

UPMC Center for Health Security

Singapore – US Strategic Dialogue on Biosecurity

Report from the second dialogue
session, held in Singapore on
November 12-13, 2014

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Executive Summary

Singapore is a critical security partner to the US in Southeast Asia. The US and Singapore share long-standing military relations, with American forces making use of Singapore's Naval Base facilities, contributing to peace and stabilizing efforts throughout the region, offering humanitarian assistance, and acting as a deterrent to potential security threats.¹ US-Singaporean security cooperation also extends to bilateral exercises, joint military training activities, and cargo screening efforts. The importance of Singapore to biosecurity in Southeast Asia continues to grow, due to its rapid biotechnology growth, its leadership in biosafety training within the region, its experience in containing the pandemic of severe acute respiratory syndrome (SARS), as well as ongoing preparedness efforts related to new, emerging diseases.

Given the importance of the Singapore-US relationship, and given the potential for naturally occurring or intentional biosecurity threats to emerge in the region, the UPMC Center for Health Security initiated the first-ever Track II biosecurity dialogue between the United States and Singapore. The dialogue is supported by the Project on Advanced Systems and Concepts for Countering WMD (PASCC), and sponsored by the US Defense Threat Reduction Agency (DTRA). The inaugural meeting was held in Washington, DC on June 10-11, 2014. The second meeting, which is the focus of this report, took place at the S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore on November 12-13, 2014.

Between the first and second sessions of the dialogue, the global health and security communities experienced several biosecurity events of great significance. In June 2014, when the dialogue was initiated, the Ebola crisis in West Africa was just beginning to receive international attention; however, by November 2014, it had become a major global concern. At the June meeting, laboratory biosafety was discussed in terms of the previous laboratory acquired infections that took place during the severe acute respiratory syndrome (SARS) pandemic of 2003, as well in the context of theoretical risks associated with the so-called gain-of-function (GOF) research. However, just days after this meeting, several biosafety incidents occurred at US laboratories: the discovery of six vials of smallpox virus (dating from the 1950s) in a cold room operated by the US Food and Drug Administration (FDA); the accidental exposure of 75 people to anthrax at the US Centers for Disease Control and Prevention (CDC); and the accidental cross-contamination of high- and low-pathogenic strains of avian influenza, which were subsequently shipped between CDC and the US Department of Agriculture.^{2,3} Dialogue participants shared perspectives about these events and a range of other important biosecurity-related issues, and also discussed implications for national and regional policy and programs going forward.

Several important findings and observations came from the Singapore meeting:

1. **Both Singapore and the US dedicate significant resources toward preparedness for a range of biological threats.** Given the frequency of epidemics, emerging infectious disease threats of national significance, and ongoing endemic threats throughout Southeast Asia, Singapore places heavy emphasis on preparing for naturally occurring infectious diseases. For example, Make Health Connect – a network of 1,200 clinics based in Singapore – has developed a disease map that offers live visualizations of infectious disease cases throughout the country, including

chickenpox, dengue fever, foot-and-mouth disease, and upper respiratory infections.⁴ Singapore's programs for deliberate biological threats are also an important part of its biopreparedness efforts. Singaporean health authorities have stockpiled enough smallpox vaccine for all of its population, including visitors. The Ministry of Home Affairs performs environmental sampling for a range of biological threat agents at important points of crossing between Singapore and Malaysia. The US, too, has made substantial investments into preparing for naturally occurring infectious diseases and deliberate biological threats, having launched the Global Health Security Agenda (GHSA) earlier this year.

2. **Both the US and Singapore face challenges in communicating with the public during sustained infectious disease emergencies.** Both public and media trust in the government's ability to manage biological threats is likely greater in Singapore than in the US. Over the course of past outbreaks in Singapore, people have responded well to messages from political and health leaders. For example, open appeals to the public by the prime minister of Singapore during the SARS pandemic resulted in valuable public cooperation. Generally, the Singaporean public has followed government guidelines with little disagreement during past public health emergencies – a contrast to the current situation in the US, where the political, public and media response to Ebola has involved direct and contentious challenges to the authority of those leading response efforts. This difficult operating environment has exacerbated the complexity and demands of the US response to the epidemic. One trend that could complicate public communication and compromise trust in government during public health crises in Singapore is the growing importance of social media as a source of news and information. During crises, Singaporeans will have many more conduits for information and competing views than they have in the past, which could alter the dynamics of public health emergency response. Both countries can continue to learn from each other's experiences in this realm.

3. **The US and Singapore can learn from each other's preparedness efforts in response to the Ebola epidemic in West Africa.** Ongoing concerns about Ebola—both in West Africa and the possibility for imported cases—have catalyzed preparedness efforts and have led to new response planning in both countries. Singaporean and US approaches to Ebola screening share several commonalities. Both support and benefit from the exit screening taking place in West Africa, and ask similar screening questions of passengers entering their airports from the region. Currently, there are very few travelers entering Singapore from West Africa, so it is unclear how frequently screening protocols will be tested there for the remainder of the epidemic. Singapore's DSO National Laboratories have taken the lead on the diagnostic front, conducting confirmatory Ebola testing on samples originating from hospitals across the country. CDC has developed a diagnostic test in the US and disseminated it to US public health laboratories. Both countries have prepared detailed plans and dedicated health care facilities for managing patients with Ebola. While participants from both countries described a wide range of Ebola preparedness efforts related to this crisis, they also acknowledged the longer-term challenge of sustaining political attention from the highest levels of government for infectious disease threats during the times between crises.

4. **Regional planning for infectious disease threats is critical to biopreparedness in Southeast Asia.** Singapore considers regional approaches to biological threats to be a high priority, given its close proximity to neighboring countries, large volume of trade, the high degree of mobility among people in the region, shared insect and animal reservoirs and threats, and close proximity to the origins of past epidemics. There are clear benefits to regional planning, including sharing of critical information and best practices, earlier detection of new outbreaks, joint approaches to specific disease control efforts, strong professional relationships to rely on during crises, and the possibility of shared costs. Regional bodies such as the Association of Southeast Asian Nations (ASEAN), of which Singapore is a member, seem to facilitate greater cooperation around threats of international consequence like Ebola. For example, ASEAN, with support from Japan's International Cooperation System, launched an effort in 2006 to stockpile medical countermeasures and personal protective equipment in preparation for an influenza pandemic. Roughly half of these assets were stored in Singapore while the rest were pre-positioned in the remaining ASEAN member states.⁵ Singaporean dialogue participants noted that such efforts helped allay public fears concerning influenza and helped promote a culture of collaboration among ASEAN nations. The US, too, sees the great importance in cooperatively addressing the important natural and deliberate biological threats and supports or participates in a number of efforts to improve bilateral and regional efforts in the region.

