.

The resource allocation response to the COVID-19 pandemic underscores the urgency of addressing the systemic inequities that compromise global biosecurity. The current landscape presents a unique opportunity to implement impactful measures that reduce these unacceptable disparities. A concerted focus on the intersection between biosecurity and inequity is paramount: strengthening equity programs is essential for advancing science and security. We must seize these effective opportunities for action to forge a safer and more secure future.

# Appendix

## ABBREVIATIONS

BWC	Biological Weapons Convention
CBM	Confidence Building Measure
CEPI	Coalition for Epidemic Preparedness Innovations
COVAX	COVID-19 Vaccines Global Access
COVID-19	SARS-CoV-2
Gavi	Gavi, the Vaccine Alliance
GHSI	Global Health Security Initiative
HIC	high-income country
IFBA	International Federation of Biosafety Associations
LIC	low-income country
LMIC	lower-middle-income country
UNICEF	United Nations Children's Fund
WHO	World Health Organization

# Endnotes

1. James N. Weinstein, Amy Geller, Alina Baciú, and Yamrot Negussie, *Communities in Action: Pathways to Health Equity* (Washington, DC: The National Academies Press, 2017).
2. Véronique Renault, Marie-France Humblet, and Claude Saegerman, "Biosecurity Concept: Origins, Evolution and Perspectives," *Animals* 12, no. 1 (2021): 63, <https://doi.org/10.3390/ani12010063>.
3. Ritu Priya, John Porter, Unnikrishnan Pappayappallimana, Amithabha Sarkar, Sayan Das, and Liz Maria Kuriakose, "Universalising Health Coverage or Crisis? Contours of the Challenges and Solutions," Research Gate, July 2023, [https://www.researchgate.net/publication/372389690\\_universalising\\_health\\_coverage\\_or\\_crisis\\_contours\\_of\\_the\\_challenges\\_and\\_solutions](https://www.researchgate.net/publication/372389690_universalising_health_coverage_or_crisis_contours_of_the_challenges_and_solutions).
4. Javier Roberti, Hannah H. Leslie, Svetlana V. Doubova, Jesús Medina Raniilla, Agustina Mazzoni, Laura Espinoza, Renzo Calderón, Catherine Arsenault, Ezequiel García-Elorrio, and Patricia J. García, "Inequalities in Health System Coverage and Quality: A Cross-Sectional Survey of Four Latin American Countries," *The Lancet Global Health* 12, no. 1 (January 1, 2024): e145–55, [https://doi.org/10.1016/s2214-109x\(23\)00488-6](https://doi.org/10.1016/s2214-109x(23)00488-6).
5. Nicholas Ngepah and Ariane E. N. Mouteyica, "Factors Influencing Inequality in Government Health Expenditures within African Regional Economic Communities," *BMC Health Services Research* 24, no. 1 (March 7, 2024), <https://doi.org/10.1186/s12913-024-10783-w>.
6. Max Roser and Hannah Ritchie, "Coronavirus Disease (COVID-19)," *Our World in Data* 1, no. 1 (March 4, 2020), <https://ourworldindata.org/coronavirus>.
7. M. A. Rifat, Md. Nazmul Huda, Ateeab Ahmad Parray, Uday Narayan Yadav, Rashidul Alam Mahmud, ARM Mehrab Ali, and Sabuj Kanti Mistry, "Global COVID-19 Vaccine Equity and the Booster Dose in Low-Resource Countries: A Decolonizing Global Health Perspective," *Global Biosecurity* 4, no. 1 (August 2, 2022), <https://doi.org/10.31646/gbio.160>.
8. Håvard Thorsen Rydland, Joseph Friedman, Silvia Stringhini, Bruce G. Link, and Terje Andreas Eikemo, "The Radically Unequal Distribution of COVID-19 Vaccinations: A Predictable Yet Avoidable Symptom of the Fundamental Causes of Inequality," *Humanities and Social Sciences Communications* 9, no. 1 (February 23, 2022): 1–6, <https://doi.org/10.1057/s41599-022-01073-z>.
