STRATEGIC MULTILATERAL DIALOGUE ON BIOSECURITY

UPMC Center for Health Security

Report on the first dialogue session held between the United States, Singapore, Malaysia, and Indonesia

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Executive Summary

Singapore, Malaysia, and Indonesia are important partners of the United States in trade, health, and defense. As such, relations between the four nations are of strategic consequence in Southeast Asia. Though Singapore is commonly viewed as America's closest ally in the region, US ties with Malaysia and Indonesia are similarly strong. The US and Malaysian militaries, for instance, engage in joint training and exercises, and the US is a noted contributor to ongoing Malaysian-led counterterrorism efforts. Additionally, the US supports Indonesian endeavors to promote peace and security throughout Southeast Asia, and has assisted Indonesia in strengthening its health systems following humanitarian crises.

The importance of all three countries – Singapore, Malaysia, and Indonesia – in matters of biosecurity in Southeast Asia continues to grow, particularly in light of critical regional contingencies including emerging zoonoses at the human-animal-ecosystem interface, changing climates, the persistent threat of terrorism, and globalization. Given the many economic and security interests of the US in Southeast Asia and the potential for a wide range of biosecurity threats to emerge throughout the region – naturally occurring, accidental, and intentional – the UPMC Center for Health Security oversaw the transition of last year's bilateral Singapore-US strategic biosecurity dialogue into a multilateral endeavor, adding delegations from Malaysia and Indonesia.[1,2] This effort was supported by the Project on Advanced Systems and Concepts for Countering WMD (PASCC) and sponsored by the US Defense Threat Reduction Agency (DTRA). The first meeting of the multilateral dialogue, which is the focus of this report, took place at the US Institute of Peace in Washington, DC on June 24-25, 2015. The meeting consisted of four plenary sessions, followed by a day-long tabletop exercise examining state and regional responses to a series of transnational bioterrorist attacks.

Dialogue participants had much to discuss. Since the last Singapore-US meeting in November 2014, several biosecurity emergencies illustrated the potential scope, severity, and diversity of biological threats. In May 2015, an outbreak of Middle East respiratory syndrome coronavirus (MERS-CoV) in South Korea resulted in school and hospital closures, while also generating considerable economic losses and public anxiety. Globally, chikungunya and dengue fever continued to spread rapidly throughout the Americas, South Asia, and Southeast Asia, and nations worldwide continued grappling with the challenges of preparing for and responding to future biological emergencies in a post-Ebola epidemic world. The safety and security of high-containment labs in the US and around the world remained a continued priority and topic of broad public discussion. In the US, the Department of Defense (DoD) reported that live anthrax had been accidentally shipped from a military laboratory to an estimated 86 facilities in 20 states, Washington, DC, and 7 other countries.[3] On the scientific front, controversy arose over the clinical trial process for experimental Ebola vaccines, diagnostics, and therapeutics in West Africa. Additionally, Chinese researchers published experimental results in *Protein and Cell* detailing the use of CRISPR-Cas9 systems to edit human embryonic genomes, which has subsequently raised questions about the ethics of acceptable scientific practice. There is interest in the security community to better understand the potential security implications of this and other cutting-edge developments.[4]

Dialogue participants shared their perspectives on these and other biological threats, and discussed their implications for national, regional, and international biosecurity policies. Several important findings and observations emerged from the June 2015 meeting. Though the biosecurity landscapes of each

nation vary considerably, the challenges shared between the four are best summarized in terms of borders, boundaries, and threats beyond detection. Following is a high-level overview of the meeting highlights and discussion topics.

1. **Singapore, Malaysia, and Indonesia and the US will face ongoing serious challenges in addressing biological threats that come across their borders.**
   Attendees from each nation acknowledged the challenges associated with detecting and managing biological threats that come across interstate borders. For example, participants from Singapore, Malaysia and Indonesia reported large populations of migrant workers, tourists, and commuters crossing their borders, and noted that it would be impossible to screen so many individuals for dangerous infections (Indonesia itself is comprised of 17,000 islands). Strategies such as fever screenings were described as useful public confidence measures, albeit mostly ineffective for detecting and isolating people carrying potentially dangerous diseases. Furthermore, agricultural and economic interests, institutionalized corruption, dependence on external resources, and the presence of internally displaced and/or refugee populations were described as factors discouraging or even overwhelming border control screening efforts in the region. A dearth of political will in certain countries further undermines efforts to increase resources for augmenting public health screening at national borders. Given the porousness of international borders and the implausibility of identifying and stopping every instance of persons traveling with serious infectious disease, participants agreed that their nations share a collective responsibility to proactively detect and respond to biological threats in their own countries, while also acknowledging that much remains to be done in this area.

2. **Inter-sectoral and interdisciplinary boundaries between entities involved in biosecurity efforts often impede national and regional responses to biosecurity threats.**
   Participants identified numerous stakeholders in the biosecurity landscapes of their nations: public- and private-sector players in the health, scientific, defense, intelligence, and law enforcement sectors; the research community; traditional and social media platforms; and members of the public. The four nations agreed that bureaucratic hurdles and the overlapping of roles between these entities have complicated responses to past biosecurity emergencies. Governments often lack policies for coordinating and integrating efforts between these stakeholders (or are forced to develop them in the midst of a crisis), even as they contend with the challenges of responding to increasingly complex biosecurity emergencies. Additionally, participants noted that inadequate communication across sectoral lines during emergencies has created institutional silos and resulted in eroding public trust in government. Though the health and security communities – which, historically, have operated in bureaucratic silos – have made substantial progress in their ability and willingness to collaborate during biosecurity emergencies (particularly in the US), considerable gaps in interagency communication and response continue to pose challenges in all four countries. Participants broadly agreed that actors in the health and security sectors would benefit from increased coordination to prevent, mitigate, and respond to biosecurity threats.

3. **Biosecurity threats that defy existing prediction and detection capabilities present the greatest challenges in terms of preparedness and response.**
Participants from all four nations underscored the considerable threat posed by "black swan" events, including events involving "unknown unknowns."[5] Black swan events – rare, consequential, and unexpected events – in the realm of biosecurity could deal severe blows to the health systems, security capabilities, and social fabrics of affected communities. Previous black swan events – such as the 1998-1999 outbreak of Nipah virus, the Amerithrax attacks of 2001, the SARS outbreak of 2002-2003, and the 2014 Ebola outbreak – galvanized public interest in preparedness and encouraged governments to be more proactive in their preparedness and response efforts. Dialogue participants noted several categories of biological threats that could have destabilizing impacts: emergence of new zoonoses at the human-animal-ecosystem interface, disease outbreaks de novo or following humanitarian catastrophes, and acts of deliberate bioterrorism. There was concern that refugee or migrant populations in the region would be particularly vulnerable to such threats, and that disease could spread especially quickly among such groups. Concerns were also raised regarding "next-generation bioterrorism" – specifically, intentional genetic manipulation of pathogens to increase their virulence and/or transmissibility. "Next-gen bioterrorism" could also include "gain of function" research involving pathogens of pandemic potential. Participants identified several technologies and capabilities required to counter an ever-evolving range of biological threats: field-deployable genetic tests, reliable diagnostics and screening strategies, enhanced surveillance systems and containment measures, rapid pathogen identification techniques, and new antibiotics and antivirals.