5. **There are key similarities and differences between American and Singaporean disease containment strategies.** Both countries place high emphasis on diagnostic capabilities, disease surveillance, and new case identification. Both also have plans in place to safely isolate patients with highly contagious diseases, but neither has endorsed travel bans as a means of controlling epidemic disease transmission; in fact, a fundamental tenet of Singapore's success in this realm is to keep people and goods moving freely even during public health emergencies. However, there are also important differences in disease containment practices. During the SARS outbreak, for example, Singaporean health authorities used in-home videos to ensure that suspected cases and their contacts remained at home, and further incentivized quarantine compliance by paying these individuals to make up for lost wages. Singaporean authorities also implemented fever screenings at airports, a measure not undertaken in the US. Though these authorities knew that few, if any, SARS cases would be detected this way, they acknowledged that such practices were important for maintaining the public's confidence in the government during a public health crisis.

6. **Singapore's approach to biosecurity and biosafety legislation and practice has much in common with US practices.** Both nations have taken legislative and administrative steps to minimize the threats associated with biosafety breaches and the ramifications of gain-of-function (GOF) research, respectively. Singapore's Biological Agents and Toxins Act, administered by the Ministry of Health, is the primary legal mechanism for regulating the use and movement of potentially dangerous pathogens. Singaporean universities also retain biosafety committees that review all research taking place at their institutions; additionally, the

Singaporean government includes a Genetic Modification Advisory Committee that would oversee GOF experiments. In light of recent biosafety breaches, the US government has issued a moratorium on funding for GOF research in an effort to review biosecurity protocols and encourage scientists to promote stronger biosafety cultures at their laboratories. These reviews will be conducted by the National Science Advisory Board for Biosecurity and the National Research Council of the National Academies.

7. **There is high perceived value in expanding the Singapore-US Biosecurity dialogue to include Malaysia and Indonesia.** Given the proximity between Singapore and its neighbors, high levels of trade and travel within Southeast Asia, and shared biological threats throughout the region, there is great potential value in expanding the dialogue to include Malaysia and Indonesia, a step encouraged by the Singaporean dialogue participants. As a predicate to that, senior officials from Malaysia and Indonesia attended this meeting of the dialogue and made valuable contributions to the conversation. Participants at the November meeting also expressed interest in expanding future dialogue meetings to include additional Southeast Asian nations. Participants also suggested that valuable topics and activities for the expanded 2015 dialogue that includes Malaysia and Indonesia could include a focused discussion and comparison of risk assessments for biological threats in the respective countries; tabletop exercises; and a more in-depth discussion of the impacts of biothreats on border security. All participants hoped to use these new forums and relationships as a platform to strengthen existing ties Singapore and the US, and further enhance in the Asia-Pacific region.

Introduction

In June 2014, the UPMC Center for Health Security hosted the first-ever Track II biosecurity dialogue between the United States and Singapore. The second meeting of this dialogue took place in November 2014, at the S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University, Singapore, 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 November dialogue was attended by participants representing academia, government, and industry in the US and Singapore, as well as two delegates representing Malaysia and Indonesia. Speakers included experts in biosecurity, biosafety, global health security, policy, the life sciences, biodefense, and regional security. Building on the momentum of the first meeting, participants at the second meeting sought to further explore the challenges associated with combating emerging infectious diseases, to critique the policies and frameworks in place for responding to various biological threats, and to examine the dynamics of regional biosecurity in Southeast Asia.

The meeting consisted of eight plenary sessions, each preceded by opening remarks delivered by select speakers. These remarks, in turn, set the stage for subsequent group dialogue. Broadly, topics of discussion included the relationships between biosecurity and homeland security, the threat of emerging infectious diseases, regional and international mechanisms for biosecurity engagement, multidisciplinary governmental approaches to biosecurity, the International Health Regulations and global health security, and national biosafety norms and capabilities. The sessions were preceded by keynote addresses delivered by Ambassador Ong Keng Yong, the Executive Deputy Chairman of RSIS, and Mr. Peter Ho, an adjunct professor at RSIS, senior advisor at the RSIS Centre for Strategic Futures, and a visiting scholar at the Lee Kuan Yew School of Public Policy. The meeting also featured a panel discussion led by the delegates from Malaysia and Indonesia.

The dialogue proceeded with keen participation from all attendees. Both the participants and meeting observers were impressed with the quality and content of each session, and expressed hopes for continuing the dialogue at future meetings, as well as for engaging partners representing other Southeast Asian nations.

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

Meeting Discussions

Perspectives in Biosecurity: Remarks by Peter Ho

The dialogue commenced with a keynote address delivered by Mr. Peter Ho Hak Ean, formerly the head of the Singapore Civil Service, the Permanent Secretary for Foreign Affairs, National Security and Intelligence Coordination, and Special Duties and Defence, who is now a visiting scholar at the Lee Kuan Yew School of Public Policy, adjunct professor at the S. Rajaratnam School of International Studies (RSIS), and senior advisor at the Centre for Strategic Futures, a division of the Office of the Prime Minister.

Mr. Ho described how “black swan” events — high-impact crises that are difficult to predict — have shaped the unique biosecurity landscapes of different nations, and the way nations consider and prepare for future threats. For example, Singapore’s DSO National Laboratories began its work in chemical defense in 1979, following increasingly frequent reports of chemical weapons usage during conflict.⁶ These efforts eventually gave rise to DSO’s Biological Defence Program. DSO later constructed Singapore’s first BSL-3 laboratory, which today examines biological samples originating from all across Southeast Asia.



Singapore’s most significant biosecurity black swan event was the severe acute respiratory syndrome (SARS) pandemic of 2003. On February 25, 2003, SARS infiltrated Singapore’s hospital system, resulting in shocking fatality rates and widespread fear among the public. Additionally, the surge in cases dealt a severe blow to the nation’s robust tourism industry, thereby generating major economic losses. Mr. Ho cited the rapid proliferation of Chikungunya in Singapore and the ongoing outbreak of Ebola virus disease in West Africa as potential black swan events that would have destabilizing impacts. He reflected that nations should refrain from waiting for shocks like SARS, Chikungunya, and Ebola to manifest before taking preventive measures. Such complacency could enable emerging diseases to quickly become endemic or escalate into pandemics. Mr. Ho also identified climate change as biosecurity’s next major challenge, and urged dialogue participants to consider how to prepare for its consequences. Changing climates have already altered patterns of vector movement and disease transmission in the US, where dengue fever and Chikungunya have recently emerged in the south; and in Singapore, where dengue season grows progressively longer each year.

