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Health Governance and Dengue in Southeast Asia

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Executive Summary and Policy Recommendations

This Report focuses on health governance of vector-borne diseases in Southeast Asia, analysed from the context of threats and opportunities brought about by climate change, urbanisation and globalisation. It first discusses regional health governance in ASEAN and the mechanisms and frameworks that have been established to promote health security, with particular focus on vector-borne diseases. It then provides a background on dengue in Southeast Asian countries, the economic burden of the disease and the regional prevention and control measures that have been implemented so far. The Report also presents a SWOT analysis that assesses the health governance systems of two Southeast Asian countries – Indonesia and Malaysia – with a particular focus on the institutions, networks and the effectiveness of domestic vector prevention and control measures. It assesses the level of integration that regional frameworks and domestic measures have achieved and policy shifts from reactive towards preventive and sustainable long term solutions. Finally, the Report lays out a number of policy recommendations relevant to regional dengue prevention and control.

Introduction

Dengue is one of the most common vector-borne diseases in Southeast Asia,[5] and has been ranked as the most important mosquito-borne viral disease with epidemic potential in the world. Among all the vector-borne viral diseases, the transmission rate of dengue is the fastest in the world. It is alarming that dengue epidemic cycles in the region have been reduced to 3 to 5 years from the average 10 year cycle. Well-integrated prevention and control programmes to combat the dengue across *all* levels and across different sectors and among stakeholders is essential. It is estimated that with the annual average 2.9 million dengue episodes in Southeast Asia, the annual economic burden in aggregate costs from 2010 data is estimated at USD950 million or about USD1.55 per capita (Shepard, Undurraga and Halasa 2013).

Convergence of Regional Frameworks and Multi-sectoral Initiatives

There are existing intergovernmental strategies from global and regional actors and multisectoral collaborations and networks that form part of the ASEAN regional health security framework, particularly strategies that deal with communicable disease control. Specifically, the regional health security framework for dengue puts the region in a good position to leverage on collaborative mechanisms for effective dengue prevention and control. ASEAN member states are very much aware of the epidemic potential of dengue and given its numerous and porous borders, there have been regional efforts to stem dengue under various initiatives under the ASEAN community building processes set forth by the ASEAN Charter and the ASEAN Socio-Cultural Community Blueprint (ASCC).

On one hand, there are intergovernmental initiatives such as the Asia Pacific Strategy for Emerging Diseases (APSED), the WHO Asia Pacific Dengue Strategic Plan and the ASEAN Medium Term Plan on Emerging Infectious Diseases (2012-2015) which mandates the observance of the ASEAN Dengue Day. The ASEAN Strategic Framework for Health Development and the Expert Group on Communicable Diseases further puts focus on endemic vector-borne diseases such as dengue and malaria. On the other hand, there are a number of multi-sectoral collaborations and networks in Southeast Asia. In line with the ASCC Blueprint's action line to "strengthen and maintain surveillance system for infectious diseases including malaria and dengue fever [among others]," there is the United in Tackling Epidemic Dengue (UNITEDengue) network focused on the cross-border sharing of dengue surveillance information and knowledge on dengue control. The network's website, hosted by the Singapore Environmental Health Institute provides its members up-to-date disease incidence, virus surveillance information and a lucid key for mosquito identification.

With regard to the ASCC Blueprint's action line to "promote collaboration in research and development on health products especially on new medicines for communicable diseases including neglected diseases

5 Southeast Asia refers to the ASEAN region which includes: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

commonly found in ASEAN Member States," there are initiatives toward dengue vaccine development and biological vector control. There are three main collaborations on dengue vaccines in the region, the Dengue Vaccine Initiative (DVI), the ASEAN Network for Drugs, Diagnostics, Vaccines and Traditional Medicines Innovation (ASEAN-NDI) and the ASEAN Member States Dengue Vaccination Advocacy Steering Committee (ADVASC). Another research program, Eliminate Dengue, aims to biologically control dengue by studying how Wolbachia bacteria can be utilised as an effective strategy to disrupt dengue transmission between people by targeting the dengue virus transmission by *Aedes aegypti* mosquitoes. In line with the ASCC Blueprint action line to "strengthen regional clinical expertise through professional organisations networks, regional research institution, exchange of expertise and information sharing," there are a number of existing networks including the Southeast Asia Infectious Disease Clinical Research Network (SEAICRN), the Inter-Islamic Network in Tropical Medicine (INTROM) and the Southeast Asian Ministers of Education Organization - Tropical Medicine and Public Health Network (SEAMEO-TROPMED).