4. **Regional coordination and information-sharing during biosecurity emergencies are generally acknowledged to be desirable goals, but they remain challenging in practice.**
Dialogue participants affirmed the necessity and value of regional coordination in the face of transnational biosecurity threats. However, several acknowledged that the lack of effective working relationships at certain levels and between neighboring states often precludes such cooperation: "We have not trusted our neighbors enough to prepare outside of our borders." Different agencies within this group of countries, for example, are proficient at collecting information before and during new outbreaks or biological crises, but lack mechanisms for sharing that information effectively amongst their own intra-national agencies and stakeholders, let alone with other regional partners. All participants agreed that the real-time reporting capabilities afforded by social media will become increasingly important methods of sharing information during biosecurity emergencies. The Association of Southeast Asian Nations (ASEAN) was also noted as a potential arbiter of future biosecurity-strengthening efforts in the region. However, participants concurred that countries' participation in ASEAN thus far has not substantially increased information-sharing or regional coordination with respect to biological threats.

5. **As biological threats continue to persist, emerge, and evolve, there is a need for new models of risk assessment, risk communication, and public engagement.**
Given that community support and participation are the cornerstones of effective public health responses, all four nations agreed that new models of risk assessment, risk communication, and public engagement are required to enhance preparedness for future biological emergencies. Participants noted that biosecurity differs from nuclear security in that the transnational implications of biosecurity threats has led many nations to reach a common understanding of biological agents and their associated threats, even if risk perceptions of those threats vary between individual countries. The ability of individual countries to prioritize biosecurity amidst a

range of other security and economic concerns also varies considerably, underscoring the important role of well-resourced states in enhancing biosecurity capabilities in resource-poor regions of the world. On the public front, events like Amerithrax, the H1N1 pandemic, SARS, and Ebola have strongly shaped community perceptions of and responses to biological threats. Concurrently, social media and other Web-based platforms have democratized information for public consumption in unprecedented ways. Governments, therefore, must contend with the challenge of building and sustaining public trust in national capacities to respond to biological threats, while also devising new strategies for communicating with their constituents before, during, and after emergencies.

Strategic Multilateral Dialogue on Biosecurity: Participants

Front row (left to right): Kenneth Bernard, Sanjana Ravi, Amanda Moodie, Zalini Yunus, Lokman Hakim bin Sulaiman, Anita Cicero, Ratna Sitompul, Tom Inglesby, Pratiwi Sudarmono, William Hostyn, Gigi Kwik Gronvall, Noreen Hynes, and Vernon Lee.

Back row (left to right): Budi Alamsyah, W. Seth Carus, M. Jegathesan, Chong Chee Kheong, Tikki Elka Pangestu, Daniel Tjen, Endy Bayuni, Kwa Chong Guan, Michelle Yap, Julie Fischer, Kyaw San Wai, and Stephanie Kam.

Introduction

On June 24-25, 2015, the UPMC Center for Health Security initiated the first Track II biosecurity dialogue between the United States, Singapore, Malaysia, and Indonesia. The meeting took place in Washington, DC, at the US Institute for Peace and was supported by the Project on Advanced Systems and Concepts for Countering WMD (PASCC) of the Center on Contemporary Conflict, sponsored by the US Defense Threat Reduction Agency (DTRA).

The purpose of the first meeting of the dialogue was to explore the biosecurity landscapes of Singapore, Malaysia, Indonesia, and the US; study policies and frameworks for addressing biological risks; strengthen partnerships between the four nations for addressing biological threats; and share lessons learned and best practices for enhancing biosecurity. The dialogue was attended by participants representing academia, government, and industry, and included experts in biosecurity, biosafety, global health security, the life sciences, journalism, healthcare delivery, and regional security (see Appendix B).

The meeting consisted of four plenary sessions, each preceded by opening remarks delivered by select participants. These remarks, in turn, set the stage for subsequent group dialogue. Broadly, topics of discussion included: distinct perspectives in biosecurity among the nations; detecting biological threats; relationships and information-sharing between the health, defense, and intelligence sectors; the threat of emerging infectious diseases and other next-generation threats to populations and governance; regional, national, and international mechanisms for biosecurity engagement; multidisciplinary governmental approaches to biosecurity threats of local, regional, and international concern; and leadership strategies during responses to major biological events. On the final day of the meeting, attendees participated in a day-long tabletop exercise designed to elucidate and compare each country's response to acts of bioterrorism within and beyond their national borders.

The dialogue also included presentations or remarks by CDR Franca Jones, Director of Medical Programs, Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs, Department of Defense; Dr. Maria Julia Marinissen, Director of International Health Security, Office of Policy and Planning, Office of the Assistant Secretary for Preparedness and Response (ASPR); Sean Andrews, Emergency Management Specialist, Office of Emergency Management, ASPR; Major General John P. Horner, Deputy Director, DTRA; Dr. Beth Cameron, Director for Countering Biological Threats, National Security Council; and Laura Holgate, Senior Director, WMD Terrorism & Threat Reduction, National Security Council. Dialogue participants attended a GHSA-focused meeting at the White House with NSC staff, and they received a tour of the Secretary's Emergency Operations Center at HHS.

The meeting participants spoke about the value of this kind of dialogue process. They noted that it was both highly useful and very uncommon to be part of a multilateral group process, and that this kind of setting allowed for detailed discussions of long-term challenges while also encouraging development of lasting and trusting relationships between participants. There was broad support for continuing the dialogue, as well as great interest in the upcoming dialogue meeting in Kuala Lumpur in November 2015 (to be co-sponsored by the Malaysian Ministry of Health). Participants also expressed support for potential engagement by the Indonesian government in future meetings as an ongoing means of strengthening ties among the leaders who bear responsibility for managing future biological threats.

The following sections describe key themes and findings from the meeting discussions.

Biological Threats Crossing Borders

Singapore, Johor (in Malaysia), and the Riau Islands (in Indonesia) comprise what is known as the SIJORI Growth Triangle, a strategic partnership that has transformed the region into a robust economic hub. As such, the region – home to some 10.1 million inhabitants – reports an unusually high volume of cross-border traffic.[6] Singapore alone receives 300,000 commuters from Malaysia every day, while Jakarta experiences a daily influx of 1.38 million individuals from throughout Indonesia and neighboring countries.[7,8] As a result, all three nations recognize that infectious diseases can and will traverse their borders, and that there is no plausible way to completely prevent this.

Attendees from Malaysia called border security generally "a very serious issue," and reported that the health security issues surrounding migrant workers had become more prominent in recent years, due in part to the challenges associated with enforcing border security protocols. Institutional corruption in the form of bribery has also enabled travelers to cross borders illicitly. As a result, verifying the legal status of migrant workers has proven challenging. Furthermore, frequent natural disasters throughout the region have led to increases in the numbers of migrants and refugees, exacerbating these challenges even further.

Given the heightened risks of infectious disease transmission within migrant and refugee groups, participants engaged in substantial discussion regarding the benefits and challenges associated with screening migrants, commuters, and travelers as a means of impeding the movement of pathogens across highly porous borders. The Malaysian attendees stated that screening strategies for diseases like tuberculosis and polio have been effective among the general population, but have yet to be successfully implemented among migrant populations. This concern was echoed by a participant from Indonesia, where there are large numbers of internally displaced individuals, and by an American attendee, who pointed out that populations recovering from humanitarian catastrophes would be especially vulnerable to the impacts of a biosecurity emergency.

Participants also discussed the economic and security considerations associated with efforts to close borders in response to biosecurity threats. Regarding border closures, one speaker recalled that during the 2009 H1N1 influenza pandemic, Singapore was able to slow travel and trade to some extent, but pointed out that if the country closed its borders completely, "we'd starve to death." Such concerns were also raised during deliberations over the International Health Regulations (IHRs) in 2005. IHR signatories eventually ensured that the Regulations were worded in such a way that the World Health Organization (WHO) would not be able to stifle routine economic activity in the name of protecting health. Given the tensions between maintaining secure borders and sustaining strong economies, participants from all four nations agreed that biosecurity constitutes a shared responsibility between regional and international partners. As one Singaporean pointed out, "It's impossible to stop a disease in one country from spreading to others. The responsibility doesn't fall to just any one country."