Mr. Ho next addressed the challenges associated with learning lessons from past and current biosecurity threats, and shared various examples of approaches taken by Singapore in considering and preparing for future biological risks. Prominent among these challenges is the sense of denial that often follows major crises. Mr. Ho referred to this phenomenon as “collective cognitive dissonance,” and described how skewed perceptions of future biological risks condemn states to “repeat the painful lessons of the past.” Similarly, governments generally focus on solving immediate problems rather than solving future threats, which Mr. Ho described as examples of “hyperbolic discounting.”

Mr. Ho next outlined potential strategies for overcoming the cognitive biases inherent in this form of reactive (as opposed to horizon-scanning) policymaking. When considering high-priority biosecurity issues, he underscored the importance of conducting tabletop exercises, citing a landmark exercise known as Dark Winter, which simulated the dynamics of emergency response in the US following a smallpox attack. Mr. Ho stressed that such exercises can reduce the shocks associated with black swan events and enhance states' readiness to respond to future crises. Furthermore, policymakers who participate in such efforts remain sensitized to potential threats, help maintain political momentum on critical biosecurity issues, and are more likely to mobilize emergency funds and other resources in the event that a crisis manifests. In fact, after a careful review of Dark Winter, Singapore completed its own smallpox exercise, which informed policymakers' decision to procure enough smallpox vaccines for all Singaporean residents and visitors.

Preparedness for Biological Threats in Singapore and in the US

Singapore, like the US, dedicates significant resources toward preparedness for biological threats. While Singapore focuses heavily on naturally occurring and emerging infectious diseases due to their ubiquity in the region, it also prepares for intentional biosecurity threats. One participant noted that Singapore's wealth and strategic alliances can be construed as national security vulnerabilities, remarking, "Singapore is at risk, because it is a very rich country, surrounded by less well-off countries with extremist and militant cells harboring a grudge against the West... toward which Singapore is perceived as a close ally." Singapore also considers itself vulnerable to infectious disease threats because it is densely populated; there is a high volume of trade and travel in the region, where many tropical diseases are endemic; there exist multiple reservoirs of infection and disease vectors; there is a high dependency on food imports; and the nation faces growing health threats posed by life in an increasingly built environment. As a result, Singapore has taken several measures to ensure the health and security of its population in the face of biological threats. Two significant examples of biosecurity preparedness commitments include having enough smallpox vaccines for all of its population (including visitors), and investing extensively in disease surveillance technologies at its borders.

Describing border security as "the first line of defense for a safe Singapore," representatives from Singapore's Ministry of Home Affairs (MHA) described the various technologies and surveillance strategies used to monitor the movement of disease at border checkpoints. Though Singapore is a small nation of roughly 5.4 million people, it has as many as 300,000 commuters daily who cross the Singaporean-Malaysia border.⁷ Last year alone saw some 15.5 million travelers entering the country, which creates a significant point of vulnerability to infectious disease outbreaks. MHA has developed tools intended to help provide early warning of infectious disease threats. These measures may include thermal screening, reviews of health declarations from inbound travelers, and "non-intrusive biosurveillance" air sampling techniques screening for influenza as well as agents of bioterrorism (e.g. plague, tularemia, smallpox, and anthrax), and emerging infectious pathogens like Ebola and the Middle East Respiratory Syndrome coronavirus (MERS-CoV). Singapore also relies on a network of BSL-2-ready, BSL-3-upgradable CBRN laboratories to rapidly identify pathogens of concern. Singapore places great

emphasis on preparing for naturally occurring infectious diseases. For example, Make Health Connect – a network of 1,200 clinics based in Singapore – has developed a disease map that offers live visualizations of infectious disease cases throughout the country, including chickenpox, dengue fever, foot-and-mouth disease, and upper respiratory infections.⁴

Communication about Disease Surveillance and Health Security Threats

Singapore’s experience with SARS in 2003 was the most powerful factor in shaping future governmental responses to infectious disease threats. Singapore was aggressive in its response to SARS, establishing temperature screening at airports, serving quarantine orders to nearly 8,000 people, placing over 4,000 individuals on daily telephone surveillance, and spending millions to bolster hospital capacity.⁸ SARS infected 238 Singaporeans, killing 33.⁸ Subsequent responses to other potential epidemics have been similarly extensive; for example, in response to the threat of MERS, Singapore has reinstated temperature checks for passengers arriving at Singapore’s airports from countries in the Middle East.⁹ Additionally, hospitals in Singapore have developed strict infection control protocols for managing suspected cases of Ebola, and the Ministry of Health has instated a 21-day quarantine policy for Ebola-positive individuals and their close contacts.¹⁰

The lessons learned by the Singaporean government and public during the SARS pandemic have influenced the nation’s approach to other biothreats. Singapore recognized the seriousness of SARS early on, and authorities considered the problem to be a serious public security threat. It took the government of Singapore only 2 days to secure legal approval for its home quarantine orders. The Prime Minister also wrote an open letter petitioning the public to practice personal responsibility and respect quarantine orders. As the pandemic progressed, political will again played an important role in alleviating stigmatization of healthcare workers and their children: a messaging campaign led by the Prime Minister worked to convince the public that the health care workers were an integral part of the disease response, and should be supported rather than shunned.

The SARS effort in Singapore was a whole-of-government response that adapted to the public’s concerns after painful experiences and lessons learned. Home Quarantine Orders (HQOs) were originally delivered by uniformed policemen; however, after complaints that their presence at people’s homes made it appear as though the residents had run afoul of the law, law enforcement authorities began dispatching plainclothes officers to perform this duty instead. Quarantine orders were further supported with follow-up contacts. All those quarantined received a home visit from a nurse along with a “quarantine kit” consisting of a thermometer and educational materials. Quarantined citizens also received a monetary allowance (roughly equal to the average Singaporean salary) to compensate for time not spent at work. The government also issued a S\$230M (\$132M USD) relief package for the hardest hit tourism and transport industries.¹¹ These measures allowed business in Singapore to proceed nearly as usual, even in the midst of a public health crisis.