9. Yang Ye, Qingpeng Zhang, Xuan Wei, Zhidong Cao, Hsiang-Yu Yuan, and Daniel Dajun Zeng, "Equitable Access to COVID-19 Vaccines Makes a Life-Saving Difference to All Countries," *Nature Human Behaviour* 6 (2022): 207–16, <https://doi.org/10.1038/s41562-022-01289-8>.
10. Chris Isaac, *Review of NTI Seminar: Dr. Margaret Hamburg on COVID-19 Vaccines, Therapeutics, and the Biosecurity Nexus* (Nuclear Threat Initiative, January 6, 2021), <https://www.nti.org/atomic-pulse/nti-seminar-dr-margaret-hamburg-covid-19-vaccines-therapeutics-and-biosecurity-nexus/>.
11. Yuki Maehira and Robert C. Spencer, "Harmonization of Biosafety and Biosecurity Standards for High-Containment Facilities in Low- and Middle-Income Countries: An Approach from the Perspective of Occupational Safety and Health," *Frontiers in Public Health* 7, no. 249 (September 2019), <https://doi.org/10.3389/fpubh.2019.00249>.
12. Marian Abouzeid, Ahlam Muthanna, Iman Nuwayhid, Fadi El-Jardali, Phil Connors, Rima R. Habib, Shahram Akbarzadeh, and Samer Jabbour, "Barriers to Sustainable Health Research Leadership in the Global South: Time for a Grand Bargain on Localization of Research Leadership?" *Health Research Policy and Systems* 20, no. 1 (December 19, 2022), <https://doi.org/10.1186/s12961-022-00910-6>.
13. Tebogo Sebeelo, "Diffracting the Global: Exploring the Implementation of WHO's COVID-19 Protocols in Sub-Saharan Africa," *Insight on Africa*, 15, no. 2 (January 7, 2023), <https://doi.org/10.1177/09750878221135078>.
14. Lewis Abedi Asante and Richael Odarko Mills, "Exploring the Socio-Economic Impact of COVID-19 Pandemic in Marketplaces in Urban Ghana," *Africa Spectrum* 55, no. 2, (July 24, 2020): 170–81, <https://doi.org/10.1177/0002039720943612>.
15. "The Pandemic Treaty: Shameful and Unjust," *The Lancet* 403, no. 10429 (March 2, 2024): 781, [https://doi.org/10.1016/s0140-6736\(24\)00410-0](https://doi.org/10.1016/s0140-6736(24)00410-0).
16. Colin Carlson, Daniel Becker, Christian Happi, Zoe O'Donoghue, Tulio de Oliveira, Samuel O. Oyola, Timothée Poisot, Stephanie Seifert, and Alexandra Phelan, "Save Lives in the Next Pandemic: Ensure Vaccine Equity Now," *Nature* 626, no. 8001 (February 23, 2024): 952–53, <https://doi.org/10.1038/d41586-024-00545-3>.
17. "COVAX: Key Learnings for Future Pandemic Preparedness and Response," Gavi, the Vaccine Alliance, September 2022.
18. David Bell, Garrett W. Brown, Wellington A. Oyibo, Samiratou Ouédraogo, Blagovesta Tacheva, Elena Barbaud, Andreas Kalk, Valéry Ridde, and Elisabeth Paul, "COVAX—Time to Reconsider the Strategy and Its Target," *Health Policy Open* (April 1, 2023): 100096, <https://doi.org/10.1016/j.hpopen.2023.100096>.
19. Tania Manriquez Roa, Felicitas Holzer, Florencia Luna, and Nikola Biller-Andorno, "Expert Views on COVAX and Equitable Global Access to COVID-19 Vaccines," *International Journal of Public Health* 66 (December 30, 2021), <https://doi.org/10.3389/ijph.2021.1604236>.
20. James Revill and Guilo Mancini, in *Education and Ethics in the Life Sciences: Strengthening the Prohibition of Biological Weapons*, ed. Brian Rappert, 165–96 (Canberra: ANU E Press, 2010). <https://press-files.anu.edu.au/downloads/press/p51221/pdf/ch091.pdf>.
21. Fatima Hassan, Gavin Yamey, and Kamran Abbasi, "Profiteering from Vaccine Inequity: A Crime against Humanity?" *BMJ* (August 16, 2021): n2027, <https://doi.org/10.1136/bmj.n2027>.