Breaking down Silos

In all four nations, entities that affect or maintain responsibility for responses to a serious biological threat include public and private stakeholders representing a range of disciplines and sectors. These include: public health, healthcare, defense, the research community, law enforcement, intelligence, traditional and social media, and the general public. The increasing diversity of these actors reflects the complexity of responding to biological crises. This complexity, in turn, blurs inter-sectoral lines and challenges existing protocols for handling crises, sometimes resulting in disjointed and ineffective institutional responses to biological threats. Participants from all nations agreed that "we still have a long way to go" to achieving the kind of integrated, large-scale response required to handle future biosecurity emergencies.

One speaker noted that confusion over agency roles and responsibilities during an emergency stems from disagreement over the definition of biosecurity itself: "When we use the term 'biosecurity,' there's a lot of confusion over what it means. Is it a health or defense sector issue? Many people don't like the idea of securitizing health. But [this work] is actually collective protection against a common threat. When we come at it from that angle, we can get people from different sectors to come to the table." Participants also discussed how a lack of intra-governmental coordination often gives rise to complicated regulatory processes or duplicative efforts between institutions. One attendee remarked, "Things have improved today. We have gotten a lot better within our stovepipes, but it's not clear if we can coordinate effectively across sectoral lines." American participants described, for example, how regulatory tensions exist between the US Department of Agriculture and the Food & Drug Administration, which maintain oversight over poultry products and vaccines, respectively. This division of responsibility has complicated recent efforts to contain outbreaks of avian influenza across the country.[9,10] Participants from all four nations shared examples of past challenges related to intra-governmental collaboration and communication, noting that the ministries of home affairs, health, and agriculture in their respective countries can have overlapping jurisdictions, which has led to difficulties in responding to past events.

A Malaysian speaker raised the issue of further integrating the defense and intelligence sectors into biosecurity response efforts, citing the Nipah virus outbreak of 1998-1999 as an example of how the responsibility of biosecurity emergency response cannot rest with a single health agency. There was wide recognition in the group that effective multiagency approaches are especially critical in responses to bioterrorism, which requires close collaboration between law enforcement and public health authorities. Both these sectors share similar concerns: early detection of crises and their perpetrators, and protecting the health and safety of the public. To address these concerns, Malaysian authorities are currently developing frameworks for handling the criminal and epidemiological procedures required during a bioterrorist event. The Indonesian delegation noted that should such threats come to pass in Indonesia, their military and defense agencies would be best suited to lead the response with active participation from the public health sector. They also noted that Indonesia, which maintains a strong track record of handling terrorism writ large, is developing a national strategy for mitigating bioterrorist threats. A number of American participants suggested that during future biosecurity emergencies, the DoD would continue to be involved, although it would not lead those efforts. Another American participant noted that DOD's capabilities in laboratory support, logistics, acquisitions and research, and development may prove more valuable during a crisis than the number of healthcare personnel it could provide.

Inter-sectoral tensions also exist between regulators and researchers in each of the four countries. A Singaporean attendee highlighted the importance of striking an appropriate balance between scientific self-governance and external regulation. A number of participants noted the importance of establishing and maintaining strong biosafety and biosecurity systems, particularly in high-containment labs. Participants discussed the possibility of equipping labs to monitor researchers and security personnel for insider threats, but agreed that such a practice would likely be unsustainable in the long term. Punitive measures for research transgressions were deemed to be reactive in nature and ineffective, since "the damage has already been done by the time they are implemented." Some research communities have taken proactive steps to eliminate institutional and inter-sectoral silos. The University of Indonesia's Faculty of Medicine, for instance, collaborates with the Ministry of Health and nine national hospitals on issues of biopreparedness and biodetection. Three of its labs serve as national reference labs for HIV, multi-drug resistant tuberculosis, and extensively drug-resistant tuberculosis, while its Department of Microbiology serves as the designated regional lab for avian influenza and conducts sentinel surveillance for influenza-like illnesses. The University has also integrated a biosafety and biosecurity module into its clinical microbiology curriculum, which it uses to train outside groups and organizations.

Participants from all four nations jointly acknowledged the challenges that the public sector faces in engaging private-sector partners, but emphasized the value of building such relationships. One attendee cautioned against viewing the private sector as a single, homogenous entity, pointing out that not all private-sector actors are concerned with profit. In Singapore, for example, the private financial sector is generally well-resourced, but remains vulnerable to the impacts of infectious disease. Following the SARS pandemic, Singaporean banks lost a lot of money and subsequently approached health authorities to conduct industry-wide exercises to prepare for pandemic events. Such successes have encouraged the Singaporean government to continue pursuing private-sector partnerships: "Once you get them interested, they have huge capacities to assist government agencies."

Threats Elusive to Detection

Dialogue participants raised and returned repeatedly to the topic of biological threats involving "unknown unknowns." All participants present felt that their countries are vulnerable to both newly emerging and bioengineered pathogens, and expressed concern that current diagnostic tools will not be effective in providing early warning of such threats. Southeast Asian countries were heavily affected by the SARS pandemic of 2002-2003, and fear that another SARS-like disease could spread even more rapidly in the populated region before authorities could detect the outbreak and devise an effective response strategy.

A Malaysian participant suggested that the four delegations address the many limitations of current "early warning" systems. He noted that new pathogens, when tested with existing diagnostics, will result in many "negative samples," and that governments require a strategy for resolving this issue. A Singaporean participant echoed this concern and agreed that current screening strategies may fail to provide early warning of a newly emerged threat. Participants included in their list of concerns the emergence of new zoonoses at the human-animal-ecosystem interface, disease outbreaks following humanitarian catastrophes, and acts of bioterrorism among refugee populations.

The group discussed recent gain-of-function mutation experiments with pathogens that have pandemic potential. It was agreed that, if permitted, scientists would continue developing new techniques and experiments over time that could increase the virulence of diseases. Participants recognized the challenges within both the science and security communities regarding how to manage such research endeavors, as well as how to create effective approaches for early detection of engineered pathogens, whether accidently or deliberately released. Concerns were raised regarding "next-generation bioterrorism"; specifically, intentional genetic manipulation of pathogens to increase their virulence and/or transmissibility. Participants discussed whether an all-hazards approach to preparedness would be effective in the face of an "unknown unknown," but were not confident that existing preparedness structures are sufficient to prevent or mitigate such threats. All agreed that much more thought and dialogue in this area is needed.

Attendees also discussed the challenges associated with investing in biosecurity prevention and response capabilities, and identified several technologies and capabilities required to counter an ever-evolving range of biological threats: field-deployable genetic tests, reliable diagnostics and screening strategies, enhanced surveillance systems and containment measures, rapid pathogen identification techniques, and new antibiotics and antivirals. Participants from Singapore, Malaysia, and Indonesia also highlighted the conundrum that smaller states face when confronted with the issue of investing in biosecurity capabilities: large countries like the US (which invest considerable sums in research and development) have brought relatively few medical countermeasures to market, so there are few perceived incentives for smaller nations like Singapore, Malaysia, and Indonesia (and their entrepreneurs) to follow suit. Attendees from all four countries agreed that nations should explore new ways of incentivizing investment, networking, and sharing of best practices in biosecurity among regional and international partners.

