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**Emerging Infectious Disease Surveillance in Southeast Asia:
Cambodia, Indonesia, and the Naval Area Medical Research
Unit 2**

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Emerging Infectious Disease Surveillance in Southeast Asia: Cambodia, Indonesia, and the Naval Area Medical Research Unit 2

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Abstract: Emerging infectious diseases (EIDs) pose international security threats because of their potential to inflict harm upon humans, crops, livestock, health infrastructure, and economies. The following questions stimulated the research described in this paper: What infrastructure is necessary to enable EID surveillance in developing countries? What cultural, political, and economic challenges stand in the way of setting up such infrastructure? And are there general principles that might guide engagement with developing countries and support EID surveillance infrastructure? Using the U.S. Naval Area Medical Research Unit No. 2 as common denominator, this paper compares barriers to EID surveillance in Cambodia and Indonesia and presents key factors—uncovered through extensive interviews—that constrain disease surveillance systems. In Cambodia, the key factors that emerged were **low salaries, poor staff and human resources management, the effect of patronage networks**, a culture of **donor dependence, contrasting priorities** between the government and international donors, and **a lack of compensation for animal culling**. The Cambodian military has also played a part. The government ceased a merit-based salary supplement scheme for civil servants after the military is alleged to have demanded similar pay incentives that donors had no interest in funding. In Indonesia the key issues emerging as barriers to effective surveillance include **poor host-donor relationships**, including differing host-donor priorities and a misunderstanding of NAMRU-2 by Indonesian authorities; **low salaries**; a **decline in the qualifications of personnel in the Ministry of Health**; **poor compensation for animal culling**; and **difficulties incentivizing local-level reporting** in an era of decentralization. As the interviews with in-country practitioners revealed, low levels of development in general are the main impediments to building EID surveillance infrastructure and are perhaps beyond the scope of health and scientific agencies at this point. Nevertheless, promoting greater understanding of these issues is a critical first step in mitigating negative outcomes.

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Introduction

Motivationⁱ

Emerging infectious diseases (EIDs) pose international security threats because of their potential to inflict harm upon humans, crops, livestock, health infrastructure, and economies. Influenza virus A/H1N1's impact on the Mexican economy in 2009, for example, has been estimated at almost 1 percent of that country's gross domestic product (GDP) (Wenzel 2010). The current state of human disease surveillance is reactive—that is, researchers detect microbes after an outbreak has already occurred.ⁱⁱ Furthermore, countries vary greatly in their EID surveillance capabilities and effective surveillance is particularly challenging in developing countries given resource constraints. To implement surveillance on a global scale, a set of fundamental questions must be answered. What infrastructure is necessary to enable EID surveillance in developing countries? What are the cultural, political, and economic challenges that would be faced in doing so? Are there general principles that may be used to guide engagement with developing countries and support EID surveillance infrastructure?

By using Cambodia and Indonesia as case studies, and analyzing the role of the U.S. Naval Medical Research Unit 2 (NAMRU-2) in these countries, this paper finds that the primary constraints to disease surveillance systems in these nation-states stem from the challenges they face in the following areas: lack of financial resources, absence of a professional civil service, prevalence of grand and petty corruption, and the existence of patronage networks.ⁱⁱⁱ To create effective EID surveillance systems, national ownership and capacity must be increased and technology transfer must take place, enabling local actors to take charge of their own systems.

The case studies of Cambodia and Indonesia demonstrate that both the technical and human aspects of disease surveillance systems must be addressed. As such, awareness of local political, economic, and cultural issues is critical if policy makers are to build more effective disease surveillance systems.

Background and Context

NAMRU-2 in Indonesia

In Asia NAMRU-2 is dedicated to maintaining the “operational readiness of deployed forces in the

region against infectious diseases with mission abortive potential,” and it represents a tremendous U.S. asset for EID surveillance. The NAMRU-2 website describes its work in emerging diseases research as follows:

This [support role] necessitates an active approach to disease surveillance, which results in early detection and assists in directing appropriate public health prevention and/or intervention. Researchers accomplish this mission throughout Southeast Asia by:

- Systematic multi-size hospital-based studies
- Investigation of outbreaks involving significant morbidity and mortality in the region
- Pre- and post-deployment serological screening of Navy populations traveling in areas of unique disease transmission and occurrence
- Monitoring the emergence of anti-microbial resistance for selected and significant disease agents in the region.^{iv}

NAMRU’s origin dates to 1944, when it was housed at the Rockefeller Institute in New York City. A detachment arrived in Jakarta in 1970 after its previous facility in Đà Nẵng, Vietnam, was closed.^v NAMRU-2 was a common entity in both Cambodia and Indonesia at the time this study was undertaken (until NAMRU-2 Jakarta was vacated in mid-2010). The two countries have pronounced differences in population (14 million in Cambodia versus 228 million in Indonesia in 2008) and land area (69,898 square miles versus 735,355 square miles, respectively).

Because of political turmoil in the Philippines, in 1991 NAMRU-2 moved its command headquarters from Manila to Jakarta, where it had 50,000 square feet of laboratory space, along with office and storage space, in three buildings within the Indonesian Ministry of Health.^{vi} The facilities were well equipped, and the animal facility was accredited by the Association for Assessment and Accreditation of Laboratory Animal Care. In October 2000, NAMRU-2 was staffed with 23 U.S. military personnel (including 14 scientists) and more than 100 non-Americans (Brachman et al. 2001). Notably, a visit report by the U.S. Institute of Medicine (IOM) at that time said that Indonesian decentralization^{vii} would result in greater demand for training and support of national, provincial, and local public health initiatives, but it also described “the absence of a training officer to coordinate formal training programs” with the Indonesian medical community. The report further noted that no staff were “assigned responsibilities for communicating or disseminating surveillance information to other partners” (Brachman et al. 2001: 51). According to a Center for Strategic and International Studies (CSIS) report, “in 2006, NAMRU-2’s staff in Jakarta numbered 175, of whom 19 were American. Indonesian staff included 44 scientists holding Bachelor’s Degrees, 7 with Master’s Degrees, and 13 with Doctoral Degrees (MD, PhD, or DVM)” (Peake 2011: 21).

At the time of its closure, NAMRU-2 Jakarta housed local technical capacity for surveillance, having created an Early Warning Outbreak Recognition System (EWORS) in 1998, but by 2008, two years after handover to the Indonesia government, two hospitals and one province had dropped out (from 11 hospitals and eight provinces in 1999) according to Siswoyo et al (2008). Celia Lowe, an associate professor of anthropology at the University of Washington who specializes in Indonesia and who has studied the anthropology of biosecurity, writes: “At the start of the Indonesian [H5N1 influenza] outbreak in 2003, Indonesia did not have a molecular biology laboratory capable of identifying the composition of biological samples suspected to be H5N1 influenza virus” (Lowe 2010: 154). In contrast, NAMRU-2 “operated a regional ‘reference lab’ for influenza virus testing in Indonesia” (Lowe 2010: Ibid). This meant that in 2003, NAMRU-2 would have been a key player in situations in which H5N1 was suspected, but within a few short years, NAMRU-2 had become marginalized by the Indonesian government. Ian Forster of the Institute of Development Studies, University of Sussex, who studied the international response to the H5N1 outbreak in Indonesia, identified several other challenges in his report:

The international response [to H5N1], which began in mid-2005, has focused on animal surveillance, control and vaccination, human health system capacity building, and information and behavior change communications. The response is challenged by the size, geography and infrastructure [of Indonesia], an exuberant democracy and extensive decentralization. Other diseases, sectarian tensions and regular natural disasters overshadow the threat of [H5N1] to human health and food security. Nevertheless, issues of trust between science, government, business and civil society, and nationalism are shown to be key, as are the varying constructions of risk, public goods and governance associated with the international organizations driving the response, and the people affected by the disease (Forster 2009: back cover).