Singapore also adapted its response to SARS based upon the community perception of risk. As described by the dialogue attendees, the SARS experience in Singapore featured a high “outrage factor” among

the general public that they would need to face such risks, which was heavily influenced by the novelty of the threat and the public's perceived lack of control people over their personal safety. The approach developed for addressing community perceptions of risk has influenced Singapore's response to Ebola in 2014. While the likelihood of Ebola being imported into Singapore is perceived to be low, and there is confidence that Singapore's hospital systems will be able to cope in the event of an imported case, the government has made concerted efforts to publicly address the threat of Ebola. Some of the lessons learned from SARS that have been applied to Ebola include the following rules: do not aim for zero fear in the public; acknowledge uncertainty and err on the side of alarm; be careful when making risk comparisons; tell people what you have done and what to expect; and give people things to do. Participants also discussed the value that some measures may have in mitigating public fears. One American participant stated that in the US, temperature screenings have been seen by public health officials as not worth the cost because they do not have a high likelihood of catching cases, but "that's not how governors think. These practices are important in terms of liaising with the public. We underestimate how important they are." Another point of difference is the issue of public respect and trust in government policies. Referring to American nurse who treated Ebola patients in Sierra Leone, returned to her home state of Maine, and defied an Ebola quarantine order by taking a bicycle ride outside – one Singaporean participant said, "Nobody in Singapore would ever ride a bike through their neighborhood if they were suspected of being sick with Ebola. It's part of the culture."

Ebola and the Possibility of Imported Cases

Participants reflected on the US response to imported cases of Ebola, and discussed how Singapore might respond to a similar situation. Comparing Singapore's border concerns to US concerns, it was mentioned that while Canada could likely marshal resources to successfully treat Ebola cases and contain the spread of the disease, Mexico, however, would probably struggle to do the same. In considering the US response, several participants remarked that some of the CDC's communications were detrimental to public confidence, particularly early claims that most American hospitals could handle an Ebola case. Still, they commended the US efforts to work with Liberia's Ministry of Health in coordinating the response, commit funds towards improving the response, strengthening laboratory systems and Emergency Operations Centers (EOCs), augmenting healthcare workforces, refining health communications, and improving surveillance.

Participants felt that the Singaporean government retains a good relationship with the media and maintains a culture of transparency when communicating with the public about risk. Yet while the media has in general a better relationship with the government in Singapore than in the US, there are generational shifts occurring in Singapore. Social media, in particular, has presented critical communication challenges. One participant commented, "How do we present messages as fast as possible—and accurately? In social media, you can present information quickly, but not necessarily accurately." Another challenge is deciding what content to present. One participant remarked that disseminating information quickly via social media platforms is not the same as communicating effectively with the public. Participants stressed the need for more effective ways of evaluating the quality and framing of public health messages, as well as their mode of dissemination.

In response to the threat of Ebola, Singapore has instituted a visa requirement for travelers originating in Guinea, Sierra Leone, and Liberia, and cautioned citizens to avoid non-essential travel to affected areas throughout Africa.¹² The US has imposed similar measures, requiring incoming travelers from Liberia, Sierra Leone, and Guinea to enter through one of five designated airports and undergo fever screenings. Select states, however, have mandated that healthcare workers returning from West Africa be quarantined for 21 days. One participant stated that travel bans may at best delay importations of cases, but will not prevent them entirely. Some in the US have argued that delaying travelers would give countries more time to prepare, while others argue that the money saved by not instituting a ban could be used immediately to strengthen existing systems and protocols. However, this is likely to be a persistent point of disagreement between and within nations.

Ongoing concerns about Ebola—both in terms of emerging cases in West Africa and the possibility of imported cases elsewhere—have catalyzed preparedness efforts in both the US and Singapore. There are opportunities for both nations to share disease containment strategies and learn from each other's efforts to prepare for emerging biothreats. While trust in government is considerably higher in Singapore than in the US – which gives rise to differences in the way emergency preparedness planning is conducted in both countries – there are generational differences heralded by social media that will create new challenges in Singapore. Singaporean participants conveyed that younger Singaporeans expect and demand greater transparency in government decision-making, which will affect preparedness and response efforts during epidemics of the aftermath of a bioterrorism event.

Regional Approaches to Addressing Biological Threats

The ongoing Ebola crisis demonstrates the need to build response capabilities at the regional level. Participants commented that one of the aftereffects of SARS was that “the value of human life shifted in the region,” leading to greater awareness and importance placed upon public health. Also, the epidemic “underscored the need for a regional approach to biosecurity” as diseases can spread from one country to another. In discussing infectious disease emergency response, participants from both sides stated that at present, they would “expect countries to respond individually.” However, based on the metrics specified in the International Health Regulations (IHR), there is considerable variance in nations' surveillance and response capacities; in fact, the vast majority lack the core public health capacities needed to detect and respond to infectious disease threats. This indicates a striking level of under-preparedness globally, regardless of whether an outbreak of disease results from a naturally occurring pathogen, a laboratory accident, or a deliberate attack.

The IHR has 196 party states. In June 2012, countries were required to report to WHO on the progress of their core capacity achievements in specified public health competencies. Only 42 nations reported that they had fully achieved these capacities, and 118 successfully submitted an extension request with a plan of action. In June 2014, countries reported again; while the numbers have not been publicly released, it is likely that many nations have yet to achieve the core capacities. Even for those nations that have achieved a certain level of capacity on paper, real-world challenges for implementing and sustaining their public health systems remain. Furthermore, there is no penalty for a nation failing to

build public health capacity. As a result, WHO depends on its authority to publicly request nations to enhance their capacities – thereby effectively “naming and shaming” non-compliant party states – to enforce the provisions of IHR.¹³

The GHSA is an effort between the US government, 44 other nations, and leading international organizations that aims to make the world safe and secure from infectious disease threats. Nations supporting the GHSA are encouraged to participate in one of eleven “Action Packages,” which consist of commitments targeted toward specific GHSA objectives. GHSA countries are free to pursue these commitments at the national, regional, or global levels.¹⁴ Participants at the dialogue observed that “there seems to be a strong sense of regional vulnerabilities,” in public health infrastructure, and so countries committed to the GHSA have begun to partner with neighboring nations to focus on regional weak links. Another participant commented that such collaborations are beneficial for all parties involved, remarking, “We can learn a lot from how smaller countries have harnessed all their resources to promote collaboration across all disciplines” which leads to greater efficiencies.

The need for enhanced regional capacities to respond to disease threats extends to laboratory services. Participants noted that diagnostic capabilities must also be expanded and coordinated to ensure that the healthcare, public health, and research communities produce coherent responses to infectious disease emergencies. Such emergencies often present opportunities for health officials to collect data that could be used to mitigate the crisis at hand, as well as plan ahead for future contingencies. However, the rapid nature of most public health crises often prevents scientists and health authorities from capitalizing on such opportunities. For example, one participant noted that “we lost an opportunity to understand SARS super spreaders”-- those individuals who, when infected, transmitted the disease to unusually high numbers of people. A lack of research plans for such a contingency resulted in critical information gaps in the health and security communities’ understanding of the dynamics of SARS disease transmission.