Building Regional Biosecurity

Dialogue participants affirmed the value of regional coordination in the face of transnational biosecurity threats. However, all agreed that the lack of trust and a lack of effective working relationships between neighboring states can often preclude such cooperation. Though Singapore, Malaysia, and Indonesia are all members of ASEAN and understand the potential benefits of a regional approach to biosecurity, one participant stated, "We have not trusted our neighbors enough to prepare outside of our borders." Another participant noted that when real biosecurity issues arise, "countries fall back on bureaucracies and national thinking" rather than turn to their neighbors to provide information or to request help. Participants from all four countries also discussed the very common phenomenon that takes place in intra-governmental dynamics. Many countries, for example, are proficient at collecting information before and during biosecurity emergencies, but often fail to share that information effectively amongst their own intra-national agencies and stakeholders, let alone with other regional partners.

Other factors also contribute to the relative lack of regional cooperation. Persistent political issues were cited as often getting in the way of actual coordination during crises. Participants also explained that the organization of WHO regional offices in Southeast Asia contributes to the disconnect between countries. Singapore and Malaysia belong to WHO's Western Pacific Regional Office, while Indonesia falls under the Southeast Asian Regional Office. This division has, in the past, complicated regional collaboration.

When asked about the potential for ASEAN to serve as an arbiter of future biosecurity-strengthening efforts in the region, participants stated that their countries' participation in ASEAN thus far has yet to increase information-sharing or regional coordination on biological threats, and that the outside perception of ASEAN's influence seems to be greater than its actual role in the realm of biosecurity. The organization has not developed a regional approach to biosecurity or biosafety, and countries do not jointly prepare for, develop common policies related to, or share information regarding biological threats through ASEAN. Participants agreed that the spirt of ASEAN in promoting a "one community" approach exists, but the organization currently lacks the unified political will to drive actual regional cooperation.

Risk, Communication, and Public Engagement

Participants examined the need for new models of risk assessment, risk communication, and public engagement to enhance responses to future biosecurity emergencies.

The communication barriers that exist between scientists and policymakers affect countries' abilities to effectively prepare for biological threats. As one participant observed, "Part of our problem is the issue of how to inform leaders during a crisis. It takes effort to create products for a policymaker's decision-making process. Scientists don't like putting judgement on findings. We need better ways of getting information into the communication delivery mechanisms used to inform policymakers." A Singaporean participant agreed, noting, "We as medical professionals can agree on certain measures based on scientific evidence. But for policymakers, it's going to be a question of rival epistemologies and sources of knowledge. NGOs and other groups have very different conceptions of public health and standards. Policymakers will have a hard time making sense of all this information." Others pointed out that understanding a threat scientifically has not always equated to good decision-making in a crisis, when political pressure is high.

Participants examined the challenges associated with evaluating information about biosecurity threats, noting that while technology has facilitated information-sharing, authorities lack guidance for accessing and using such information to respond effectively to biological threats. An American speaker remarked, "There will not be less information in the future, but much more. So how do we manage it? There is great faith that we will automatically know what to do with big data. But we haven't thought enough about how to build systems to manage the data we have and will continue to generate. To do so will require enormous political will. Information already moves across agencies, institutions, and borders, albeit very inefficiently." Additionally, attendees agreed that different sectors must make efforts to learn from each other, considering that they are likely to take different approaches to making sense of information about a given threat.

In addition to exploring varying biological threat perceptions between different sectors, participants also examined how such perceptions might vary in different ethical and political contexts. With respect to conceptualizing risk, a Singaporean attendee observed, "Different nations have different ideas about what constitutes an acceptable biosecurity risk….It may look like we are imposing a Western hegemony upon the rest of the world." A few participants suggested drawing from the risk assessment methodologies used in the nuclear security world, but an American speaker countered this idea, contending that biosecurity is not analogous to nuclear arms control given the range of sources of risk and the very different responses that would be required. The speaker also asserted that nations think about health differently than they do about nuclear arms, citing cooperation between Palestine, Jordan, and Israel on issues of healthcare delivery despite ongoing conflict in other realms. A Singaporean participant concurred, remarking, "There is a common understanding of biological agents and their associated threats. The risk perceptions might be different from country to country. But biological threats have global impacts, unlike nuclear threats, whose impacts are more localized."

All attendees agreed that assessing the risks associated with "unknown unknowns" and ensuring that such threats remain a priority is a major challenge. An American participant noted, "Conceptually, trying to tackle unknown unknowns requires a much richer intellectual framework than what we currently rely on in a large bureaucracy like the US government." A Singaporean speaker observed that living in a complex world of unknown unknowns means that full understanding of a given threat comes only with hindsight; however, leaders will need to be able to make some sense of the crisis as it is evolving. As

such, preparing for unknown unknowns requires leaders to abandon current, linear strategies of crisis management in favor of "sensing models of understanding a given threat." Still, despite the potentially destabilizing impacts of biological threats, participants noted the challenges related to prioritizing health amidst a plethora of other national security considerations, and suggested that nations focus on their shared interests in building preparedness and response capabilities. As a speaker from Singapore observed, "The challenge is building capacities to deal with biological issues. Nobody disagrees on the intentions of the IHRs. But if you go to nations individually, they have other priorities like the economy. It's only when better-resourced nations go to poorer resourced countries and offer to help that they actually start building those capacities."

Participants also affirmed the need to improve strategies for preserving institutional memory and sharing lessons learned following a biosecurity crisis. Acknowledging the difficulty of conducting effective training and exercises, attendees agreed that the biosecurity enterprises of all four nations would benefit from incentives for networking across sectors, investing in biosecurity, and capturing lessons learned. As one American stated, "We need to build the evidence base for lessons learned in responding to emergencies. We have to do this more systematically, at the facility, local, state, and national levels. We need to be able to share our lessons learned more effectively." Furthermore, while there are communication pathways for conveying information between federal, state, and local authorities, information-sharing mechanisms for individual facilities (e.g. laboratories, hospitals, and clinics) do not exist. Citing recent cases of Ebola in the US, the participant also observed that the hospitals that responded most effectively "are forming readiness teams that can help others examine and revise their own infection protocols and practices – a very low-cost, low-tech solution." However, sustaining appropriate levels of education and outreach between events – and without causing pandemic fatigue – remains a difficult challenge.

Gaps in institutional approaches to risk assessment and mitigation often translate into ineffective public engagement during emergencies, as illustrated by the participants' debate over the merits of screening travelers for disease. Some asserted that such measures engendered public confidence in government efforts to contain and counter biological threats, but others maintained that these practices were largely inefficient and ineffective. One Singaporean participant asserted, for example, that "a lot of the measures we try to put out are designed for a very singular purpose. For example, if I know the US is screening travelers for Ebola, I won't admit to having a fever, so the system has failed. You can have the best screening tools, but you have to have public cooperation as well. We need to ask how to minimize individual errors in not reporting illness." Participants also underscored the importance of tailoring public health interventions to the cultural context in question. One Indonesian speaker noted, "Cultural competence – or incompetence – in biosecurity is a huge issue. We found a huge cluster of avian influenza in a part of Indonesia where, after a festival with a close human-chicken interface, nine people became sick. There may also be bats in Indonesia infected with Ebola, but these bats are traditionally consumed as a delicacy. We need a lot of capacities and efforts to improve awareness among the public, since such traditions have gone on for many years." Others maintained that even excellent communication and cultural competence cannot overcome the overall lack of scientific awareness and understanding among the general public, a fundamental challenge that exists in wealthy and resource-poor nations alike.