In addition, “viral sovereignty” emerged as an issue in Indonesia in 2006. The country’s minister of health at that time, Siti Fadilah Supari, argued that viruses are the sovereign property of individual nations. According to an Institute of Medicine report, “Indonesia claimed ‘viral sovereignty’ over samples of H5N1 collected within its borders” and “announced that it would not share them until the World Health Organization (WHO) and developed countries established an equitable means of sharing the benefits (e.g., vaccine) that could derive from such viruses.” (IOM 2010: 181) Supari has invoked the 1992 Convention on Biological Diversity in arguing for Indonesia’s control of genetic material within its borders. Dennis Normile, a Japan-based reporter for *Science*, presciently warned in 2008 that NAMRU-2 “may fall victim to Indonesia’s determination to develop its own research capabilities and take control of its H5N1 viral samples” (Normile 2008: 598).

NAMRU-2 in Cambodia

Cambodia's relationship with NAMRU-2 began in 1998, when the U.S. ambassador to Cambodia, Kenneth Quinn, and the Cambodian minister of health, Hong Sun Huot, signed an agreement establishing the NAMRU-2 laboratory in Phnom Penh.^{viii} Both parties envisioned an active partnership to study infectious diseases. To support the agreement, the minister of health allowed the laboratory to operate in a two-story, 2,670-square-foot building at the Cambodian National Institute of Health. Currently, the building houses a diagnostic laboratory, epidemiology staff, and an administrative office, employing Cambodian technicians in bacteriology, serology, parasitology, molecular biology, and accessioning sections. As of June 2011, the detachment is staffed by a U.S. Navy captain and a lieutenant, five local foreign civilian employees, and more than 85 contracted laboratory technicians and medical/field staff. Studies are being conducted on malaria drug resistance and avian influenza transmission, and passive surveillance is taking place at nine district clinics for etiology of febrile illnesses. The laboratory also engages with the Cambodian military for training of medical staff.

Cambodia is a heavily aid-dependent country where half of the government's budget is donor-financed.^{ix} The country has enjoyed smooth relations with its NAMRU-2 detachment to date. Just as Indonesia had done after the arrival of NAMRU-2's detachment in 1970, and the command itself in 1991, Cambodia has allowed NAMRU-2 (and the U.S. Centers for Disease Control) to build an office complex within its national public health institute's compound. As it had done in Indonesia, NAMRU-2 has contributed to EID surveillance in Cambodia, assisting in the discovery of the country's eighth and ninth confirmed H5N1 cases. Both victims survived, unlike all seven previous cases as well as eight subsequent cases (who were not discovered by NAMRU-2). As of this writing, there have been 17 cases (of which seven in 2011).

Nonetheless, animal surveillance has lagged in Cambodia, in part because the government culls poultry without compensation (Ear and Burgos 2009), as it did in Indonesia, where H5N1 in animals is endemic. In addition, politics plays an important role in science in Cambodia, just as it did in Indonesia. The author was told by knowledgeable sources that positive results have been suppressed in regard to H5N1 detection in animals. This "outbreak declaration sovereignty"—in which the country exercises discretion in declaring (or more importantly, not declaring) an outbreak to the

World Animal Health Organization (Office International des Epizooties, or OIE)—is Cambodia’s version of viral sovereignty. As with all members of the OIE, only the member government itself has the authority to declare in-country animal outbreaks through its OIE Permanent Delegate (PD),^x and it protects its right to do so as a sovereign state.^{xi} As shown in table 1, Cambodia has shifted its OIE PD among three positions in the Ministry of Agriculture, Forestry and Fisheries (MAFF). The elevation of titles over time suggests that the importance of being an OIE PD has grown politically more powerful. (A deputy secretary general outranks a director who in turn outranks a deputy director, and so on.)

Table 1. Permanent Delegate of Cambodia to the World Animal Health Organization

Date	Name	Title
4 May 2009	Dr X	Deputy Secretary General, MAFF
23 April 2007	Dr Y	Director, Department of Animal Health and Production, MAFF
1 May 2004	Dr X	Deputy Director, Department of Animal Health and Production, MAFF
7 February 2003	Dr Z	Chief of National Animal Health and Production Investigation Center, MAFF

Source: <http://www.oie.int/en/about-us/key-texts/official-acts/appointment-of-official-delegates/>.

By contrast, as shown in table 2, the OIE PD changes almost as regularly in Indonesia as in Cambodia, but the title remains the same: Director General, Livestock Services, Ministry of Agriculture (MoA). The author was informed during interviews in Indonesia that the country had not declared any H5N1 outbreaks to the OIE in recent years, despite the fact that (or perhaps because) the disease is already endemic in poultry.^{xii}

Table 2. Permanent Delegate of Indonesia to the World Animal Health Organization

Date	Name	Title
21 November 2007	Dr A	Director General, Livestock Services, MoA
10 October 2005	Dr B	Director General, Livestock Services, MoA
22 July 2004	Dr C	Director General, Livestock Services, MoA

Source: <http://www.oie.int/en/about-us/key-texts/official-acts/appointment-of-official-delegates/>.

The complexities of disease surveillance are noted in a 2009 paper by Louise Gresham of the Nuclear Threat Initiative (NTI) and others entitled “Trust Across Borders: Responding to 2009 H1N1 Influenza in the Middle East” in which the authors argue that “The sensitive nature of local political, economic, and social conditions existing within regions reinforces the notion that successful partnerships focus on mutual interests that will produce net benefits to all partners”

(Gresham et al. 2009: 403). Using the Middle East Consortium of Infectious Disease Surveillance as a successful case study, the authors emphasize the inadequacy of a one-size-fits-all model of effective disease surveillance. Rather, flexible networks are necessary and may be created through informal memorandums of understanding or more formal legal architectures detailing specific obligations (Gresham et al. 2009). According to Bernard Vallat, head of OIE,

Appropriate prevention and control of animal diseases depends first of all upon policies of good veterinary governance [that] must be underpinned by legislation inspired by OIE standards, but they must also be backed up by the necessary resources for its enforcement, in particular by the Veterinary Services supported by their public and private sector components working together in a clearly defined partnership.^{xiii}

Scholars and policy makers have clearly recognized the political and economic challenges to improving EID surveillance, but what about cultural considerations?

Indonesia and Cambodia have enough similarities to provide adequate grounds for comparison when addressing cultural considerations. At the same time, one important difference—namely, Indonesia’s greater financial resources and independence—allows us to glean new insights on barriers to effective EID surveillance.

Literature Review

The question of the necessary, or ideal, infrastructure needed for effective disease surveillance has been discussed extensively in the context of developing countries. A Government Accountability Office report notes:

Surveillance systems in all countries suffer from a number of common constraints. However, these constraints have their greatest impact in the poorest countries, where per capita expenditure on all aspects of health care amounts to only about 3 percent of expenditure in high-income countries. Surveillance in developing countries is often impaired by shortages of human and material resources. Key positions in laboratories and clinics often are filled by people who do not possess the necessary qualifications. According to [the World Health Organization], staff in over 90 percent of developing country laboratories are not familiar with quality assurance principles, and more than 60 percent of laboratory equipment is outdated or not functioning. . . . In addition, poor roads and communications make it difficult for health care workers to alert higher authorities about outbreaks or quickly transport specimens to laboratories. . . . In addition, multiple surveillance systems are often poorly coordinated and not firmly linked to response measures. The absence of a clear response discourages lower level officials from investing effort in surveillance, and this leads to many cases of disease going unrecorded and unreported. These weaknesses limit the effectiveness of even the most widely supported international disease control programs. They also impair routine surveillance for other diseases and efforts to investigate and respond to outbreaks, newly emerging diseases, and

growth in antimicrobial resistance. (GAO 2001: 3)

Aside from an explicit critique of the technical (“equipment is outdated or not functioning”) and human resource constraints (“shortages of human . . . resources”), this 74-page report hints at both economic (“shortages of . . . material resources”) and political (“absence of a clear response”) obstacles. However, the report never delves into an important political aspect—namely the *lack of political will for surveillance due to competing incentives*—nor does it touch upon cultural constraints that impair effective surveillance. While there is no known source for recent statistics on quality assurance and outdated or malfunctioning equipment in developing country laboratories, the director of laboratory systems development at a major American university with whom GAO’s description was shared for insights wrote the following: “From my own [recent] experiences in countries (Southern Caucasus, Central Asia, Southeast Asia, India, Sub-Saharan Africa) I believe the status has not changed much from the date of the report you cited.”^{xiv} The source works closely with the U.S. government and is not named to enable a frank discussion. Indeed, there may even be disincentives to detecting emerging (and reemerging) infectious diseases, especially when trade is at stake. Mark Zacher, emeritus professor of political science at the University of British Columbia, argues: “The impact of the early surveillance was also limited because countries often did not report on disease outbreaks for fear of losing commerce. This pattern has held over the course of this century.” (1999: 271)