Since disease can spread beyond national borders to affect regions very quickly, participants discussed the merits of establishing well-defined protocols for mobilizing funds, personnel, and resources prior to an emergency. Such measures exist in the nuclear community, as was observed by one participant, but are absent for biological threats. Given that there is no equivalent of a security exigency equivalent for biological threats, engaging nations in committing resources regionally to combat such threats remains a challenge. Still, dialogue attendees nevertheless affirmed the necessity and importance of regional approaches to biosecurity. As one American participant remarked, “We in the US need to be in dialogue with the countries around us—our defenses are only as good as the weakest link in the global chain.”

Participants also noted that while the science and technology required to make biological weapons is quite accessible, “we don’t see a lot of people doing it.” Most agreed, however, that this is not a consequence of the difficulty of creating bioweapons, citing the relative ease with which the Rajneeshee cult poisoned salad bars in the US in 1984. One individual speculated that perhaps the reluctance to use bioweapons might have something to do with the perception of the morality of using biological agents as weapons. If that is the case, the normative actions of international treaties, statements of regional political affiliations, and dialogues between nations reinforce the non-biological weapons norm. This

underscores the importance of the Biological Weapons Convention (to which both Singapore and the US are members) as well as the UN Security Resolution 1540 (UNSCR 1540), which obligates signatory states to take measures against the proliferation of chemical, biological, radiological, and nuclear weapons, and thereby prevent non-state actors from acquiring such weapons of mass destruction.

Substantive government action on public health problems requires a multi-sectoral approach, and a deliberate framing of the non-health consequences of inaction. In both Singapore and the United States, public health issues must often be framed in non-public health terms (i.e. threats to the nation's economy or security) to garner attention from the highest levels of government. Participants from both nations agreed that there are opportunities for shared action on mutually important public health challenges.

A great deal of the discussion centered around how public health is perceived and acted upon in other, non-public health contexts; for example, if a public health crisis is also seen as a national security threat, or as a threat to trade or commerce sectors, more decisive action is taken to resolve the public health problem. Public health actions in these contexts, however, take on greater political meaning in these typically, larger scenarios.

Some participants felt that some in the US government and state governments believe that Ebola is a challenge that requires a strong response from CDC, NIH, and possibly federal immigration authorities, but that other government agencies need not be centrally involved. Participants from both Singapore and the US agreed that infectious disease crises like Ebola generate cascading effects that extend to all areas of government and all aspects of governance. The US response to Ebola stands in stark contrast to its earlier response to the threat of pandemic influenza. In the response to 2009 H1N1 and in the whole-of-government preparations that preceded that epidemic, there was a great deal of engagement across government sectors in the US. Now, however, "nobody in the USG believes they should be in charge of Ebola." Another participant agreed, saying that "Ebola remained a health issue [versus a national security issue] for far too long – it didn't reach the White House until six months into the outbreak."

Key challenges remain for such whole-of-government approaches to disease, regardless of whether the event is in Singapore or in the US. Different agencies retain different standard operating procedures, use different language, or assign different meanings to operating terms depending on the agency involved. One participant remarked, "People can use the same terminology, but they might be hearing different things".

Still, past crises that have required multi-sectoral responses have led to enhanced preparedness now. As one participant noted, "In Singapore, we have gone through multiple crises in the health arena – SARS, dengue, preparedness for Ebola, influenza. These have all brought all the government sectors together....In a crisis situation, there tends to be greater collaboration because there is a common goal or a common enemy to fight against." During a crisis, it is easier to get stakeholders to volunteer, build networks, and to repurpose equipment, personnel, and resources. However, after crises abate, sustaining needed investments in preparedness – e.g. building facilities, enhancing laboratory capabilities, and buying equipment – remains challenging.

Both Singapore and the US appear to be taking similar, interdisciplinary approaches to biosecurity and public health. Participants agree that the most progress is made when public health officials conduct outreach to the various arms of government and society that don't regularly engage in public health. Oftentimes the stumbling blocks to an effective response during public health emergencies emerge in influential non-health sectors. Therefore, one participant advised that public health officials would do well to frame public health issues in non-health contexts to maintain engagement from non-health sectors. He also emphasized that 70% of emerging diseases now are zoonotic and there is a need to break down barriers between the agricultural, veterinary, and health sectors.

The Role of ASEAN

Another potential regional approach for Singapore is to involve the Association of Southeast Asian Nations (ASEAN). ASEAN is a regional organization founded in 1967 whose member states today include Singapore, Malaysia, Indonesia, Thailand, the Philippines, Brunei, Laos, Myanmar (Burma), Brunei, and Vietnam. Its primary aim is to enhance regional cooperation in the realms of trade and economic growth, cultural development, social progress, promoting peace and regional stability, and education.¹⁵

Participation in ASEAN depends on the country; usually, there is an in-kind financial contribution by states. Involvement in ASEAN is thought to promote transparency among regional partners, as nations "have a better sense of what Country A might be facing." Without such a framework, it was mentioned, it would be harder to encourage countries to work together on pressing problems. The ASEAN framework encourages states to help each other on health security issues, as an outbreak in one country presents a threat to the whole region. One participant remarked, "There is a deep sense of shared vulnerabilities in the region. You hear that at the top and at the bottom – you are all interconnected. It's easy to convince policymakers that they should act on certain things – otherwise my insecurity becomes your insecurity." ASEAN's forays into health security matters are still early, and the effectiveness of the organization's work in the space remains to be determined; during SARS, their role was more passive.¹⁶ ASEAN has no mandatory assistance requirements, and some acknowledged that its deliberations can at times move slowly. One participant noted that ASEAN has been more effective in promoting a collaborative approach to addressing non-biological threats. Responses to natural disasters, for example, have been swift and regional. In January last year, an ASEAN Track-1 dialogue was focused on global response mechanisms for emergencies. However, the infectious disease contingency of ASEAN remains less agile in formulating similarly effective regional responses.

ASEAN has successfully dealt with some biosecurity issues, such as stockpiling medical countermeasures. Some countries were reluctant to stockpile smallpox vaccines, for example, because of the cost. "But," one Singaporean attendee shared, "Malaysia and Singapore decided that we had to do it to allay public fears...In ASEAN, some of the less-developed economies think stockpiling is unnecessary – it is very expensive to create and maintain a stockpile. But overall, this was a good exercise for ASEAN's culture – it helped promote the idea of preparedness among member countries."