Tabletop Exercise: Viral Shock

Participants engaged in a day-long tabletop exercise, Viral Shock, to explore their nations' potential responses to a multinational act of bioterrorism involving weaponized Ebola virus (see Appendix A for the scenario and associated documents). This tabletop exercise was developed based upon knowledge gained from past Ebola outbreaks including the most serious outbreak in West Africa, as well as published literature regarding the pathogenesis, epidemiology and social impact of Ebola. The exercise was comprised of five segments, during which participants were given new information regarding an evolving Ebola crisis. Each segment was followed by a series of discussion questions. The exercise highlighted a range of operational and policy challenges, and provided participants the opportunity to explore those challenges collaboratively and in context. Following are major themes and findings that emerged.

Chains of command vary depending on the nation in question and its perception of the threat.
All participants agreed that verifying the legitimacy of the threat was a key priority. However, each country's response and chain of command varied depending on the initial assessment of the threat as a public health or national security crisis. The Malaysians noted that if the threat came to the health sector, then the Ministry of Health would lead the response, but if it went to Malaysian law enforcement authorities, then they would assume charge. As a national security crisis with a health component, the response would proceed through joint efforts between the public health and security sectors. The Indonesian members shared that their government would establish a national commission to coordinate response activities and communication between the Ministries of Foreign Affairs, Defense, and Health. The health sector would be charged with the medical response, while the security sector would lead the criminal investigation. The Singaporeans said that the initial threat assessment would be led by the security and intelligence communities – specifically, the Ministry of Home Affairs – while the health sector would offer subject matter expertise as the crisis evolved. The US delegation stated that the intelligence sector would handle the investigation of the threat against the US, while the National Security Council would oversee the political and global security aspects of the situation. Depending on the credibility of the threat, the public health and healthcare sectors would also be informed. The defense sector would likely be involved only peripherally at the start of the scenario.

Sharing information between sectors, regional partners, and the general public may present key challenges during a crisis.
Participants acknowledged the challenges associated with controlling the flow of information during a crisis, and they struggled with the issue of how and when to communicate about an unconfirmed threat. Members of all four delegations cautioned against notifying the public until the threat in question had been deemed credible, predicting that public anxiety could hamper response efforts. A speaker from Indonesia emphasized that while the government's credibility is an important consideration, problems emerge when information comes only from government authorities. Therefore, news for public consumption should also come from credible think tanks and experts in good standing with the public. Others cautioned against overemphasizing terrorist involvement when communicating via both traditional and social media, given that public health responses to both naturally occurring cases and acts of bioterrorism would be the same. Several participants, while acknowledging the challenges associated with early public announcements of the threat, pointed out that informing the healthcare professionals and regional partners would be the key to preventing and detecting of Ebola cases. The Malaysians affirmed that, if faced with a credible threat, they would notify their counterparts in Indonesia through formal mechanisms established by the IHR. The Singaporeans underscored the need

for similar channels of communication with Malaysia and Indonesia, given the high volume of cross-border traffic between the three nations.

The issue of sharing clinical samples between nations may generate viral sovereignty challenges.
Malaysia does not have laws prohibiting sample-sharing, and attendees affirmed their willingness to share samples in the event of a crisis, as they have during past outbreaks. Members of the US delegation, by contrast, remarked that it is often difficult to share samples between intra-governmental agencies, let alone with other countries. Furthermore, given that Ebola is designated as a select agent in the US, there would be additional restrictions on sharing samples. Others pointed out that while there are memoranda of understanding and protocols in place to govern sample-sharing activities, gaps remain in coordinating these efforts seamlessly in the midst of a crisis.

Travel restrictions, quarantines, and limiting mass gatherings are likely to generate detrimental social and economic consequences.
A Malaysian speaker raised the issue of border security, stating, "We haven't reached the level of being able to work through emergencies at state borders." One Singaporean maintained that it would be impossible to enforce travel restrictions between the three countries. Another pointed out that the economic impacts of implementing such restrictive measures would be enormous, but that the Ministry of Home Affairs would likely boost efforts to conduct fever screenings at border checkpoints, prepare their laboratories' standby Ebola kits, and activate PCR platforms for Ebola. Another speaker, however, disagreed with the fever screening strategy, describing it as a "crude tool." While selectively screening travelers (i.e. only those from West Africa) might be feasible, screening travelers indiscriminately would generate vast numbers of false positives and confer authorities with enormous logistical burdens. Regarding quarantines and patient isolation, an Indonesian speaker noted that school closures would be unlikely, but recalled how individual houses and villages were quarantined during past bird flu outbreaks. Another speaker also pointed out that during the H1N1 influenza pandemic, members of the public voluntarily restricted their travel to and from affected regions. The US delegation acknowledged that there would be considerable political pressure to restrict incoming travelers from nations affected by Ebola in this scnario, and that the decisions made at the state and local levels (as opposed to those made within the federal government) would largely drive on the ground responses to an outbreak. Members of all delegations agreed that public trust in government (or lack thereof) would play an important role in determining citizens' willingness to cooperate with ongoing response measures and restrictions.

Nations are generally amenable to sharing medical countermeasures, but ability to share is contingent upon the scope and severity of the threat.
Members of the US delegation acknowledged the necessity of sharing medical countermeasures in the event of a growing Ebola crisis in Southeast Asia, but noted that the President would have to authorize the Secretary of Health to make vaccines and drugs available to other affected nations. Countermeasures could be shared bilaterally, but multilateral sharing arrangements would likely be coordinated through the World Health Organization. The US participants stressed, however, that it was very likely that a substantial portion of its medication and vaccine stockpile would be retained for domestic use, and that the personal relationships between heads of state in the affected countries would largely dictate the terms and extent of sharing agreements. A Singaporean participant predicted that Southeast Asian nations would most likely share resources bilaterally, without ASEAN involvement. Another speaker raised the possibility that this kind of crisis would pressure individual nations to develop domestic self-sufficiency in terms of vaccine production, which in turn could galvanize policymakers to mobilize biodefense funding and engage with all relevant ministries and agencies

responsible for handling response efforts. As one American speaker remarked, "The best way to deal with most of the problems in the world is to stop waiting for the US or Western Europe…Building regional capacities is key." Others, however, pointed out that mobilizing enough funding in the midst of a crisis would be extremely difficult. One speaker described the Indonesian Ministry of Health's budget as "far from sufficient," a sentiment echoed by the Malaysian delegation. A Singaporean participant admitted, "There's never a limit on how much we can spend. But we look to the US to be partners in getting therapeutics and countermeasures. That's not something we have the capacity to do ourselves. We view [medical countermeasures] in terms of insurance – we invest in them and hope to never need them."

ASEAN could potentially evolve into a future arbiter of regional cooperation in the face of biological threats.

The delegations from Southeast Asia debated the merits of involving ASEAN in future regional responses to biological threats. Singapore and Malaysia belong to WHO's Western Pacific Regional Office, while Indonesia falls under the Southeast Asian Regional Office. This division has, in the past, complicated regional collaboration. Participants from Singapore, Malaysia, and Indonesia all acknowledged that lack of confidence in each other's capabilities and willingness to assist have also undermined previous collaborative efforts. One Malaysian attendee remarked, "Generating the political will to actualize the regional cooperation symbolized by ASEAN is very hard. It's an ongoing challenge. We still fall short of being as open and trusting with one another as we should be. If you want to move [response] teams between countries, that would generate big procedural challenges. We're not at that level yet." When asked if ASEAN could assist in mitigating the threat of bioterrorism, participants responded that it would be unlikely, given that ASEAN is "a policy shop, not a response agency." Others pointed to ASEAN's role in quickly and effectively standardizing food safety practices across the region, suggesting that there are certain types of biological threats that the organization was well-suited to handle. Additionally, Singapore stores a repository of one million doses of Tamiflu and 700,000 sets of personal protective equipment (financed in part by Japan) designated for ASEAN use in the event of a pandemic influenza event.[11] While these promising examples of ASEAN's potential as a central coordinating entity exist, it was readily acknowledged that the organization in its current form could not effectively coordinate a regional response to a bioterrorist attack or a disease outbreak. As an alternative, participants suggested studying and adopting best practices from NGOs, citing the speed with which humanitarian organizations were able to amass large quantities of aid and establish regional response mechanisms following the 2004 Indian Ocean earthquake and tsunami.