As evidenced by Mexico’s experience with A/H1N1 in 2009, which resulted in a nearly 1 percent loss of GDP (Wenzel 2010) or \$8.8 billion, a global fund could help countries recover from the losses incurred from a major outbreak. In 2002, WHO and NTI created an Emergency Outbreak Response Fund “to strengthen the global response to infectious disease outbreaks, whether naturally occurring or from the release of biological weapons. The . . . Fund will ensure that response teams can be on the ground within 24 hours of a detected outbreak—wherever it occurs around the globe.”^{xv}

This WHO-NTI fund was established with a renewable \$500,000 grant for responses to outbreaks and has been replenished annually. This money was *not* for economic losses incurred from *reporting* outbreaks; it was a foundational sum designated by WHO for immediate mobilization and response, while longer-term funding was solicited from the member countries of the World Health Assembly.

The resources required to make a dent in \$8.8 billion lost to A/H1N1 are orders of magnitude greater than \$500,000.

Gap between Awareness and Practice

Sociologist Hendri Restuadhi (2008) studied, from an anthropological perspective, Indonesia's Participatory Disease Surveillance and Response Program, which was carried out by the Ministry of Agriculture, local government livestock services, and the Food and Agriculture Organization (FAO) and supported primarily by the U.S. Agency for International Development (USAID), the Australian Agency for International Development, and the government of Japan.^{xvi}

Restuadhi's findings echo those of medical anthropologist Benjamin Hickler (2007), who examined the gap between H5N1 "awareness" and practice in Cambodia. Although poultry holders have high awareness of H5N1, they cannot afford to follow recommended practices, especially in the presence of Newcastle disease (an endemic poultry disease like H5N1, but harmless to humans). This gap, Hickler discovered, can even exist in a family that has had a member die from H5N1. In Restuadhi's determination, "it is thought that there is a gap between these three situations: the dissemination of information on the AI outbreaks, the weak follow-up to the outbreaks, and the chicken consumption pattern that remains unchanged. While the communication campaigns are very intense, the follow-up of outbreaks is inadequate and the eating habits stay the same" (Restuadhi 2008: 31). In other words, in the presence of insufficient resources, ad campaigns are understood but not powerful enough to change long-held food-handling techniques and consumption. In Cambodia, for example, farmers tend not to follow the recommendation to quarantine new poultry when introducing it to existing flocks because it is cost prohibitive, and poultry found dead are still regularly consumed. Prior to 2011, Cambodia had only 10 confirmed cases of H5N1; since 2011, seven new confirmed cases of avian influenza have emerged, and all of these have been fatal. Many factors could account for this increase—including the loss of effectiveness of behavior change modification policies (washing hands, reporting disease outbreaks, etc.) or a post-election cycle in which reporting of outbreaks and deaths is not seen as a threat to the regime as it would be pre-election. It remains to be seen whether the Commune Election of 2012 and National Election of 2013 will see the sudden collapse of cases reported.

Can Rumor Surveillance Help? Yes, But ...

Australian epidemiologist Gina Samaan et al. (2005) describe the enhanced rumor surveillance undertaken during the H5N1 outbreak in 2004, during which the WHO's Western Pacific Regional Office identified 40 outbreak rumors (seeking out and analyzing media reports, professional groups, the public, and persons in the WHO network) and verified nine to be true. They argue that rumor surveillance informed immediate public health action and prevented unnecessary and costly responses. Specifically,

Each rumor was followed up by an email or a telephone request to the relevant WHO country office to investigate its veracity. The WHO country office in turn sought verification from the country's health authorities. *Overall, the onus of the verification process was in the hands of the affected country's health authorities* [emphasis added]. The authorities had to demonstrate to WHO that appropriate investigations were conducted to deem rumors correct or incorrect. To ensure this process, WHO sometimes supported rumor verification by assisting in laboratory testing or shipment of isolates. (Samaan et al. 2005: 464)

Even with WHO's assistance in laboratory testing or shipment of isolates, the contrast between what the authorities in Cambodia are capable of doing on their own, in particular with regard to laboratory testing, and what Indonesia can do is significant.

Methodology

Building on the insights of the existing literature described above, a qualitative comparative case study focusing on effective surveillance in Cambodia and Indonesia was undertaken. Nearly 50 people were interviewed during 2009 and 2010 following a semi-structured format, with Indonesian research emphasized because the author had undertaken prior research in Cambodia on Avian Influenza (Ear and Burgos 2009; Ear 2011). The Cambodia interviews took place in Phnom Penh over the course of three visits in January, August, and December 2009 and were conducted in English and Khmer. The interviews in Indonesia took place over the course of 12 days in Jakarta during January 2010 and were conducted in English and Bahasa Indonesia with the help of two research assistants. More than 200 pages of notes were collected and subjected to content analysis and tagging of key concepts,^{xvii} which enabled frequency analysis to obtain a ranking of top issues raised.

The limitations of drawing conclusions based on interviews are as follows: Interviews are labor intensive, time consuming, and subject to bias, distortion, and lack of validity and reliability. In

addition, the author's American citizenship could bias interviewees, and the author's business card—showing an affiliation with the Naval Postgraduate School—meant that for some officials, particularly in the Indonesian government, interviews could not be undertaken without prior authorization from a supervisor at the director level. In one case, an interview was aborted due to untimely authorization. In other instances, the author's Cambodian origin caused some Indonesian informants to be very open and brotherly—Indonesia being far larger and more economically developed than Cambodia. However, having worked in international development for a number of years for the World Bank, the Asian Development Bank (ADB), and the United Nations Development Programme (UNDP), the author was able to engender a rapport quickly with informants who might otherwise have perceived the author as an ivory tower academic.

By comparing two different country cases with one common actor—NAMRU-2—the study identified success and failure determinants for a wider range of developing country contexts.^{xviii} As detailed earlier, the Cambodia-Indonesia comparison offers a great contrast. In Indonesia, mistrust between the government and international organizations has resulted in tense relations, while Cambodian officials are more than happy to have NAMRU-2 there because the country is so dependent on external help. Indeed, unless NAMRU-2 were to begin to undermine the political regime by destabilizing it or offending it, there is no foreseeable end to NAMRU-2's presence in Cambodia in the coming decades.

Hypotheses Devised in January–February 2009

Originally hypothesized challenges (table 3) included the lack of financial and technical resources for Cambodia's public health infrastructure (civil servants, for example, are paid as much as garment workers—about \$50 per month). This means that much of the work that takes place in Cambodia is funded by donors and can therefore be fickle. Namru-2's own involvement in Cambodia, however, is autonomous of the donor community. Although it donates resources, it is not there as a donor. Political support for soft sectors such as education and public health is often eclipsed by more powerful ministries such as defense in Cambodia, while in Indonesia viral sovereignty threatens the involvement of external participants, such as NAMRU-2. Finally, on a cultural level, the use of regional (non-Cambodian) technical staff in management positions (because of the lack of indigenous expertise to staff these positions) for Cambodia's NAMRU-2 office can be a culturally

challenging exercise because of the country’s tensions with neighboring countries (such as Thailand). Being sensitive to this context can increase the likelihood of success in transferring technical skills.

Table 3. Hypothesized Challenges to Effective EID Surveillance in Cambodia and Indonesia Devised in January–February 2009

	Cambodia	Indonesia
1. Economic	Lack of financial and technical resources set an already low bar for the public health system. Existing heavy donor involvement unlikely to be sustainable.	Lack of financial and technical resources
2. Political	Lack of political will in public health infrastructure and recurrent costs support (salaries and other monthly/yearly expenses); plenty of willingness to spend in defense sector. Resources politicized, patronage rampant, and privatization of public hospitals is on the horizon (implications for surveillance remain to be seen).	Viral sovereignty.
3. Cultural	Technical knowledge may come from neighboring countries that have had historical tensions with Cambodians.	Vaccines to be produced by non-Western states such as the Islamic Republic of Iran (news announced 18 January 2009).