22. Siddhanth Sharma, Nisrine Kawa, and Apoorva Gomer, "WHO's Allocation Framework for COVAX: Is It Fair?" *Journal of Medical Ethics* 48, no. 7 (2022): 434–38, <https://doi.org/10.1136/medethics-2020-107152>.
23. "Countries Obstructing COVID-19 Patent Waiver Must Allow Negotiations," MSF Médecins Sans Frontières (MSF) International, March 9, 2021.
24. Sharifah Sekalala, Lisa Forman, Timothy Hodgson, Moses Mulumba, Hadijah Namyalo-Ganafa, and Benjamin Mason Meier, "Decolonising Human Rights: How Intellectual Property Laws Result in Unequal Access to the COVID-19 Vaccine," *BMJ Global Health* 6, no. 7 (July 2021): e006169, <https://doi.org/10.1136/bmjgh-2021-006169>.
25. Vanessa Di Lego and Ignaz Seipel Platz, "Uncovering the Gender Health Data Gap," *Perspectives Cad. Saúde Pública* 39, no. 7 (2023): 65423, <https://doi.org/10.1590/0102-311XEN065423>.
26. Carolee Lee, "The Gender Gap in Health Research Funding Is Hurting All of Us," Northwell Health, <https://www.northwell.edu/katz-institute-for-womens-health/articles/gender-gap-in-health-research>.
27. Brandon E. Turner, Jecca R. Steinberg, Brannon T. Weeks, Fatima Rodriguez, and Mark R. Cullen, "Race/Ethnicity Reporting and Representation in US Clinical Trials: A Cohort Study," *The Lancet Regional Health—Americas* 11 (April 2022): 100252, <https://doi.org/10.1016/j.lana.2022.100252>.
28. Charlotte Edmond, "How Can We Remove Racial Bias from the Future of Healthcare?," World Economic Forum, February 8, 2024.
29. Brandon E. Turner, Jecca R. Steinberg, Brannon T. Weeks, Fatima Rodriguez, and Mark R. Cullen, "Race/Ethnicity Reporting and Representation in US Clinical Trials: A Cohort Study," *The Lancet Regional Health—Americas* 11 (April 2022): 100252, <https://doi.org/10.1016/j.lana.2022.100252>.
30. National Institute on Minority Health and Health Disparities, "Diversity and Inclusion in Clinical Trials," NIMHD, 2023, <https://www.nimhd.nih.gov/resources/understanding-health-disparities/diversity-and-inclusion-in-clinical-trials.html>.
31. MCDP Temporary Working Group, "From Concept to Confidence and Uptake: Involving Communities in Development and Delivery of Medical Countermeasures for Health Emergencies," Issue Paper 2, Ministry of Foreign Affairs, Japan (December 20, 2023), <https://www.mofa.go.jp/mofaj/files/100620759.pdf>.
32. Amesh A. Adalja, "Biothreat Agents and Emerging Infectious Disease in the Emergency Department," *Emergency Medicine Clinics of North America* 36, no. 4 (November 2018): 823–34, <https://doi.org/10.1016/j.emc.2018.06.011>.
33. Irving Zucker and Brian J. Prendergast, "Sex Differences in Pharmacokinetics Predict Adverse Drug Reactions in Women," *Biology of Sex Differences* 11, no. 1 (June 5, 2020), <https://bsd.biomedcentral.com/articles/10.1186/s13293-020-00308-5>.
34. Jennifer Corbin, interview with the authors, May 3, 2024.