During the final debrief session of Viral Shock, participants agreed that the exercise was "quite thought-provoking" and helped to facilitate more in depth conversations about specific gaps in preparedness. A Singaporean participant was encouraged that in the future, the "relationships [in this dialogue] will bear fruit".

Future Strategic Discussions

Following the tabletop exercise, participants turned their attention to the next multilateral biosecurity dialogue session, scheduled to be held in Kuala Lumpur, Malaysia on December 3-4, 2015. Participants from Malaysia's Ministry of Health are helping to plan the meeting. Several attendees proposed raising the profile of the dialogue by engaging ministerial-level officials from each of the four nations, pointing out that some of these officials have already committed to the Global Health Security Agenda and would gladly attend future meetings on biosecurity policy.

Participants shared suggestions for topics of discussion at the Kuala Lumpur meeting. One attendee noted that wildlife trade and disease emergence at the human-animal-ecosystem interface were critical issues worth exploring, and suggested adding a veterinarian or agriculture expert to the December roster. Additionally, all participants agreed that further examination of military, intelligence, counterterrorism, and law enforcement roles in biosecurity should remain an important priority for the next meeting. Dialogue participants from Southeast Asia were very impressed by the talks on the US Ebola response given by General Horner and Commander Jones, and their remarks made them interested in further engaging and involving representatives from their militaries in the dialogue.

Participants would also like to continue discussion of strategies for engaging and educating the public on biosecurity threats, and all agreed that the group should address mechanisms for sharing best practices between nations in countering biological threats. In this realm, participants affirmed the value of parsing information flows during biosecurity emergencies, identifying components of effective early-warning systems, and seeking ways of building confidence and trust between regional partners to promote information-sharing.

Participants also expressed great interest in addressing the potential risks and benefits of emerging biotechnologies and synthetic biology, and suggested engaging members of their countries' National Academies of Sciences in some form of discussion. They also expressed interest in having deeper discussions around strategies for examining "unknown unknowns." A final suggestion was to examine the differences between enhancing preparedness capacities for all hazards as opposed to specific threats, and to explore the challenges and benefits associated with each approach.

Appendix A: Tabletop Exercise Materials

The goal of the Viral Shock tabletop exercise is for participants to consider their nations' likely responses to the unfolding events in the scenario, so as to increase mutual understanding among all participants, identify issues that merit further and deeper dialogue, and provide new and possibly unexpected insights about the potential impacts of and reactions to crises related to use of biological weapons.

Participants are asked to make their best judgments about responses to the circumstances that follow. The scenario will be presented in a number of distinct segments, with questions asked of the group after each segment is presented.

After we conclude with the final segment, we will ask participants to reflect on the scenario proceedings, and discuss the findings that were most useful, most surprising, most reassuring, and/or most concerning.

Background

The story begins in January 2018. Since the West African Ebola epidemic of 2014-2015, governments, NGOs, and health officials worldwide have accelerated efforts to strengthen public health and healthcare delivery efforts, enhance disease surveillance systems, and boost national medical countermeasure production capabilities. Studying Ebola has become a priority for research institutions across the globe, and many of those with BSL-4 laboratory facilities carry samples of Ebola for further study. The United States has stockpiled 5 million doses of Ebola vaccine (rVSV-ZEBOV), along with 100,000 doses of ZMapp for treating Ebola in the event of future outbreaks. Both are available under an Emergency Use Authorization (EUA) issued by the US Food & Drug Administration (FDA).[†, 12]

No new cases of Ebola have been reported in West Africa or outside the region since November 2015. As of December 2017, though the threat of Ebola and other infectious diseases remains an important priority for affected nations, many countries have begun redirecting their efforts and resources toward mitigating the burden of non-communicable diseases.

The threat of terrorism is on the rise. Recent acts of terror in Southeast Asia have been attributed to Jemaah Islamiyah, an organization with links to al-Qaeda and cells in both Indonesia and Malaysia. In light of the growing threats posed by Jemaah Islamiyah, political leaders in those countries have arrested key leaders from the group with assistance from the United States. In June 2017, the US, Malaysia, and Indonesia formalized these cooperative efforts by agreeing to spearhead a new initiative aimed at combating terrorist activity in Southeast Asia. Since then, several other members of various terrorist organizations have been detained as a result.

[†] EUAs, which are issued by the FDA, allow for public use of unapproved medical products, or for unapproved uses of approved medical products needed in an emergency to diagnose, treat, or prevent serious or life-threatening diseases caused by chemical, biological, radiological, and/or nuclear threat agents when there are no adequate approved, and available alternatives.

Scenario: January 2, 2018

On December 31st-January 1st 2017, nations across the world celebrate the New Year.

The following morning, the White House Communications Agency receives an anonymous email addressed to the President. The email is not immediately traceable and was sent by an unnamed group. It announces that samples of Ebola virus had been released in Malaysia, Indonesia, and the United States during the previous night's New Year celebrations. Asserting that "many people [would] die from Ebola" in those countries, the message also cites anger over these countries' recent efforts against terrorism as the impetus for the attack, and threatens future attacks if the previously captured terrorist leaders are not released.

Alarmed, US officials quickly reach out to their counterparts in Malaysia and Indonesia and share the contents of the email.

Questions:

- What are your priorities at this point?
- Is this a public health crisis or a national security crisis? Would that make a difference in terms of how your country would handle the threat?
- Do you share threat information with the health, defense/security, and/or responder communities in your country?
- How confident are you in your abilities to detect and diagnose cases quickly? What surveillance systems would you rely on?

Update 1: January 12-13, 2018

10 days later, after Malaysian health authorities alerted its hospitals of the potential threat of Ebola, reports of 3 cases of unusual febrile illness surface: 2 at Kuala Lumpur General Hospital and another at Sultan Ismail Specialist Hospital in Johor Bahru.

The patients in question – all previously healthy Malaysian nationals – present with suspicious symptoms consistent with Ebola: fever, diarrhea, abdominal pain, and shock. Two of the patients are in critical condition. The third patient, a pregnant woman, begins hemorrhaging shortly after arriving at the hospital, and died that evening.[13,14] None report leaving the region in the past several months. None had ever visited West or Central Africa. One patient, however, reports visiting Jakarta on New Year's Eve. These symptoms and travel histories, along with the possible threat of Ebola, prompt Malaysian health authorities to immediately test the patients' samples for Ebola. Researchers and governments around the world begin requesting viral samples from Malaysia.

The next day on January 13th, laboratory tests at a Ministry of Health facility confirm that the patients have Ebola. There are no obvious connections between the three patients.

Malaysia makes an official request to the US government for Ebola vaccine and ZMapp. The US is considering this request, but no decisions have been made.