Source: Adapted from Ear (2009: 4).

Results^{xix}

This section first presents the key issues that emerged from the dozens of interviews conducted and considers these issues in light of the hypothesized political, economic, and cultural challenges to effective surveillance described in table 3. It proceeds with an analysis of these challenges by interpreting similarities and differences in the context of each country’s level of development and dependence on foreign aid—a proxy for sovereignty since the less aid a country receives the less it relies on others. It concludes by arguing that while technical problems can be fixed with technical solutions (NAMRU-2 being a case in point), even the most advanced laboratory cannot overcome political, economic, and cultural barriers. Consequently, while EID surveillance systems that are not nationally owned may possess short- to medium-term viability (a decade, if that), these systems are not sustainable over the long term even with external funding, or may never reach a fully functional level in accordance with donor expectations. Although money may trump sovereignty in the short run, sovereignty trumps money in the long run.

Analysis of Interview Results and Response on Hypothesized Variables

Extensive interviews conducted by the author with public health officials across government, non-governmental, and donor agencies in Cambodia and Indonesia (table 4) reveal that the countries exhibit both similarities and differences in the perceived barriers to effective surveillance for EIDs.

Table 4. Interviews Conducted

	Cambodia	Indonesia	Total
Interviews	14	26	40
Unique interview subjects*	12	37	49

Note: *The number of interviews and unique interview subjects differ because while most interviews were one on one, some interviews were conducted with two or more persons, while others might have involved the same individual over the course of multiple visits.

Source: The author.

For each country, interview subjects identified several economic, political, and cultural issues that stand in the way of effective surveillance for EIDs. Table 5 lists the most commonly identified barriers in the order of their importance (based on frequency of occurrence in interviews).

Table 5. Key Issues Identified by Interview Subjects by Country

<u>Cambodia</u>		<u>Indonesia</u>	
Issue	Respondents referring to issue (percent)*	Issue	Respondents referring to issue (percent)†
Low salaries	5 of 12 (42%)	Poor host-donor relationship	13 of 26 (50%)
Donor dependence culture	5 of 12 (42%)	Differing host and donor priorities	8 of 26 (31%)
Poor staff management/HR	4 of 12 (33%)	Low salaries	7 of 26 (27%)
Patronage networks	4 of 12 (33%)	Decline in Ministry of Health quality	6 of 26 (23%)
No compensation for culling	4 of 12 (33%)	NAMRU-2 is misunderstood	6 of 26 (23%)
Differing host and donor priorities	3 of 12 (25%)	Poor compensation for culling	4 of 26 (15%)
		Local levels don't see reporting translated into response	4 of 26 (15%)

Note: Content analysis was performed on interview notes and tagged for key themes; these tags were then analyzed for frequency.

* By proportion of interview sessions.

† By proportion of interview sessions.

Source: The author.

In both countries, interviewees noted problems of corruption, patronage, low salaries, inadequate or nonexistent compensation schemes for animal culling, and the potential for conflict between international donors and host governments. Differences emerge, however, in the perceived importance of these issues. In Cambodia the lack of resources received greater attention as the primary barrier to effective surveillance, while in Indonesia, conflict between external and host actors was given greater emphasis. In both countries, interview subjects perceived animal disease surveillance to lag significantly behind human disease surveillance.

Cambodia-Specific Findings

For Cambodia, the key factors that emerged from interviews were low salaries, poor management of staff and human resources and the effect of patronage networks, a culture of donor dependency, contrasting priorities between the national government and international donors, and the lack of compensation for animal culling. Furthermore, the military's influence on the Cambodian government plays a significant role. Yet some hypothesized variables did not prove to be key factors at this point.

Low Salaries

The low level of salary compensation (around \$50 per month for a laboratory technician, far less than the cost of living in Phnom Penh) was the most often cited culprit in a larger context of poor human resources, a result that concurs with the hypothesis that a lack of resources would be a key barrier. In particular, this issue draws attention to the fact that of the myriad resources necessary for effective surveillance, human resources are most lacking in Cambodia (and in developing countries in general).^{xx} Subjects who mentioned this issue as a barrier frequently made reference to the fact that technical capacity far exceeded human capacity, and that the lack of skilled staff was in fact preventing the efficient use of donor-funded equipment. At the same time, incentives were such that skill itself was not rewarded in government service. As one international doctor bluntly stated: “In Cambodia, like anywhere in the world, if you pay people, they do their job. If you don’t pay them, they won’t. They’ve got to feed their kids.”^{xxi} Both the lack of expertise and poor compensation have created a vicious circle. All informants who discussed the low compensation of civil servants—including those working in government labs—proceeded to explain that donors’ inability to tackle

this problem was why donor-funded laboratory and/or EID surveillance equipment and supplies were underutilized, unused, or even pilfered (as in the case of valuable reagents by the lab's director).

Poor Staff/Human Resources Management and the Effect of Patronage Networks

Poor management and the detrimental effects of patronage networks^{xxii} on the workplace are further manifestations of the prevalence of human resource utilization problems. Patronage networks, in particular, have a paralyzing effect on the work environment, often preventing managers from disciplining or taking corrective measures with staff out of a fear that the employees might have political or family connections above their own pay grade. In other instances, the managers themselves are behind the racket. (Consider the above-cited case of a director helping himself to foreign-donated reagents for his private laboratory.)

Donor Dependence

In Cambodia, there are specific problems associated with donor dependence, including a range of issues concerned with long-term planning. One is the lack of sustainability inherent in the donor-driven model. In such a context, priorities can shift on a yearly basis, leading local workers to question the long-term commitment to a specific program. Such ambiguity is obviously detrimental to any program, as local staff are unlikely to dive enthusiastically into a project if they fear that funding will be cut before results can be shown.

Contrasting Priorities

Lack of ownership more generally is a serious problem in development work. How can external interventions be locally owned? Informants noted that the government turns down funds when these come with too many strings attached, such as overly stringent auditing (ministry of health official),^{xxiii} as well as the lack of a government grand plan to coordinate the various donor-driven programs (ministry of health senior official).^{xxiv} In the latter situation, the Cambodian government is seen as insufficiently critical of donor-driven projects when these are funded, even when such funds are not helpful (international doctor).^{xxv} The respondent went on to elaborate that the worst sin is to jeopardize donor funds and keep them from flowing. A holistic program focused on training, equipment, and concept of operations (a document describing the characteristics of a proposed system from the viewpoint of an individual who will use that system) has been proposed,^{xxvi} but while it is necessary, it is not sufficient. Laboratory personnel still need to be paid at a level

commensurate to their skills. (A government lab technician is still paid only \$50 per month, while at the Pasteur Institute and at NAMRU-2, the compensation would be hundreds of dollars, if not more than \$1,000, per month.)

Lack of Compensation for Animal Culling

Finally, interviewees emphasized the Cambodian government's policy of not compensating for the culling necessary after animal outbreaks. While donors, including the World Bank and the United Nations, expressed a desire to help fund a compensation scheme, Cambodian authorities refused. The specific circumstances surrounding this decision, which came from the highest echelons of the government, remain shrouded in secrecy. There has been speculation, however, that the government deemed the possibility of corruption in poultry holders—whereby they might be compensated after willfully infecting their flocks even partially, so as to avoid a collapsed poultry market in which their birds would remain unsold—to be too large a potential liability and too likely to set a dangerous precedent of compensating citizens for government actions. This issue in particular is indicative of the manner in which resources can be politicized.