Indonesia

There is an increasing diversity of actors and stakeholders involved in health governance and dengue across the archipelago. Dengue prevention is not wholly limited to government actors but also is slowly being integrated into the objectives of the private sector, academia, non-government, faith-based and community-led organisations, international funding agencies, pharmaceutical companies and regional organisations. However, the health system including infrastructure and human resources are still inadequate. Improvements on this front, especially recruiting more health professionals into the public sector and retaining them are critical. There is potential for improvement in dengue prevention and control in Indonesia. Political will, community leadership and private sector initiatives can all help in supporting and strengthening public and environmental health across all provinces and special autonomy areas. Long-term commitments for dengue prevention and control are also needed, as many initiatives are usually project-based and most of them are not properly monitored and evaluated. Some local pilot projects were successfully scaled up but not on a national scale as a result of limited financial resources.

Malaysia

A recent increase in dengue incidence is a significant cause of concern, especially given the hyperendemicity of serotypes. The 2009 – 2013 National Strategic Plan for Dengue included a commitment to half the total number of cases by 2013 but was not achieved. Greater urbanisation has led to an increase in encroachment on natural habitats and this could lead to greater co-habitation between mosquito vectors and humans. Thus, there should be further investigation into more sustainable land-use strategies. More recently, the Malaysian government has implemented prevention and control measures at the local level as well as policy measures at the state level. One commendable national level measure was the creation of a Dengue Task Force headed by the Deputy Prime Minister in July 2014. However, while the government's programmes are well-designed especially in terms of engaging different actors, improvements are needed in terms of infrastructure and human resources investment in rural areas. Further development of community and faith-based organisations can help to spread awareness regarding dengue prevention and control measures particularly in rural areas. Alongside this investment, higher levels of engagement with the private sector, especially in the tourism and food & beverage sector to share best practices would encourage a more consistent culture of prevention and control.

Policy Recommendations

This NTS Report provides an initial assessment of regional dengue interventions and an examination of Indonesia and Malaysia in dengue prevention and control. From a regional perspective, multilateral arrangements can provide an avenue to develop cooperative responses to emerging and accelerated spread of communicable diseases as a result of urbanisation, the movement of people and climate change. Below are some policy recommendations for ASEAN:

- Utilise and reinforce established APSED and APT mechanisms to achieve IHR core capacities. Integrate the UNITEDengue mechanism into the post-2015 ASEAN framework.
- Promote new diagnostic technology in dengue confirmation and infection across ASEAN.
- Promote more public-private partnerships in dengue vaccine development.
- Stimulate the expansion of the collaborative clinical research network of hospitals and research institutions to further strengthen regional clinical expertise on dengue.
- Encourage climate data use to support early warning systems and dengue prevention and control.
- Promote dengue prevention and control as a component of corporate social responsibility especially in the tourism sector.
- Scale up efforts to biologically controlling dengue.
- Advocate for a World Dengue Day, building on the success of ASEAN Dengue Day.

Singapore, May 2015

Health Governance and Dengue in Southeast Asia

Introduction

Dengue is one of the most common vector-borne diseases in Southeast Asia, and has been ranked as the most important mosquito-borne viral disease with epidemic potential in the world (WHO, 2014). Among all the vector-borne viral diseases, the dengue transmission rate is the fastest in the world. It is concerning that dengue epidemic cycles in the region have reduced to three to five years from the average ten year cycle. A well-integrated dengue prevention and control programme across *all* levels, sectors and among stakeholders is essential. This Report first assesses regional health security frameworks and the state of the regional approach to dengue prevention, control and elimination as a means to further develop sustainable and effective dengue policy measures. The Report then examines dengue prevention and control measures undertaken at the national and local levels in Indonesia and Malaysia. With a SWOT analysis, it aims to qualitatively assess existing prevention and control measures, including the impact of climate change on vector-borne diseases, as well as the link between urbanisation and dengue, and the transboundary health risks and threats due to migration patterns. In summary, this Report provides some insights on the implications of the dengue responses in local health systems and at the regional level to address vector-borne diseases.