Questions:

- What are you most worried about? What are your concerns related to:
    - The capacity of your hospitals to handle Ebola patients
    - Community spread of Ebola
    - Closures of schools, businesses, or other places of employment
    - Public reaction to domestic cases
    - Media reactions and coverage of the situation
- Would the Malaysian government or hospital authorities publicly announce the cases immediately? Would the US, Singapore, and Indonesia do so under the same conditions?
- How would Malaysia handle requests for viral samples from the US, Singapore, and Indonesia?

Update 2: January 13, 2018 (a few hours later)

10 cases of suspected Ebola are diagnosed at Cipto Mangunkusumo Hospital in Jakarta, as well as 5 additional cases in George Town, Malaysia. All are in critical condition, and two have severe bleeding complications. Government labs in both countries confirm the cases as Ebola.

The viral samples are found to match the strain of Ebola Zaire found in West Africa in 2014-2015. Extensive travel histories show that none of the patients had ever traveled to West or Central Africa. One of the patients, however, reports being a frequent user of KTM Antarabandar, an intercity train service operating in Peninsular Malaysia, Singapore, and Thailand.

Indonesia makes an official request to the US government for Ebola vaccine and ZMapp. Deliberations over sharing medical countermeasures continue in the US.

Questions:

- Would your nation consider:
    - Conducting fever screenings at international travel checkpoints?
    - Implementing restrictive visa policies?
    - Imposing travel bans?
    - Closing schools or places of work?

- What impacts (e.g. economic) would your country experience as a result of travel bans or restrictions? Who (or which agency) would ultimately decide whether to impose travel bans or other new restrictive measures?

- Would the measures listed above be publicly supported or opposed?

- At this point, would your Ministries of Defense be involved in the response? How?

Update 3: January 15, 2018

Singaporean health authorities report 2 in-country cases of Ebola. One is a Malaysian citizen who commutes daily to Singapore, and the other is an Indonesian tourist visiting friends in the city. Meanwhile, 10 additional patients in Kuala Lumpur – including military servicemen –are confirmed to have Ebola, as well as 2 civilians and 2 healthcare workers in Jakarta. As health authorities start contact tracing efforts for these individuals, 5 suspected cases are reported among citizens in Johor Bahru (Malaysia), Bandung (Indonesia), and Yogyakarta (Indonesia).

Meanwhile, media outlets report that there are samples of Ebola at a US military lab in Singapore. Some speculate that the virus escaped from this lab, and is responsible for the current outbreak.

Singapore makes an official request to the US government for Ebola vaccine and ZMapp. Indonesia, Malaysia, and the World Health Organization also request the US to make a decision. As deliberations continue, China announces that it has supplies of Ebola vaccine that it is willing to share with Malaysia, Indonesia, and Singapore.

Questions:

- US: Would you share ZMapp and/or Ebola vaccine with Malaysia, Indonesia, and Singapore? If so, would you do so bilaterally, multilaterally, or with the assistance of WHO?

- US: How would potential allegations and negative public reactions to the US' deliberation affect the US' decision to share medical countermeasures?

- Broadly, how would this affect the US' standing in Southeast Asia?

- Malaysia, Singapore, and Indonesia: How do the news stories affect response efforts in your countries? Will they sway public reaction?

- How would you respond to China's offer of vaccines?

Update 4: January 18, 2018

3 people admitted to hospitals in Washington, DC test positive with Ebola after developing fever and shock. Later in the day, 4 cases of Ebola are also diagnosed in Santa Barbara (1), Los Angeles (2), and San Diego, California (1). Only 1 has evidence of bleeding. None of the patients in DC and California had ever traveled to West Africa, Central Africa, or Southeast Asia. There is great deal of US public anxiety, as well as round-the-clock media reporting on the Ebola threat. Meanwhile, additional suspected cases of Ebola are discovered in both Kuala Lumpur and Jakarta.

Over the next two weeks, Ebola cases in the US appear in the Los Angeles metropolitan area, as well as in Las Vegas. Health officials across the US, as well as in Malaysia, Singapore, and Indonesia, are directing efforts to conduct widespread Ebola testing.

Questions:

- US: Would US cases change the decision to share medical countermeasures?
- All countries: You will have limited supplies of vaccine in your nation. Whom would you vaccinate? How would you prioritize and allocate doses? What part of government is responsible for making these decisions?
- What will happen or change in your country if more Ebola cases continue to emerge over weeks?
    - Surveillance
    - Political leadership
    - Public health and healthcare delivery
    - Funding for health and biodefense initiatives
    - Law enforcement and anti-terrorism efforts
    - The roles of your Ministries (or Departments) of Health, Defense, Home Affairs, etc.
    - Prioritization of populations for medical countermeasures

Debrief

Questions:

- What do you think your country would do well in a crisis like this? What would be most challenging?
- What was most surprising to you?
- What do you think are the most significant potential leadership mistakes that could be made and should be avoided?
- How would relations between our countries be affected?
- If you had to choose one area to focus on for improvement now in order to be better prepared for this type of scenario, what would it be?
- What are your major takeaways from this exercise?

Assumptions

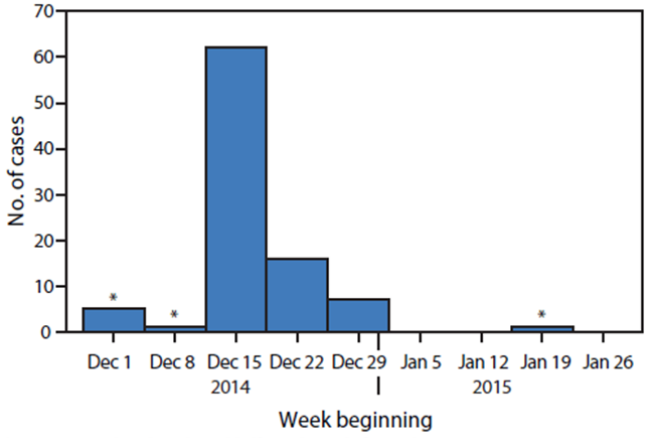
Method of Attack
Six months before the first round of attacks, the perpetrators enlisted the assistance of scientists working in BSL-4 laboratories where Ebola was being studied. With the scientists' help, they stole samples of Ebola virus from one of these laboratories and cultured additional quantities in a private facility.

In December 2017, the perpetrators disseminated the virus by loading the samples into small pesticide sprayers concealed in backpacks. They then activated the sprayers while walking through crowds in Kuala Lumpur, Jakarta, Washington, DC, and Los Angeles that had gathered to celebrate the New Year.

Assumptions

- This scenario assumes point-source transmission of Ebola in each of the four countries, as illustrated by emergence of 85 cases of Ebola in Kissidougou, Guinea following a widely-attended burial on December 4, 2014.[15]

FIGURE 1. Number of confirmed Ebola cases, by week — Kissidougou, Guinea, December, 2014–January 2015



* Cases not related to the midwife assistant's funeral cemerony.

- We estimated that each attack in the scenario resulted in 10-20 first-generation cases of Ebola.

- We did not calculate the caseload resulting from secondary transmission. The scenario ends before secondary transmission occurs, which would most likely happen among family members and close acquaintances of the first patients, as well as among healthcare workers.

Scenario Development
This tabletop exercise was developed iteratively, drawing from news reports and scholarly accounts of the Ebola epidemic in West Africa, the factors contributing to emergence of new cases, and the threats of weaponized Ebola. The scenario was also informed by findings from the Singapore-US Strategic Dialogue on Biosecurity in 2014. Subject matter experts reviewed scenario content for accuracy and plausibility.

Fact Sheet: Safety of Medical Countermeasures against Ebola

ZMapp™

ZMapp™ is an experimental new therapy that is being developed to treat patients with Ebola. It is comprised of a series of three different monoclonal antibodies that work to prevent the spread of the disease within the body. ZMapp™ is administered intravenously, i.e. it is introduced directly into a patient's bloodstream.