The Budget and the Military: Behind the Key Issues

Furthermore, it should be noted that the Cambodian budget includes significant military expenditures—at least the equivalent of one-seventh of the foreign aid Cambodia received in 2007 based on budget figures. In addition, the surprising end of a donor-funded incentive pay scheme—which included laboratory health employees funded by the Global Fund to Fight Aids, Tuberculosis and Malaria—was driven in part by complaints from the Cambodian military, who wanted similar pay incentives but for whom there were no donor resources. A subdecree signed by Prime Minister Hun Sen in 2005 set salary supplements of up to \$400 per month for a civil servant with the rank of director general and \$50 for the rank of secretary (Wallace and Bopha 2010). By January 2010, however, the prime minister had decided to stop salary supplements. While imperfect, the supplements were still a largely positive force in the lives of the country's government workers and the last vestige of what had been a merit-based pay structure (the term has to be used loosely in the Cambodian context).^{xxvii}

Potential Challenges Still Unproved

Finally, some hypothesized variables (such as cultural ones; see table 3) did not emerge as challenges—at least not yet. Hospital privatization in Cambodia, while controversial, has yet to begin, and thus its influence on the effectiveness of EID surveillance is undetermined. In Indonesia and Cambodia, private health-care providers appear disconnected from public health surveillance systems, however. Private practice and hospital privatization are not one and the same. As one informant who is foreign medical doctor emphasized, the effect on surveillance will depend heavily on the privatization method chosen, and particularly on whether privatized hospitals continue to receive government and/or donor funding for treating poor patients.^{xxviii}

Additionally, while cultural issues involving supervisors from Thailand working in Cambodia were raised in several interviews, their overall impact is unclear. Certainly, historical tensions with Thailand and Vietnam have given rise to difficulties, particularly when Thai or Vietnamese nationals are placed in charge of Cambodians, but it is difficult to ascertain how exactly this issue affects EID surveillance.

Indonesia-Specific Findings

In Indonesia, the key issues emerging as barriers to effective surveillance include poor host-donor relationships, differing host-donor priorities, a misunderstanding of NAMRU-2 by Indonesian authorities, low salaries, a decline in the quality of personnel in the ministry of health, poor compensation for culling, and difficulty incentivizing local actors to report back to the central government in an era of decentralization following democratization.

Poor Host-Donor Relationships

In contrast to Cambodia, the two most commonly cited barriers to effective EID surveillance in Indonesia both focused on the relationship between the host country and its donors. The issue cropped up again in the fifth-most-emphasized factor: a misunderstanding by Indonesian authorities of NAMRU-2's activities and contributions to disease surveillance. It should be noted that interviews were conducted during NAMRU-2 Jakarta's last days—staff were still coming to work, hoping closure could be averted. As often happens with departing diplomats and those about to leave their jobs, this made for candid conversations sometimes laced with wishful thinking and/or pessimism due to circumstance. With NAMRU-2 Jakarta officially closed since April 2010 and its new commanding officer now based in Hawaii, any hope of a resolution has withered.

Independent of the NAMRU-2 affair, problems in host-donor relations are an understandable barrier in Indonesia, a country that exhibits significantly greater autonomy than Cambodia and other developing countries in the international realm and vis-à-vis donors. Unlike the government in Cambodia, the Indonesian government operates surveillance systems proactively, out of its sense of accountability to its citizens. Consequently, it has been better at articulating its own needs. Tension has arisen when donors have viewed the country's needs differently, or expressed different funding priorities.

Low Salaries

The issue of low salaries is similar to that in Cambodia, and indicative of a lack of adequate resources that is particularly acute on the human capacity side. It should be noted, however, that in Indonesia there was no perception of “ghost labs” as there was in Cambodia—labs that are equipped but empty of local personnel because they moonlight elsewhere during business hours. Concurring with the preliminary hypotheses, the lack of resources was emphasized to a much lesser extent in Indonesia than in Cambodia.

Although the Indonesian government contributes significantly more of its own money to public health activities than Cambodia, Indonesia still suffers from a lack of sustainability in its surveillance efforts and public health laboratory capacity—a fact some donors did not recognize until activities they funded were handed over to the Indonesian authorities. For example, Indonesian authorities took control of NAMRU-2's EWORS but could not continue efforts due to a lack of financial resources. When Indonesian authorities requested NAMRU-2 to hand over the millions of dollars needed to run EWORS, NAMRU-2 refused as these were U.S. government funds that could not simply be given to Indonesian authorities to spend. EWORS is reportedly not functioning.^{xxix}

Decline in Ministry of Health Personnel Quality

As discussed, viral sovereignty emerged as a key issue as a result of the Indonesian government's impression that it was being asked to pay millions of dollars for a vaccine that was developed using a sample that the government had originally provided for diagnostic purposes. Ultimately, as the interview material reveals, the root of the problem was not this incident itself—although it might

have been a catalyst—but a breakdown in communication between a specific donor (NAMRU-2) and the host government that had begun much earlier.^{xxx}

There was a perceived decline in qualified personnel at the ministry of health, though criticism focused on the specific personality of former minister of health Siti Fadilah Supari, and was connected to the fallout over NAMRU-2. Concurrently, the composition of NAMRU-2's American staff shifted from highly experienced, seasoned hands who had already established themselves as authorities to younger researchers who needed to “publish or perish,” according to an interview with an international scientist.^{xxxi} Because the more established scientists decades earlier were not driven by such concerns, they were able to foster a mutually beneficial relationship; by contrast, the young researchers were seen to be driven by self-interest.^{xxxii} An epidemiologist in Thailand's ministry of health reported similar issues with an American government lab in Thailand.^{xxxiii} The effect is that refereed research became paramount and capacity-building became an afterthought.

The cultural hypothesis involving Indonesia's desire to partner with a state such as Iran, also a Muslim country, was unsupported. There was the 2008 announcement of a possible partnership with Iran to manufacture vaccines, but this was more rhetoric than reality, with evidence confirmed in conversations during my visit. The minister of health attempted to garner support by announcing in March 2009 that she wanted to stop vaccinating children against meningitis, mumps, and other childhood diseases with Western-made vaccines, in order to prevent global pharmaceutical companies from exploiting Indonesians the way they have exploited Africans (Ricks 2009, citing the Associated Press).

Another cultural element that emerged in discussions was ethnic Chinese poultry producers versus the ethnically Javanese-dominated civil servants who regulate them. To provide some context, Indonesia enjoys industrial production of poultry, as opposed to the backyard production that takes place in Cambodia. The majority of Indonesian commercial poultry producers are said to be majority ethnic Chinese (Interview, Jakarta, 4 January 2010). Precise numbers are not available, but it is known that while 1% of Indonesia is ethnic Chinese, the captains of industry come from this group, and they tend to be deeply distrusting of the Javanese-controlled government. Lack of consultation and lack of trust have meant that public-private cooperation suffers, and problems are not reported. Indeed, to avoid regulations and taxes, some “mom and pop” operations use wooden

pens even if they hold 100,000 chickens. This enables them to be categorized as backyard operations.

What is certainly true is that the arrival of the new minister of health, Endang Rahayu Sedyaningsih, has renewed confidence in the rational-legal basis of policy making in the ministry. She holds a master's degree and doctorate from Harvard University's School of Public Health and was an adviser in the Department of Communicable Disease Surveillance and Response at WHO (Simamora 2009); the former minister, Siti Fadilah Supari, was a clinician practicing cardiology. Yet whether the Indonesia-U.S. Center for Biomedical Research, announced in 2009 to replace NAMRU-2, will materialize (it has not as of this writing) may not depend solely on the decisions of the Indonesian minister. The joint center will require U.S. and Indonesian funding. One idea had been to reallocate the U.S. Navy's original funding to NAMRU-2 to the joint center, but then U.S. Navy personnel would necessarily be involved in the center which appeared unacceptable to the Indonesians: Why would a civilian lab have military officers working there?

Poor Culling Compensation

As in Cambodia, the absence of compensation for culling also emerged as a key issue in Indonesia. Indonesia's regime has, in fact, allowed for some compensation. In 2006, Indonesia budgeted Rp 33 billion (\$3.69 million as of 20 January 2011 exchange rate) for compensation, and in 2007 it budgeted Rp 15 billion (\$1.67 million) plus up to Rp 100 billion (\$11.18 million) from an emergency budget, if needed. In addition, the World Bank provided \$5 million in grant-based funding on 7 March 2006 (creating the National Committee for Avian Influenza Control and Pandemic Influenza Preparedness, known as Komnas FBPI). However, no actual compensation is said to have been issued due to disbursement problems.