35. Jennifer Tsai, Laura Ucik, Nell Baldwin, Christopher Hasslinger, and Paul George, "Race Matters? Examining and Rethinking Race Portrayal in Preclinical Medical Education," *Academic Medicine* 91, no. 7 (July 2016): 916–20, <https://doi.org/10.1097/acm.0000000000001232>.
36. Daniel Greene, Kathryn Brink, Melissa Salm, Connor Hoffmann, Samuel Evans, and Megan Palmer, *The Biorisk Management Casebook: Insights into Contemporary Practices* (Stanford Digital Repository, 2023), <https://doi.org/10.25740/hj505vf5601>.
37. Kristen L. Eckstrand, Jennifer Eliason, Tiffani St. Cloud, and Jennifer Potter, "The Priority of Intersectionality in Academic Medicine," *Academic Medicine* 91, no. 7 (July 2016): 904–7, <https://doi.org/10.1097/acm.0000000000001231>.
38. Philip E. Hulme, Jacqueline R. Beggs, Rachelle N. Binny, Jonathan P. Bray, Naomi Cogger, Manpreet K. Dhami, Susanna C. Finlay-Smiths, et al., "Emerging Advances in Biosecurity to Underpin Human, Animal, Plant, and Ecosystem Health," *iScience* 26, no. 9 (September 15, 2023): 107462, <https://doi.org/10.1016/j.isci.2023.107462>.
39. Paul Alexander Royce, "Biosecurity through Community Engagement: A Case Study of Rural Agricultural Region," PhD thesis, Charles Darwin University, April 25, 2011, <https://www.proquest.com/docview/260687891>.
40. Paul Royce, "Using a Community Approach to Foster Effective Biosecurity Practices across Social Borders," In *Managing Biosecurity across Borders*, ed. Ian Falk, Ruth Wallace, and Marthen L. Ndoen, 93–107 (Dordrecht, Netherlands: Springer), [https://doi.org/10.1007/978-94-007-1412-0\\_5](https://doi.org/10.1007/978-94-007-1412-0_5).
41. Meru Sheel, interview with the authors, May 17, 2024.
42. Kristy Crooks, Dawn Casey, and James S. Ward, "First Nations Peoples Leading the Way in COVID-19 Pandemic Planning, Response and Management," *Medical Journal of Australia* 213, no. 4 (July 20, 2020): 151, <https://doi.org/10.5694/mja2.50704>.
43. Nicholas Steyn, Rachelle Binny, Kate Hannah, Shaun C. Hendy, Alex James, Tahu Kukutai, Audrey Lustig, et al., "Estimated Inequities in COVID-19 Infection Fatality Rates by Ethnicity for Aotearoa New Zealand," *New Zealand Medicine Journal* 133, no. 1521 (September 4, 2020): 28–39.
44. Teshia G. Arambula Solomon, Rachel Rose Bobelu Starks, Agnes Attakai, Fatima Molina, Felina Cordova-Marks, Michelle Kahn-John, Chester L. Antone, Miguel Flores, and Francisco Garcia, "The Generational Impact of Racism on Health: Voices from American Indian Communities," *Health Affairs* 41, no. 2 (2022): 281–88, <https://doi.org/10.1377/hlthaff.2021.01419>.
45. Elizeus Rutebemberwa, Fortress Yayra Aku, Eva Inam Kayed, and Hedia Inam Bellali, "Reasons for and Barriers to Biosafety and Biosecurity Training in Health-Related Organizations in Africa, Middle East and Central Asia: Findings from GIBACHT Training Needs Assessments 2018–2019," *Pan African Medical Journal* 37 (2020), <https://doi.org/10.11604/pamj.2020.37.64.23390>.