Biosafety and Biosecurity Practice

In addition to discussing naturally occurring biological threats, dialogue participants explored the biosecurity risks inherent in scientific research and laboratory practice. Recent biosafety breaches in the US and Singapore have underscored the importance of enhancing biosafety as a means of minimizing biosecurity vulnerabilities in both nations. The CDC, for example, has come under scrutiny for a number of mishaps at its laboratory facilities. In June 2013, CDC reported that one of its labs neglected to adequately inactivate live cultures of anthrax, resulting in the exposure of some 75 staff to the potentially deadly bacteria. All those exposed received protective courses of antibiotics and were monitored for symptoms following the accidental exposure.² Then, in July, CDC reported that a sample of low-pathogenicity H9N2 influenza virus was accidentally contaminated with high-pathogenicity H5N1 virus. The contaminated samples were subsequently transported to a facility at the Department of Agriculture before the error was discovered.¹⁷ In the same month, vials containing viable samples of variola virus were found at the National Institutes of Health (NIH) campus, in a laboratory operated by the Food and Drug Administration. Over the course of subsequent inspections of other government laboratories, investigators discovered improperly stored samples of other dangerous select agents, including ricin and *Yersinia pestis*, the bacteria that cause plague. In response to these events, Dr. Thomas Frieden, the director of CDC, ordered reviews of biosafety culture, protocols, and personnel at CDC, and assembled an external team of experts to advise CDC on future courses of action. Additionally, NIH ordered a comprehensive sweep of all its laboratories and declared September 2014 to be “National Biosafety Stewardship Month,” during which its grantees and contractors were encouraged to review their respective biosafety practices and conduct inventories of laboratory samples.

Singapore, too, has experienced consequential lapses in biosafety in the past. During the 2003 SARS pandemic, for example, the country reported an isolated case of the disease resulting from an accident at a BSL-3 laboratory at the National University of Singapore. The patient, a doctoral student, was infected with a strain of the SARS coronavirus that had been cross-contaminated with a sample of West Nile virus.¹⁸ Upon inspecting the facility in question, Singapore’s Environmental Health Institute identified numerous structural deficits and reported insufficient training amongst laboratory workers; ultimately, the inspectors recommended that the facility address these deficiencies, implement stricter recordkeeping protocols, and undergo an external audit before reopening.¹⁹

Both nations experience the challenge of maintaining laboratory safety and reducing insider threats while still promoting science. As one participant noted, “we don’t want to stifle scientific creativity by over-regulating and ensuring compliance with protocols – we need to get people to actually think about risk as they work instead of doing things blindly.”

Reporting biosafety mishaps also remains challenging. In the US, biosafety accidents are required to be reported for all incidents involving select agents, just like in Singapore. In fact, in Singapore, every high-risk experiment has to be registered with the government to ensure that, in the event of accidental exposure, first responders are aware of the specific infectious threat in question, and can inform hospitals ahead of time. Like the US, Singapore has created mechanisms for reporting incidents to university research authorities, as well as to MOH and the Ministry of Manpower. However, participants from both countries acknowledged that lessons learned from biosafety breaches are not widely shared.

Lessons are shared internally within individual labs for the most part, and are not promulgated unless the incident is particularly severe.

Perspectives from Indonesia and Malaysia

Delegates from Malaysia and Indonesia -- Dr. Chong Chee Kheong, Director of the Disease Control Division of the Malaysian Ministry of Health; and Dr. Daniel Tjen, Surgeon General of the Indonesian Armed Forces. -- were invited to this meeting of the dialogue to bring in the perspectives of additional, strategic players in the region, and to further strengthen participants' understanding of the regional dynamics of biosecurity in Southeast Asia. Drs. Chong and Tjen provided attendees with an overview of biosecurity practice and policy in their respective countries, and identified potential areas of further exploration and future collaboration. Building on the success of the US-Singapore Strategic Dialogue on Biosecurity, the UPMC Center for Health Security plans to expand the existing framework into a Track II multilateral dialogue, adding Malaysia and Indonesia to the US-Singapore contingent in 2015.

Given that Singapore, Malaysia, and Indonesia are geographical neighbors, members of the Association of Southeast Asian Nations (ASEAN), and partners in trade, defense, and health, relations between the three are of strategic consequence in the Southeast Asian region. Key sociopolitical, economic, and cultural differences exist between these nations. Singapore is a small, high-income nation with a population of 5.4 million people and a gross domestic product of \$297.9 billion (USD) in 2013.²⁰ Indonesia, by contrast, is a lower-middle-income nation (GDP \$868.3 billion) with the world's fourth-highest population (249.9 million).²¹ Malaysia is an upper-middle-income nation (GDP \$312.4 billion) with a population of 29.72 million people. Singapore is considered to be the most religiously diverse of the three nations (though it has a Buddhist majority), retains a large expatriate population, and is shaped by cultural and political influences from the West.²² Malaysia and Indonesia, meanwhile, are predominantly Muslim countries and are home to large Malay, Chinese, Japanese, and Sundanese populations. Singapore and Malaysia are both affiliated with the World Health Organization's (WHO) Western Pacific Regional Office, while Indonesia belongs to WHO's Southeast Asian Regional Office. All three nations are represented in the Asia Pacific Biosafety Association, though Malaysia and Indonesia maintain their own in-country biosafety organizations.

During the meeting, Dr. Chong outlined Malaysia's approach to biosecurity, describing a spectrum of biological threats ranging from naturally occurring disease outbreaks to deliberate uses of biological weapons. As an adopter of UNSCR 1540, Malaysia recently submitted a progress report affirming its ability to fulfill the mandates of the Resolution, and has offered assistance to other states seeking to do so.²³ Malaysia is also a party to the Biological and Toxin Weapons Convention (BTWC), has enacted numerous laws in support of the Convention, and hopes to pass new legislation to further support BTWC and UNSCR 1540 implementation. However, the Malaysian government has encountered difficulties in passing the legislation (which was originally prepared in 2011), and has struggled to solicit buy-in from academic researchers, who harbor concerns that it could constrain their work.²⁴ The Malaysian government employs an interagency approach to biosecurity, with the Ministries of Health, Defence, and Natural Resources & Environment responsible for devising biosafety and biosecurity policy,

fostering collaboration with international partners, and conducting risk assessments for safe usage of biotechnology, respectively. Additionally, the Department of Standards has developed biosafety and biocontainment protocols for laboratories, while the Malaysian Biosafety and Biosecurity Association organizes international workshops and seminars in support of safe laboratory practices. Dr. Chong also addressed Malaysia's future biosecurity priorities, highlighting increased interagency cooperation, exercises involving all levels of industry, academia, and government, strengthening national capacities in preparedness and response, and enhancing collaboration with international partners.