Komnas FBPI, created by executive order and staffed by young people—some of whom were known to be contractors and therefore temporarily employed—may have been too small and too new to execute such a complex operation. And its head, Bayu Krisnamurthi, may have been overcommitted: he was also vice minister for the coordination of economic affairs, agriculture and maritime affairs, chairman of the National Coordination Team for Food Stability, and vice chairman of the Program of Action for the Use of Alternative Energy. Komnas FBPI ended its mandate on 13 March 2010 as scheduled in the presidential decree that established it in 2006. In its short existence,

it created public service announcements for television and radio and distributed 100,000 avian influenza kits containing masks, gloves, a street banner, two bird-flu Video CDs, liquid soap, bar soap, stickers, flyers, and a booklet on H5N1 to high-risk hamlets.

Difficulties in Incentivizing Local-Level Reporting

Finally, during four group interviews in Indonesia, participants said the country's recent experience with decentralization had had a significant impact on surveillance. In particular, very strong top-down central government control has given way in recent years to local autonomy. While this may be a positive development in some regards, disease surveillance data need to be collected and centralized in order to discover potential outbreaks. And this does not appear to be happening effectively. While local health workers are responsible for reporting EIDs, they do not view this as their main job. Rather, they are primarily concerned with diagnosing and treating illness. Moreover, participants reported that, following decentralization, local workers often fail to see reported cases addressed by the central government and experience long delays between sending samples to Jakarta and getting results. This lack of responsiveness has made them even less likely to file timely reports, putting the disease surveillance system in jeopardy.

Overall Findings

It is critical to note that while this research is concerned with political, economic, and cultural barriers to disease surveillance (as opposed to technical or scientific barriers), the interviewers were open to hearing about all kinds of barriers. But the interview subjects referred to “social science” variables with much greater frequency than technical ones. Their responses thus indicate that at present, the greatest barriers to effective surveillance systems involve human resources, although additional interviews with government officials and nongovernmental organizations (NGOs) with in-country experience are needed to confirm this preliminary finding.

Consequently, and in contrast to the priorities of many donors, what is needed is not a greater investment in hardware—a \$200 million lab instead of a \$3 million lab, for instance—but a *greater investment in creating productive work environments*. In particular, donors must be allowed and encouraged to provide the necessary financial incentives to retain effective workers, even if such salary supplements will cause disparity and wage distortions and are themselves not sustainable in the long

run. In Cambodia, two subjects (a ministry of health senior official and an international scientist)^{xxxiv} described state-of-the-art “ghost labs,” where donor-funded infrastructure goes unused due to inadequate human resources. This problem could be ameliorated if donors took a greater role in incentivizing workers.

Other issues that interview subjects identified as impeding surveillance systems in Cambodia and Indonesia stem from these states’ status as developing countries. Unsurprisingly, a lack of financial resources, the absence of a professional civil service, and the existence of patronage networks and corruption constitute challenges in this context. It is reasonable to hypothesize that other developing countries, then, face similar barriers along a continuum from one extreme (Cambodia, where a genocide resulted in the death of a quarter of the population, particularly intellectuals) to another (Indonesia, where expensive labs can be run by Indonesians educated in France and Australia, with some donor support). In both countries, heavy donor involvement has been needed to achieve the present surveillance systems.

But as the interviews revealed, donor involvement has met a different response in the two countries. While interview subjects noted the potential for friction in both countries, it was particularly pronounced in Indonesia, where apprehension and miscommunication between host country and donors contributed to the closure of NAMRU-2. Beyond the poor relationship between the host government and international actors (including non-American ones, such as former colonizers), other challenges specific to Indonesia include a perceived decline in the qualifications of ministry of health personnel and the central government’s difficulty in incentivizing local reporting by responding to reports in a timely manner. In Cambodia, the challenges posed by corruption, patronage, and the lack of human resources are perceived to be more acute. Additional issues also arise due to poor management and a culture associated with donor dependence.

Ultimately, these differences are symptomatic of Cambodia’s and Indonesia’s different levels of development and their roles within regional and international communities. Cambodia is significantly less developed and appears to be locked in a cycle of “donor dependence,” where international donors (NGOs, bilateral agencies, and multilateral agencies) have assumed much of the cost and burden of governing. Indonesia, on the other hand, has developed a relatively higher level of governing capacity, or sovereignty. While donors remain significantly involved in key functions,

the Indonesian government ultimately assumes responsibility for taking care of its citizenry and funds a greater proportion of its operations through its own tax base. (Cambodia's tax revenues are 8 percent of GDP, while foreign aid is above 10 percent of GDP; Indonesia's tax revenues are 11 percent, while its foreign aid is 1.1 percent of GDP.) Furthermore, while Cambodia is a small country of approximately 14 million, Indonesia spans 17,508 islands populated by approximately 228 million people—a point Indonesian interviewees seldom fail to stress—making it the world's fourth-most populous country and reasonably placing it in the category of a “regional power.”

This context is central to understanding the interviews conducted: it demonstrates that donor dependence is the primary difference in barriers to surveillance between the countries. In Cambodia, donor dependence has resulted in an environment where the primary objective is to obtain funds from donors. As a result, the host government is generally compliant with donor priorities; the relationship between the host and donor is cordial, and the host will go to great lengths to please its benefactor, often acting like a supplicant. The downside of this environment, however, is lack of ownership and poor governance: endemic corruption and oppressive patronage networks impede meritocratic work environments, with an expected detrimental impact on surveillance. This overriding problem can explain why, despite significant technical investment, disease surveillance systems fall short of donors' standards: the human side of the equation remains underdeveloped.

Indonesia's greater independence and more competent governance, on the other hand, has the benefit of alleviating—though certainly not eliminating—the problems of corruption, patronage, and ineffective civil service. These same attributes, however, carry a certain trade-off for donors, as the host government is understandably more aware of its own local needs and is better able to articulate these needs. The accompanying expectation is that organizations hosted by the national government will assist in meeting these national priorities.^{xxxv} In contrast to a more aid-dependent nation, Indonesia does not view donors' money and presence as an unambiguous good. As a result, in Indonesia, the overriding challenge facing donors is maintaining a good working relationship with the host government. If the interests of the host and foreign donor organization diverge, or even appear to diverge, the foreign organization is at risk of “wearing out its welcome.”^{xxxvi} In this environment, a foreign organization must give greater thought to effective public relations, not to mention political and cultural considerations, as the risks of being misunderstood can be catastrophic and have the potential to lead to derailments like that of NAMRU-2.

Of particular relevance to this study was the agreement in both Cambodia and Indonesia that animal disease surveillance lags behind human disease surveillance. The finding was also reflected in the respondents' views of the ministries of health versus the ministries of agriculture; the latter were uniformly viewed as less capable and less important. This factor fails to appear in table 5 because, while this view is commonly acknowledged, only a handful of respondents (two in Cambodia and three in Indonesia) emphasized it as a primary barrier to effective disease surveillance. There was also some indication that rivalries between ministries contributed to poor animal surveillance (two respondents in Cambodia and one in Indonesia noted this factor). Additionally, two respondents in Indonesia indicated a more general need for better coordination between the multiple agencies and organizations involved in the effort.

WHO's Angela Merianos, of the Department of Epidemic and Pandemic Alert and Response, argued in a study that on "a global level, the human health sector lags behind the animal health sector in the assessment of potential threats" because "little attention has been given to determining the direct and indirect costs of human disease outbreaks, including morbidity and excess mortality, health service delivery costs, public health expenditure, the psychosocial impact on affected individuals, families and communities, the economic impact on travel, tourism and the insurance industry, and loss of confidence in governments and health services." (2007: 479) She further allowed that "substantive differences exist among countries in their national preparedness planning for emerging diseases" (Merianos 2007: Ibid) and both Cambodia and Indonesia have shown this to be the case.