ZMapp™ results from a public-private partnership comprised of a consortium of scientists from the Public Health Agency of Canada, Defyrus, the US Army Medical Research Institute of Infectious Diseases (USAMRIID), Kentucky BioProcessing, and Mapp Biopharmaceutical, among other institutions, who joined together to advance plant-based antibody therapies to combat Ebola.[16]

ZMapp™ is currently in Phase II clinical trials in Monrovia, Liberia. The trials, which follow an RCT design, involve two patients, one of whom has died. It is currently unknown whether the patient received ZMapp™ or a placebo. The trials are being run by the US National Institute of Allergies and Infectious Diseases, with support from the US Biomedical Advanced Research and Development Authority.[17]

rVSV-ZEBOV Vaccine

Recombinant vesicular stomatitis virus-vectored *Zaire ebolavirus* vaccine (rVSV-ZEBOV) is an experimental vaccine developed by the Canadian National Microbiology Laboratory. The vaccine consists of a vesicular stomatitis virus that has been genetically engineered to express Ebola glycoproteins, thereby provoking an immune response against the Ebola virus. The vaccine is administered via intramuscular injection.[18]

rVSV-ZEBOV is currently in the midst of Phase III clinical trials (ring vaccination design), which are being led by the World Health Organization and the Ministry of Health Guinea in Conakry, Guinea. In April 2015, the US Centers for Disease Control and the Ministry of Health Sierra Leone commenced additional Phase III trials in Freetown, Sierra Leone (cluster-based, non-blinded, individually randomized design).[17]

Preliminary reports on vaccine safety are encouraging. There were no observed serious adverse events during Phase I trials, but some recipients of the vaccine reported mild influenza-like illness, arthritis, and minor skin lesions.

Appendix B: Participant List

Endy M. BAYUNI
Senior Editor
The Jakarta Post

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National Security and Biodefense

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CHONG Chee Kheong, PhD, MPH
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Gigi GRONVALL, PhD
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MG John P. Horner
Deputy Director
Defense Threat Reduction Agency

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Directory, Advisory Committees and Programs Office
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Manikavasagam JEGATHESAN, MD
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And Intra-Global Connections sdn bhd

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Deputy Director General of Health (Public Health)
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Zalini YUNUS, PhD
Head of Biosurveillance & Bio-Defence
Protection & Biophysical Technology Division
Science & Technology Research Institute for Defence (STRIDE)
Ministry of Defence

Appendix C: Meeting Agenda

June 23, 2015 **Guests arrive and check in to Sofitel Hotel**
806 15th St., NW, Washington, DC 20005 Phone: (202) 730-8800

June 24, 2015

08:00-08:15 **Hotel Guests Meet in Lobby**

08:15-08:30 **Shuttle from Hotel to US Institute for Peace – West Boardroom**
2301 Constitution Avenue, NW, Washington, DC 20037

08:30-09:00 **Continental Breakfast, Coffee/Tea (West Boardroom at US Institute for Peace)**

09:00-09:45 **Welcome, Goals of Meeting, and Dialogue Participant Introductions**

Dr. Tom Inglesby
Director, UPMC Center for Health Security

Ms. Anita Cicero
Deputy Director, UPMC Center for Health Security

09:45-10:45 **Session 1: Perspectives on Biosecurity**

Singapore, Malaysia, Indonesia, and the US have different histories, cultures, and priorities that inform their respective views on biosecurity and biological weapons. During this opening session, we will begin to discuss how leaders in government and other experts approach the risk of biological threats in each country. What major national institutions are responsible for both bioterrorism and disease epidemic preparedness and response strategies? How do history and the current political climate in each country affect national attitudes toward biosecurity? What "black swan" events are most concerning to you?

Opening Remarks: Tikki Elka Pangestu, Tjandra Yoga Aditama, Ken Bernard, Lokman Hakim Bin Sulaiman

10:45-11:00 **Coffee Break**

11:00-12:00 **Session 2: Detecting Biological Threats**

What types of biosurveillance systems (e.g., human disease surveillance, environmental detection) are in place to detect natural or deliberate biological threats? Do you feel that they are sufficient? Which agencies are in charge of such systems? Do you have challenges in communicating between the public health and defense communities? How would you distinguish between an outbreak and

the use of a biological weapon? Do your human and animal surveillance systems/communities interact?

Opening Remarks: Chong Chee Kheong, Michelle Yap, Ratna Sitompul, Noreen Hynes

12:00-13:00 **Lunch on Terrace**

13:00-14:00 **Session 3: Future Approaches to Combating Biological Threats**

Participants will exchange ideas about potential future priorities and approaches to prevention, response, and recovery from biological threats (natural, accidental, deliberate). What are the most difficult technical, political, or organizational challenges faced by your Ministry of Health? Home Affairs? Defense? To what extent do current international/regional engagement initiatives improve preparedness and response for biological threats? What works? What doesn't? Give examples of gaps and challenges.

Opening Remarks: Manikavasagam Jegathesan, Vernon Lee, Julie Fischer, Daniel Tjen

14:00-14:30 **Presentation: DoD Strategies for Countering Biological Threats**

CDR Franca R. Jones, MS, PhD
Director, Medical Programs
Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs

14:30-14:45 **Group Photo**

14:45-15:45 **Session 4: Leadership Strategies During Major Biological Events**

If a serious outbreak of a rapidly spreading infectious disease emerges in your nation or in a neighboring nation, or if there is an act of bioterrorism close to home, how should your leaders react? Is it clear who would be in charge? How well are agencies poised to cooperate? How would sensitive information from the intelligence community be conveyed to the public health community in the event of an act of bioterrorism? Would leadership change depending on whether the event is naturally occurring or man-made? Would one leader or well-known figure be tasked with all public communication?

Opening Remarks: Seth Carus, Endy M. Bayuni, Zalini Yunus, Kwa Chong Guan

15:45-16:00 **Shuttle to White House**

16:00-16:30 **Check in and Receive Badges**

16:30-17:45	**Meeting with National Security Staff to discuss the Global Health Security Agenda, Eisenhower Executive Office Building**
17:45-17:55	**Walk to Sofitel Hotel**
18:30	**Cocktails and Dinner at Ici Urban Bistro, Sofitel Hotel**

June 25, 2015

07:00-07:45	**Breakfast available in hotel lobby**
07:45-08:00	**Shuttle from Hotel to US Department of Health & Human Services (HHS)**
08:00-08:30	**Check in and Receive Badges**
08:30-09:30	**Tour of the Secretary's Operations Center (SOC), which is the focal point for critical public health and medical information in the US government. The tour will be followed by a presentation on US regional cooperation.** Dr. Maria Julia Marinissen, Director of International Health Security Office of Policy and Planning, Office of the Assistant Secretary for Preparedness and Response
09:30-10:00	**Shuttle from HHS to US Institute for Peace**
10:00-10:30	**Coffee Break**
10:30-11:15	**Presentation: US DoD Experiences During Ebola** Major General John P. Horner, Deputy Director of the Defense Threat Reduction Agency
11:15-13:00	**Bioterrorism Tabletop Exercise**
13:00-14:00	**Lunch on Terrace**
14:00-15:00	**Bioterrorism Tabletop Exercise**
15:00-15:30	**Debriefing and Impressions of Exercise**
15:30-16:00	**Wrap-up and Discussion of Topics for Next Dialogue Session in Malaysia**
16:00-17:00	**Cocktail Reception on Terrace**

Appendix D: References

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