The Health and Socioeconomic Burden of Dengue in Southeast Asia

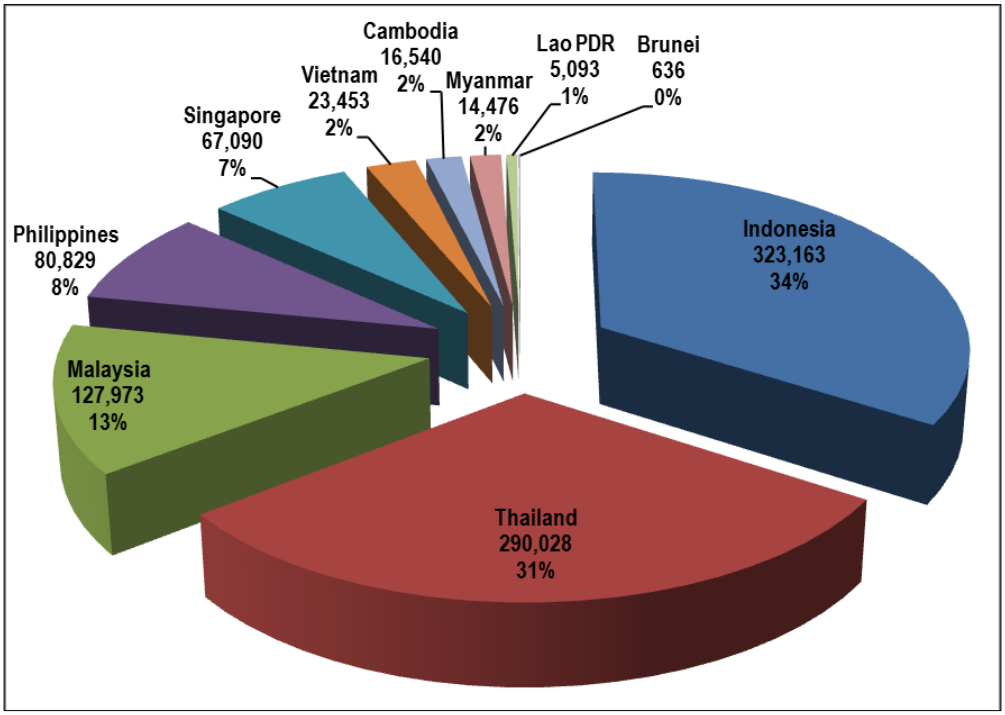
In Southeast Asia, combined mortality and morbidity (DALYs[6]) due to dengue is estimated at 436,000 in 2000 and at 606,000 in 2012 (Global Health Estimates 2014). Dengue is an *Aedes aegypti* mosquito-borne viral disease that mainly causes flu-like symptoms including fever, headache, eye pain, muscle and joint pain and only shows symptoms in an infected person after three to fourteen days. About seventy-five per cent[7] of dengue virus carriers do not manifest symptoms, are not identified through public health surveillance and unknowingly become virus transmitters (Bhatt et al. 2013). The WHO (2014) highlights that most vector-borne diseases like malaria and dengue fever have long been associated not only with climate and humidity but also to access to safe drinking water and sanitation policies as well as urban development that impacts land use, deforestation, water resource management, settlement siting and house design. All these environmental determinants of health evolve into risks when exacerbated by conditions brought about by extreme weather.

In ASEAN, Lao PDR, Indonesia and the Philippines bear the highest dengue burden as of 2012 (See Table 1 below). The most comprehensive study on the economic cost of dengue in Southeast Asia so far is that of Shepard, Undurraga and Halasa (2013), which focused on the cost of dengue episodes, excluding prevention and vector control from 2001 to 2010. Shepard et al. (2013) estimated that with the annual average 2.9 million dengue episodes in Southeast Asia, the annual economic burden in aggregate costs from 2010 data is estimated at USD950 million or about USD1.55 per capita. Indonesia has the highest economic burden of dengue in terms of aggregate cost, with about 34 per cent of the total regional economic burden of dengue, followed by Thailand (30 per cent) and Malaysia (13.5 per cent) (See Figure 1). However, in terms of cost per capita, Singapore bears the highest burden, followed by Malaysia and Thailand (See Figure 2).