Further research is necessary to determine why Cambodia and Indonesia buck this global trend—if indeed Merianos' assessment is accurate.^{xxxvii} The market may be a factor: unlike Mexico, neither Indonesia nor Cambodia officially exports livestock in significant quantities to richer countries—the United States in Mexico's case—which means that animal health threats need not be vigilantly evaluated as a bottom-line issue for export compliance (sanitary and phytosanitary measures). Absent such investigation, the most plausible explanation for discrepancies between animal and human disease surveillance may simply be that the life of a human is valued more than that of an animal, and in poor countries struggling to find the resources to deal with human beings, the monitoring of animals will suffer from chronic neglect.

Conclusion

Scientists are fully capable of fixing technical problems in disease surveillance systems, but nontechnical barriers have been more difficult to confront. The primary challenges impeding surveillance are observed on the human resources side of the equation. Nevertheless, as experiences in both Cambodia and Indonesia demonstrate, the technical and human sides of disease surveillance systems are complementary inputs—and an awareness of economic, political, and cultural issues is critical if policy makers are to strategically build more effective systems.

On 11 April 2010, a senior Indonesian scientist whom the author interviewed in January 2010 sent me the following e-mail: “Namru-2 Jakarta is shutting down. I have been very sad. Not only because I am losing my job, but more than that, Indonesia will [lose] an established laboratory research [because] of political reasons.”^{xxxviii} The United States’ loss may not be Indonesia’s gain, for who knows where or for whom this scientist will work next. The expected visit of President Obama in March 2010 (postponed from 2009 once already and again in March due to the passage of the health care reform bill) offered a glimmer of hope, according to U.S.-Indonesia affairs expert Bara Hasibuan, the co-chairman of International Relations for the Indonesian National Mandate Party and a U.S.-Indonesia affairs expert: “I think we should be able to get a new agreement on science and technology . . . beyond Namru. We should be able to groom our own scientists and achievements from the relations” (“Obama visit 'opens doors for RI” *The Jakarta Post* 2010). Yet diplomatic visas for American NAMRU-2 personnel were evidently not renewed beyond April 2010,^{xxxix} leading to the permanent closure of NAMRU-2 and lessened surveillance capacity in the short to medium term.

Indeed, when it comes to viral sovereignty, New York University School of Law fellow Matthew Herder, who has been studying the impasse between Indonesia and the rest of the world, has proposed a solution that sounds simple enough: “Developed countries should provide technology transfer to help poor countries, allowing them to produce their own vaccines” (Ricks 2009: 74). In fact, only if technology transfer entails the development of both human (a skilled and educated local labor force) and material capacity (equipment that will meet the demands of the projects) can sustainability be possible. Hasibuan echoes the same argument more generally when speaking of

what would have been the March 2010 visit of President Obama: “Of course, we automatically hope there will be an increase in trade and investment relations. What we need is a transfer of technology and scientific research that give us a boost. It’s one of the most concrete benefits we can get” (*The Jakarta Post* 2010). That visit finally took place in November 2010, far too late to save NAMRU-2 or jump-start the Indonesia-United States Center for Biomedical and Public Health Research announced in September 2009, but stillborn as of this writing.

Yet the transfer of technology is more easily said than done.^{xi} International development—that is, the business of transferring both technology and human capacity—has tried for more than 60 years to achieve the transfer of technology indeed, development, with limited success (Taiwan and South Korea enjoyed high levels of foreign aid *and* succeeded in developing). What is certain is that Indonesia’s human resources are already capable of producing some vaccines given sufficient technology (PT Bio Farma, a state-owned company based in Bandung, produces influenza vaccine),^{xii} while Cambodia will require a decade or more to produce vaccines in-country—with the issue of viral sovereignty not yet on the horizon.^{xiii}

Many of the key factors emerging from interviews are symptomatic of current levels of development and as such are perhaps beyond the scope of health agencies. Nevertheless, greater understanding is a critical first step in mitigating negative outcomes. Overall, it is obvious that scientists and international agencies wishing to build more effective disease surveillance systems must recognize the nontechnical constraints that each country presents.

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ⁱ This motivation is drawn from DTRA (2008).

ⁱⁱ While there is active surveillance, in which health care providers report notifiable diseases or syndromic information, it is rare in the developing world.

ⁱⁱⁱ Defined as "Power to confer favors, give support and protection, or to appoint to office or position. Providers of patronage (patrons) and receivers (clients) form a network through which access to various resources is obtained. It originates from unequal distribution of power and, since ancient times, is closely linked with corruption" (<http://www.businessdictionary.com/definition/patronage.html>, accessed 8 October 2011).

^{iv} http://www.med.navy.mil/sites/nmrc/Pages/namru_2_edr.htm, accessed 20 January 2011. In previous years, the page referred to Indonesia specifically.

^v <http://www.med.navy.mil/sites/nmrc/documents/Timeline.pdf>, accessed 8 October 2011.

^{vi} Details of NAMRU-2 Jakarta drawn from <http://www.nhrc.navy.mil/geis/sites/namru2.htm> (no longer operational, but PDF of page is available) and history from <http://www.med.navy.mil/sites/nmrc/documents/Timeline.pdf>, accessed 8 October 2011.

^{vii} Decentralization is defined as "the dispersion or distribution of functions and powers; specifically : the delegation of power from a central authority to regional and local authorities" (<http://www.merriam-webster.com/dictionary/decentralization>, accessed 8 October 2011).

^{viii} Details of NAMRU-2 drawn from http://www.med.navy.mil/sites/nmrc/documents/NMRD_News_Vol_I_Issue_2.pdf.

^{ix} Foreign aid pledges for 2010 to Cambodia totaled nearly \$1 billion in 2009, while the national budget for 2009 was \$1.88 billion, including foreign financing.

^x As the OIE itself notes: "Whenever an important epidemiological event occurs in a Member, the Member must inform the OIE by sending an Immediate Notification ([terrestrial](#) and [aquatic](#) animals) which includes the reason for the notification, the name of the disease, the affected species, the geographical area affected, the control measures applied and any laboratory tests carried out or in progress. Diseases notifiable to the OIE used to be classified into two lists, [List A](#) and [List B](#). In May 2004, OIE Members approved the creation of a [single list](#) of diseases notifiable to the OIE. Modifications to the List can be made annually, subject to the approval of the World Assembly of Delegates during its General Session. The modified List does not come into force until the following January, so as to ensure that the list of diseases remains the same for any given calendar year. Proposed changes to the List are based on a decision tree contained in an OIE international standard. A [new list](#) has been approved in May 2009 by the Assembly and came into force in 2010" (<http://www.oie.int/en/animal-health-in-the-world/the-world-animal-health-information-system/the-oie-data-system/>, accessed 8 October 2011).

^{xi} It should be noted that in 2002, OIE began a program of nonofficial and rumor reporting for animal health and public health. However, OIE still requires verification of rumors collected from unofficial data in order to broaden syndromic surveillance (which includes media reports). As OIE notes "One of the OIE's chief mandates is to ensure the transparency of the world animal health situation. To meet this objective, the OIE collects official notifications of animal diseases from its Members, including notifications involving zoonoses (animal diseases transmissible to humans) and

disseminates this information to the international community . . . To this end, Members have authorised the OIE Headquarters to contact their national Delegate directly whenever health information is reported in the media or other non-official sources that could involve an event legally requiring immediate notification to the OIE)”

<http://www.oie.int/en/animal-health-in-the-world/the-world-animal-health-information-system/the-oie-data-system/>, accessed 8 October 2011.

^{xiii} To understand the political economy of outbreak declaration in animals, examining the human health equivalent and the incentives/disincentives involved, is useful: “Since 1951 states have been required by the International Sanitary Regulations (renamed the International Health Regulations in 1969) to notify the WHO within 24 hours of cases of designated diseases (including, as of 1981, those on airplanes and ships) and to obtain laboratory diagnoses. States are also required to inform the WHO and travellers of measures they intend to enact and to submit weekly reports on the development of outbreaks. In practice, however, many states have not reported outbreaks, and when the WHO has announced such occurrences, it is often some time after the fact. This rather weak system, hardly the fault of the WHO secretariat or its committees, reflected the lack of concern about the transmission of diseases among industrial countries and an unwillingness to suffer the consequences of reporting among many developing countries” (Zacher 1999: 272).