Dr. Tjen followed with a description of Indonesia's biosafety and biosecurity infrastructure. He underscored emerging and re-emerging infectious diseases – notably, malaria, tuberculosis, dengue fever, avian influenza, anthrax, plague, Hantavirus, Nipah virus, and rickettsiosis – as persisting problems. Indonesia also faces challenges in enhancing laboratory safety and security at the national level in a sustainable way, and is working to strengthen BSL-2 capabilities nationwide. The gravity of these threats is accentuated in part by the presence of several extremist groups across the country, including Jamaah Anshorut Tauhid (an Al-Qaeda sympathizer), Negara Islam Indonesia (a sympathizer of the Islamic State), and Jamaah Islamiah. Dr. Tjen also highlighted the prominent role played by the Indonesian military in responding to national health emergencies, noting the military's strengths in logistics management, communication, and resource mobilization. Another dialogue participant (also from Indonesia), added that the military enjoys a high degree of respect from the public, given its "instrumental role" in securing the nation's independence. Still, Dr. Tjen noted that communication between the military and civilian sectors remains weak, and that the military is often excluded from whole-of-society planning for biosecurity emergencies.

Notably, both Dr. Chong and Dr. Tjen cited outreach to local leaders and non-governmental partners as important components of enhancing biosecurity in their respective countries. In Malaysia, for example, mobile clinics and "flying doctor" clinics enhance healthcare delivery among hard-to-reach populations, while volunteers play important roles in managing the country's burden of non-communicable diseases. Malaysia has also enlisted practitioners of traditional medicine in healthcare delivery efforts to further penetrate hard-to-reach populations. General increases in health literacy in Malaysia have facilitated these efforts, as such populations increasingly subscribe to modern medical treatment. Additionally, the Indonesian government has collaborated with stakeholders in academia and the private stakeholders to formulate a Code of Conduct on Biosecurity, and also works with provincial- and district-level leaders to enhance military integration into local preparedness efforts.

Next Steps

The next dialogue, which will likely include Indonesia, Malaysia, Singapore, and the United States, will tentatively be held in Washington, DC in June, 2015. Thinking ahead to that meeting, participants discussed possible agenda topics and activities for that meeting. Some suggested that one important goal would be to include a focused discussion and comparison of risk assessments for biological threats in the respective countries.

Participants agreed that a more thorough discussion of border issues would likewise be useful. There was great interest in having a more detailed discussion about options for detection and response to biological threats at each nation's respective borders. Singaporean participants said that they would be interested in understanding better how the US would coordinate with Canada and Mexico, should a regional biosecurity event occur.

Many participants were also enthusiastic about undertaking a biosecurity themed tabletop exercise at a future meeting. Participants agreed that such exercises can be very effective ways to draw out potential gaps in preparedness and potential problems with coordination during biosecurity emergencies. While regional coordination seemed to be a shared goal, there are many obstacles which could potentially be highlighted and addressed during future discussions and tabletop exercises. A US participant offered that it would be likewise useful to explore case studies in order to discern lessons learned. Agreeing, a Singaporean participant suggested that the group jointly identify specific gaps in preparedness that could be addressed in the dialogue.

Some participants also urged the group to consider the inclusion of additional countries in the Asia-Pacific region. Others acknowledged the value of doing so, but expressed the hope that the group did not expand too quickly so that participants would not lose the near term ability to more deeply understand the approaches, challenges, and views of those countries already engaged in the dialogue. One participant encouraged the group to consider developing actual policy recommendations, when appropriate.

All participants agreed that the biosecurity dialogue is an excellent forum to develop long-lasting relationships that can collectively be an effective platform to strengthen biosecurity in the US and in the Asia-Pacific region.

About RSIS

RSIS traces its origins to 1996 when it was originally established as the Institute of Defence and Strategic Studies. In January 2007, the Institute was designated as an autonomous school within Nanyang Technological University, and evolved into a leading academic center for the study of international affairs. Today, RSIS consists of six centers dedicated to examining issues that affect the security and stability of the Asia Pacific region: the Institute of Defence and Strategic Studies, the International Centre for Political Violence and Terrorism Research, the Centre for Excellence for National Security, the Centre for Non-Traditional Security Studies, the Temasek Foundation Centre for Trade & Negotiations, and the Centre for Multilateralism Studies. RSIS collaborates internationally with other schools specializing in international affairs, forming a global network of excellence in scholarship and practice.

Appendix A: Agenda

Singapore–US Strategic Dialogue on Biosecurity

November 11, 2014

19:00-21:00 **Welcome Dinner (by invitation only)**
Straits Kitchen, Grand Hyatt, 10 Scotts Road

Lecture Theatre, Student Wing
S. Rajaratnam School of International Studies (RSIS)
Block S3.1, Level B3
50 Nanyang Avenue, Singapore 639798

November 12, 2014

08:00-08:15 **US Participants meet at Marriott Hotel lobby, to be transported to RSIS**
09:00-09:30 **Participants arrive at RSIS, coffee/tea (Reception Area)**

09:30-10:00 **Welcome and Introductions**

Ambassador ONG Keng Yong
Executive Deputy Chairman, RSIS

Dr. Tom INGLESBY
Chief Executive Officer and Director, UPMC Center for Health Security

Dr. Gigi GRONVALL
Senior Associate, Principal Investigator, UPMC Center for Health Security

Keynote Address

Mr. Peter HO
Visiting Scholar, Lee Kuan Yew School of Public Policy
Adjunct Professor, RSIS
Senior Advisor, Centre for Strategic Futures
Former Head, Singapore Civil Service
Former Permanent Secretary for Foreign Affairs, National Security and Intelligence
Coordination, Special Duties and Defence

10:00-10:15 **Coffee Break**

10:15-11:15 **Session 1: Biosecurity Through the Lens of Homeland Security**

Exploration of how biosecurity preparedness has enhanced homeland security in Singapore and the US, from upstream monitoring of state of the art technologies to

downstream implementation and deployment of feasible technologies. In Singapore, how have these technologies been deployed to meet Singapore's homeland security needs and also to serve as a reference point for regional learning? For the US, how has the homeland security role of the laboratory and other biosecurity assets changed over the past decade?

Opening Remarks: Dr. LEE Fook Kay and Dr. Jim LE DUC

11:15-12:30

Session 2: Ebola and Emerging Infectious Diseases

The continuing Ebola crisis will be reflected on, with a discussion of how Singapore and the US have responded. There will be a specific examination of what the US or Singapore might do in the event of increased Ebola importations or an outbreak in a neighboring country. Lessons learned thus far for the US and Singapore will be discussed, as well as the role of the media in communications regarding infectious disease threats.