46. Jean Kaseya, "Africa CDC Strategic Plan 2023–2027," Africa CDC, September 2, 2023, <https://africacdc.org/download/africa-cdc-strategic-plan-2023-2027>.
47. "Report on the Consultative Process to Identify Priorities for Strengthening Biosafety and Biosecurity," Africa Centres for Disease Control and Prevention (Africa CDC), May 2021, <https://africacdc.org/download/africa-cdc-biosafety-and-biosecurity-initiative-report-on-the-consultative-process-to-identify-priorities-for-strengthening-biosafety-and-biosecurity>.
48. Corey Meyer, interview with the authors, May 10, 2024.
49. Stephanie Marie Norlock, Patrick W. Okanya, Anastasia Trataris, Michael E. Hildebrand, Jean de Dieu Baziki, Imane Belkourati, and Maureen Ellis, "South-to-South Mentoring as a Vehicle for Implementing Sustainable Health Security in Africa," *One Health Outlook* 3, no. 1 (October 6, 2021), <https://doi.org/10.1186/s42522-021-00050-x>.
50. Doris Bota, Albert Bunyasi, Angela Amayo, Jedida Wangari Wachira, and Jacob Onyango Okello, "Strengthening Medical Laboratory Systems in Kenya: An Innovative Biosafety Training Model," *Applied Biosafety* (April 5, 2021), <https://doi.org/10.1089/apb.20.0072>.
51. Nidia E. Lucero and Faustino Siñeriz, "The Argentine Experience in Enhancing Biosafety through Good Laboratory Practices," *Asian Biotechnology and Development Review*, January 1, 2005.
52. Alina Rocha Menocal, Greg Power, and Olivia Kaye, "Promoting Inclusive Governance More Effectively: Lessons From the Dialogue for Stability Programme," *Journal of Peacebuilding and Development* 14, no. 1 (April 2019): 84–89, <https://doi.org/10.1177/1542316619835121>.
53. Joan Rohlfing, Samantha Pitts-Keifer, and Andrew J. Bieniawski, "Global Dialogue on Nuclear Security Priorities: Building an Effective Global Nuclear Security System," Nuclear Threat Initiative (March 1, 2016), [https://www.nti.org/wp-content/uploads/2016/03/global\\_dialogue\\_report\\_final.pdf](https://www.nti.org/wp-content/uploads/2016/03/global_dialogue_report_final.pdf).
54. Sabrina Brizee, Katherine Budeski, Wilmot James, Michelle Nalabandian, Diederik A. Bleijs, Scott J. Becker, Sacha Wallace-Sankarsingh, et al., "Accelerating Action in Global Health Security: Global Biosecurity Dialogue as a Model for Advancing the Global Health Security Agenda," *Health Security* 17, no. 6 (December 1, 2019): 495–503, <https://doi.org/10.1089/hs.2019.0121>.
55. Marie Isabelle Chevrier and Iris Hunger, "Confidence-Building Measures for the BTWC: Performance and Potential," *The Nonproliferation Review* 7, no. 3 (September 2000): 24–42, <https://doi.org/10.1080/10736700008436823>.
56. Richard Horton, "Offline: Political Declarations—Clichés and Lies," *The Lancet* 402, no. 10407 (September 1, 2023): 1028–28, [https://doi.org/10.1016/s0140-6736\(23\)02023-8](https://doi.org/10.1016/s0140-6736(23)02023-8).
57. David G. Victor, "The Use and Effectiveness of Nonbinding Instruments in the Management of Complex International Environmental Problems," American Society of International Law, *Proceedings of the 116th Annual Meeting*, 91 (January 1, 1997): 241–50, <https://doi.org/10.1017/s0272503700065782>.
58. International Atomic Energy Agency, "International Conference on Nuclear Security: Sustaining and Strengthening Efforts," January 10, 2019, <https://www.iaea.org/events/nuclear-security-conference-2020>.
59. Jennifer Gaudioso, Lisa Astuto Gribble, and Reynolds M. Salerno, "Biosecurity: Progress and Challenges," *Journal of the Association for Laboratory Automation* 14, no. 3 (June 2009): 141–47, <https://doi.org/10.1016/j.jala.2009.01.001>.
60. Robert C. Johansen, "Developing a Grand Strategy for Peace and Human Security: Guidelines from Research, Theory, and Experience," *Global Governance: A Review of Multilateralism and International Organizations* 23, no. 4 (August 19, 2017): 525–36, <https://doi.org/10.1163/19426720-02304001>.