^{xiii} <http://www.oie.int/en/for-the-media/editorials/detail/article/veterinary-medicinal-products-and-vaccines-indispensable-tools-for-any-effective-animal-health-and/>, accessed 8 October 2011.

^{xiv} E-mail to author on Tuesday, 31 August 2010, 11:28:40 AM. The director further added “The Division for which I was responsible . . . focused on quality assurance rather than on disease specific tests. Funding for any work related to strengthening laboratories generally comes from disease specific programs (e.g., HIV, Malaria, TB, etc.) so the laboratory work tends to focus on implementing tests with little consideration of the infrastructure that is required to assure quality practices. Disease specific programs didn’t (and for the most part, still don’t) see laboratory quality assurance and management as issues for expending their disease-specific resources. As you might imagine, this is a source of considerable frustration since the new direction for the Global Health Initiative is supposed to be focused on country ownership and sustainability. Without attention to issues of quality (including the ability of a country to procure quality test kits/reagents, access to proficiency testing, oversight of laboratories, etc.), sustainability will not be possible. With respect to diagnostic microbiology, the issues are even more complex. While many seem to think that technology will provide the answer through point-of-care assays, those are some distance off and despite supposed ‘ease of use’ those assays still require an understanding of appropriate quality assurance. In addition, many of the new molecular technologies are dependent on instrumentation that is expensive and dependent on a constant power supply which does not exist. Conventional microbiology also requires an understanding of quality assurance practices and the ability to procure quality materials. If donors are providing everything without paying attention to the shortcomings of the systems issues within the country, then the work will not be sustainable. Not a very direct response to your question and a bit long-winded, but those are the major issues I see that will hold back implementation of conventional or new technology. I am currently doing some work in Ethiopia, and there is virtually no diagnostic microbiology being performed in hospitals in Ethiopia. In India, where I have worked with World Bank and CDC Global AIDS Program, the situation is not much better. While some facilities perform microbiological procedures, there is no way to document quality of any of the work. As an example, I was in a district hospital where the laboratory director (a medical microbiologist) told me they had dehydrated blood agar. When I asked him about the source of blood, he said it was dehydrated. While I am sure someone in his lab knew that they needed to add sheep blood, this person who was supposed to be somewhat authoritative did not understand that there was no blood in the bottle of dehydrated medium he was showing me.”

^{xv} <http://www.who.int/mediacentre/news/releases/pr92/en/>, accessed 8 October 2011.

^{xvi} According to international development scholar Paul Forster (2009: 34), Participatory Disease Surveillance and Response “is based on a qualitative approach to epidemiology known as participatory epidemiology, which has the objective of developing and supporting a community-based response to detecting and preventing the disease by using local knowledge of where and when outbreaks are occurring, and enlisting the local population in control efforts. It has much in common with established techniques of participatory rural appraisal (PRA) but has evolved significantly in Indonesia. The first phase of the PDSR project emphasized the detection and control of HPAI by separate surveillance and response teams primarily in ‘backyard’ settings at the household level. Now, a broader village-level approach encompasses all poultry farmers, traders and community leaders; a greater stress is put on empowering communities to understand the origin, prevention and control of all poultry diseases; and better links are sought with veterinary services, where capacity is being developed through PDSR.”

^{xvii} Content analysis is used in the social sciences for studying the content of communication by analyzing recorded transcripts of interviews with participants. Harold Lasswell (1951: 525) formulated the core questions of content analysis: “Who says what, to whom, why, to what extent and with what effect?” Ole Holsti (1969: 14) offers a broad

definition of content analysis as “any technique for making inferences by objectively and systematically identifying specified characteristics of messages.”

^{xviii} Given that both Cambodia and Indonesia are in Asia, the addition of a case study on Egypt or Kenya in future research will strengthen the validity of findings.

^{xix} This analysis would not have been possible without the heroic efforts of my Research Assistant Zachariah James Falconer-Stout.

^{xx} This problem eclipses even the common theft of reagents from public labs for use in private labs (owned by staff and management in public labs), which hobbles public health surveillance efforts.

^{xxi} Interview, Phnom Penh, 8 August 2009.

^{xxii} Definition of patronage: “. . . an unequal relationship of mutual dependence and reciprocity . . . depends on differentiation of power, wealth and status in society . . . creates the position of Patron (who dispenses largesse, resources and protection) and Client (who provides loyalty and support to the patron) . . . is a voluntary and instrumental relationship. 2. A patron usually has several clients. Depending on their proximity to the Patron, clients may also have their own clients. The result is an informal hierarchy taking the shape of a pyramid with the Patron or ‘Big Man’ at the apex. Patrons may enter into mutually beneficial alliances. The patronage network refers to patronage ‘pyramids’ and patron alliances operating in a particular area/ community” (<http://www.icgg.org/downloads/2010/Cherotich.pdf>, accessed 8 October 2011).

^{xxiii} Interview, Phnom Penh, 8 August 2009.

^{xxiv} Ibid.

^{xxv} Ibid.

^{xxvi} It is also used to communicate the quantitative and qualitative system characteristics to all stakeholders (http://en.wikipedia.org/wiki/Concept_of_operations, accessed 8 October 2011.)

^{xxvii} Wallace and Bopha (2010). I am quoted at the end of the story as saying the following about salary supplements: “Were they perfect? No. Did they incentivize? Yes. Did they make a life-or-death difference in someone’s livelihood? Probably not. Will things work better as a result of their elimination? Probably not.”

^{xxviii} Interview, Phnom Penh, 8 August 2009.

^{xxix} Interview, Jakarta, 4 January 2010. A pilot system, called EWARS (Early Warning and Reporting System), with limited support by WHO and U.S.-CDC, should not be confused with EWORS.

^{xxx} Interview, Jakarta, 7 January 2010.

^{xxxi} Ibid.

^{xxxii} It could also be that the drive for and incentive to publish (built into evaluations of personnel working for labs like NAMRU-2) have changed over time. Three decades ago the pressure might not have been as severe as today.

^{xxxiii} Interview, Beijing, 15 July 2010.

^{xxxiv} Interviews, Phnom Penh, 8 August 2009.

^{xxxv} For example, if NAMRU-2 scientists are evaluated on the basis of research produced, and this priority conflicts with meeting host nation needs, then reconciling these priorities might be a step towards improving relations. Alternatively, more senior (retired) scientists—if willing to serve as some apparently were decades earlier—could also be tapped.

^{xxxvi} Even during the 2004 tsunami that affected Aceh, Indonesia, and many other countries, there was great sensitivity to having American military personnel on the ground in the humanitarian mission that followed. In Cambodia, examples abound. The most recent cancellation by the Cambodian authorities of a \$28.8 million Land Management and Administration Project by the World Bank because of “too many conditions,” according to Cambodia’s Prime Minister (as quoted in O’Toole and Chakrya 2011).

^{xxxvii} Early findings from the author’s follow-on study of Mexico’s experience with A/H1N1 confirmed Merianos’ finding there—animal disease surveillance, driven by trade concerns with the United States—appears in better shape than human disease surveillance.

^{xxxviii} E-mail communication received by the author on 11 April 2010 at 9:45pm.

^{xxxix} “Namru was closed down after Jakarta and Washington failed to agree on its operational procedure, including on diplomatic immunity sought by Washington for US staff working at the lab” (Budianto 2010).

^{xl} The Indonesia-United States Center for Biomedical and Public Health Research first announced in September 2009 in a joint statement between U.S. Department of Health and Human Services Secretary Kathleen Sebelius and then Indonesian Minister of Health Siti Fadilah Supari has yet to materialize.

^{xli} For example, one advanced laboratory in Indonesia is in such dire need of money that its scientists (interviewed in Jakarta on 12 January 2010) work on a month-to-month basis.

^{xlii} A Ministry of Health official in Cambodia knew about viral sovereignty and even characterized the issue as one of benefit sharing, but unless Cambodians become involved in testing (as happened in the case of AIDS anti-retrovirals for

prophylaxis use, when the Cambodian Prime Minister stopped trials), viral sovereignty does not appear to be of immediate concern in Cambodia.