Opening Remarks: Dr. Noreen HYNES, Dr. Tikki PANGESTU, Dr. Vernon LEE, and Dr. Annelies WILDER-SMITH

12:30-13:30

Lunch

13:30-15:15

Session 3: Asia-Pacific Regional Contingencies for Biosecurity: The Role of Regional Bodies and International Organizations

This session will focus on areas where Singapore and the US may work together to resolve regional contingencies with biosecurity implications. This discussion will also consider the role of collaborative relationships among scientists, public health practitioners, and the security community, with an emphasis on discussing the role of regional bodies such as ASEAN and APEC and the regional presence of international organizations (WP and SEA regional WHO offices, and the Asia Pacific Strategy for Emerging Diseases).

Opening Remarks: Mr. KWA Chong Guan and Dr. Seth CARUS

Briefing: Dr. Mely CABALLERO-ANTHONY

15:15-15:30

Coffee Break

15:30-16:45

Session 4: Regional Panel

Dr. CHONG Chee Kheong and Dr. Daniel TJEN will present biosecurity perspectives from their countries. In particular, their remarks will address regional preparedness and realities of biosecurity threats, with a focus on active regional militant groups that may be considering using biological weapons.

16:45-17:00

Group Photo (by RSIS photographer)

18:00-21:00

Dinner (by invitation only)

Quentin's Eurasian Restaurant

139 Ceylon Road, Eurasian Community House, Singapore 429744

November 13, 2014

08:00-08:15 **US Participants meet at Marriott Hotel lobby, to be transported to RSIS**

09:00-09:30 **Participants arrive at RSIS, coffee/tea (Reception Area)**

09:30-10:45 **Session 5: Biosecurity and Multidisciplinary Governmental Approaches**

In this session, the participants will discuss the challenges and opportunities to enhance biosecurity preparedness in a necessarily multisector approach (health, defense, homeland security, science and technology, industry), from the perspectives of Singapore and the US. In addition, there will be a discussion of nongovernment dimensions, such as the roles and responsibilities of traditional and social media, as well as the private health sector and NGOs.

Opening Remarks: Dr. Vernon LEE and Dr. Kenneth BERNARD

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

11:00-12:30 **Session 6: International Health Regulations: Strengthening Capacities, Lessons from Ebola**

Building on the previous meeting's discussion on public health and the global health security agenda, this session will focus on approaches to strengthening international compliance with the International Health Regulations, health system preparedness in regional countries, and a discussion of how progress can be measured. What are the most valuable contributions the US and Singapore can make to this effort?

Opening Remarks: Dr. Julie FISCHER and Dr. OOI Peng Lim Steven

12:30-13:30 **Lunch**

13:30-15:00 **Session 7: Biosafety and Developing National Norms and Capabilities**

This session will focus discussion on recent biosafety events and mishaps and will discuss strategies in Singapore and the US to focus attention on safety. How can policymakers be engaged in discussions about biosafety progress?

Opening Remarks: Dr. CHUA Teak-Mean, Dr. Barbara JOHNSON, and Dr. Gigi GRONVALL

15:00-15:15 **Coffee Break**

15:15-16:45 **Session 8: Wrap-up and Discussion on Expanding the Dialogue**

The concluding session will solicit suggestions for specific people and areas of expertise to be included in the 2015 multilateral dialogue.

Appendix B: References

1. Tomkins D. US Reaffirms Asia Role. *The Diplomat*. June 8, 2011.
2. Centers for Disease Control and Prevention. *Report on the Inadvertent Cross-Contamination and Shipment of a Laboratory Specimen with Influenza Virus H5N1* August 15 2014.
3. Centers for Disease Control and Prevention. *CDC Media Statement on Newly Discovered Smallpox Specimens* July 8, 2014.
4. Hoh WK. Singapore's First Disease Map Delivers Real-Time Information on Infectious Diseases. *The Straits Times*. October 5, 2014.
5. Japan International Cooperation System. *JICS Presented the ASEAN Stockpile Project at the ASEAN Senior Officials Meeting on Health Development 2013*.
6. DSO's Chemical Defence Program. *Unveiling the Face of Progress*.
7. Tong LC. Economic reform needed to tackle exodus of Malaysians to Singapore. *The Malaysia Insider*. June 21, 2014.
8. Tan CC. SARS in Singapore -- key lessons from an epidemic. *Ann Acad Med Singapore*. 2006;35(5):345-349.
9. Spyerkman K. Temperature checks at S'pore airports from Sunday. *Channel News Asia*. 2014. <http://www.channelnewsasia.com/news/singapore/mers-temperature-checks/1107836.html>. Accessed July 3, 2014.
10. Risk of Ebola spreading to Singapore 'low': MOH. *Channel Newsasia*. September 8, 2014.
11. Tourists Return to Singapore After SARS. *China Daily (Hong Kong edition)*. October 8, 2003.
12. Ministry of Health Singapore. *Visa Requirement for West African Countries Affected by Ebola 2014*.
13. Kamradt-Scott A, Rushton S. *The IHR revisions: socialization, compliance and changing norms of global health security*: European Research Council; September 18 2011.
14. Centers for Disease Control and Prevention. *Global Health Security Agenda: Action Packages*. 2014.
15. Association of Southeast Nations. Overview. <http://www.asean.org/asean/about-asean/overview>
16. Curley M, Thomas N. Human security and public health in Southeast Asia: the SARS outbreak. *Australian Journal of International Affairs*,. March 2004;58(1):17-32.
17. Kaiser J. *CDC explains mix-up with deadly H5N1 avian flu*. Science Insider. 2014.
18. Senior K. Recent Singapore SARS case a laboratory accident. *Lancet Infect Dis*. Nov 2003;3(11):679.
19. Review Panel on New SARS Case and Biosafety. *Biosafety and SARS Incident in Singapore September 2003*. 2003.
20. The World Bank. 2014; http://data.worldbank.org/country/singapore#cp_wdi. Accessed December 16, 2014.
21. The World Bank. 2014; <http://data.worldbank.org/country/indonesia>. Accessed December 16, 2014.
22. Forum TP. *Global Religious Diversity*. April 4, 2014.
23. Nuclear Threat Initiative (NTI). *Malaysia 1540 Reporting*. September 8, 2014.
24. Nuclear Threat Initiative (NTI). *Malaysia Prepares Biological Weapons Convention Implementation Legislation*. July 19, 2011.

Appendix C: Participant List

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