61. "Advancing Gender Parity in Nuclear Security," World Institute for Nuclear Security, March 23, 2021, <https://www.wins.org/document/advancing-gender-parity-in-nuclear-security>.
62. Sundiatu Dixon-Fyle, Kevin Dolan, Vivian Hunt, and Sara Prince, "Diversity Wins: How Inclusion Matters," McKinsey & Company, May 19, 2020, <https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters>.
63. Kathryn Millett, "Financial Woes Spell Trouble for the Biological Weapons Convention," *Health Security* 15, no. 3 (June 2017): 320–22, <https://doi.org/10.1089/hs.2017.0030>.
64. Nirmalya Syam, "The WHO CA+ Discussions on Pathogen Access and Benefit Sharing: State of Play," Policy Brief, The South Centre, December 14, 2023, [https://www.southcentre.int/wp-content/uploads/2023/12/pb123\\_the-who-caplus-discussions-on-pathogen-access-and-benefit-sharing\\_en.pdf](https://www.southcentre.int/wp-content/uploads/2023/12/pb123_the-who-caplus-discussions-on-pathogen-access-and-benefit-sharing_en.pdf).
65. Nina Schwalbe, Elliot Hannon, Lynda Gilby, and Susanna Lehtimäki, "Governance Provisions in the WHO Pandemic Agreement Draft," *The Lancet* 403, no. 10434 (April 6, 2024): 1333–34, [https://doi.org/10.1016/s0140-6736\(24\)00585-3](https://doi.org/10.1016/s0140-6736(24)00585-3).
66. Civil Society Organisations, "A Pandemic Instrument That Does Not Deliver on Equity Is a Failure," 2024, [https://haiweb.org/wp-content/uploads/2024/04/CSO-Statement\\_A-Pandemic-Instrument-that-Does-Not-Deliver-on-Equity-is-a-Failure.pdf](https://haiweb.org/wp-content/uploads/2024/04/CSO-Statement_A-Pandemic-Instrument-that-Does-Not-Deliver-on-Equity-is-a-Failure.pdf).
67. Brett Schaefer and Steven Groves, "The WHO Pandemic Treaty Fails Again," Issue Brief 5350, Heritage Foundation, April 19, 2024 <https://www.heritage.org/sites/default/files/2024-04/IB5350.pdf>.
68. Steven J. Hoffman, Prativa Baral, Susan Rogers Van Katwyk, Lathika Sriharan, Matthew Hughsam, Harkanwal Randhawa, Gigi Lin, et al., "International Treaties Have Mostly Failed to Produce Their Intended Effects," *Proceedings of the National Academy of Sciences* 119, no. 32 (August 2022), <https://doi.org/10.1073/pnas.2122854119>.
69. Layth Hanbali, Elliot Hannon, Susanna Lehtimäki, Christine McNab, and Nina R. Schwalbe, "Independent Monitoring and the New Pandemic Agreement," *BMJ Global Health* 8, no. 11 (November 1, 2023): e013348, <https://doi.org/10.1136/bmjgh-2023-013348>.
70. "The Pandemic Treaty: Shameful and Unjust," *The Lancet* 403, no. 10429 (March 2, 2024): 781–81, [https://doi.org/10.1016/s0140-6736\(24\)00410-0](https://doi.org/10.1016/s0140-6736(24)00410-0).

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John Hurst is an infectious disease scientist with a specialization in modeling biological agent spread and medical countermeasure resource distribution. He has worked to develop environmental monitoring bioassays, designed challenge kits for biothreat sentinel laboratories, and explored the potential threat that novel information technologies like artificial intelligence can pose to biosecurity. John has an interest in approaching biosecurity and global health from the perspective that increased equity and proactive information sharing results in exponential returns on investments.



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Dr. James Kimber is a medical doctor in Adelaide, Australia, hoping to complete training in infectious diseases. He is a Master of Public Health student at the University of Sydney and a researcher with the University of Adelaide. James is passionate about preventing pandemics and global health.



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Pierce Manlangit is a Filipino technologist exploring biology in service to create flourishing futures. He co-leads Paro Institute, focused on advancing alternative proteins in the Philippines, while taking steps to make significant contributions and shift his focus to biosecurity. Pierce is also interested in the interplay between community, technology, and culture.