6 Disease burden is measured by the World Health Organization in terms of disability-adjusted life year (DALY) or one lost year of healthy life .DALYs measure the overall disease burden in terms of number of years lost due to ill-health, disability or early death. One DALY is equivalent to one lost year of healthy life. It is calculated as the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for people living with the health condition. The YLL basically correspond to the number of deaths multiplied by the standard life expectancy at the age at which death occurs. To estimate YLD for a particular cause in a particular time period, the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead). Source: Health statistics and information systems, Metrics: Disability-Adjusted Life Year (DALY), http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/

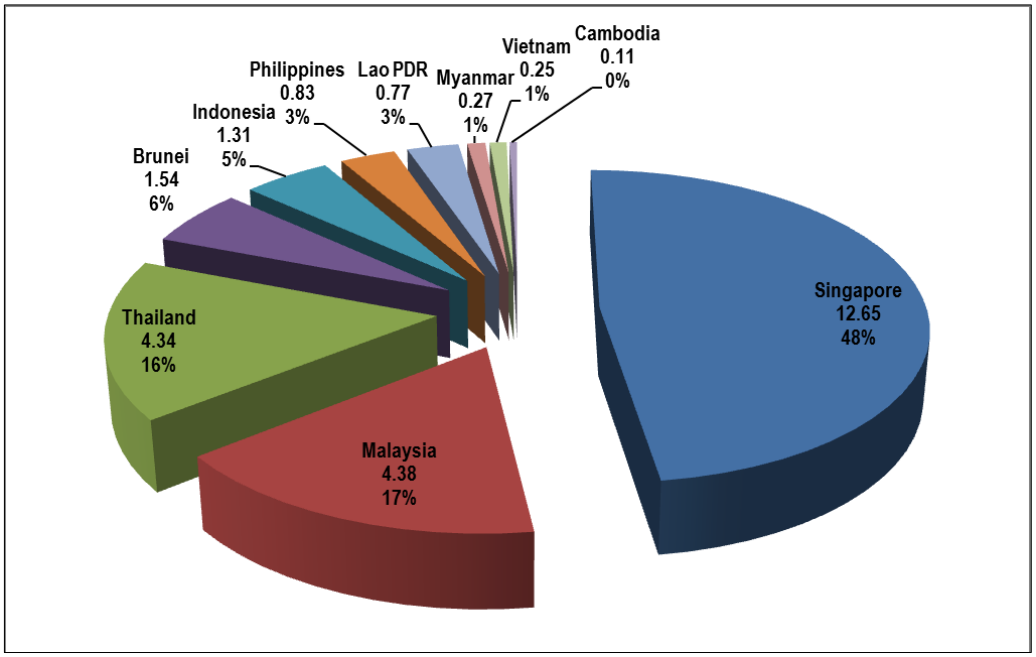
7 Bhatt et al estimated about 290 million inapparent infections from 390 million infections of which only 96 million cause apparent dengue infections.

Figure 1. Annual Aggregate Cost of Dengue (in USD thousand)



Source: Shepard, Undurraga and Halasa 2013

Figure 2. Annual Cost of Dengue per capita (in USD)



Source: Shepard, Undurraga and Halasa 2013

Table 1: Combined mortality and morbidity (DALY) due to dengue (2000, 2012) and economic burden of dengue in Southeast Asia (aggregate and per capita)

Country	Population 2012	DALYs 2000	DALYs 2012	Aggregate Cost 2010 (in USD)	Cost per capita (in USD)
ASEAN	**610,325,000**	**436,000**	**605,500**	**949,281,000**	**1.55**
Indonesia	246,864,000	**173,200**	142,100	**323,163,000**	1.31
Thailand	66,875,000	8,800	9,500	290,028,000	4.34
Malaysia	29,240,000	6,400	8,400	127,973,000	4.38
Philippines	96,707,000	92,800	94,600	80,829,000	0.83
Singapore	5,303,000	1,200	1,600	67,090,000	**12.65**
Vietnam	90,796,000	49,300	40,000	23,453,000	0.25
Cambodia	14,685,000	63,800	35,000	16,540,000	0.11
Myanmar	52,797,000	35,600	26,200	14,476,000	0.27
Lao PDR	6,646,000	4,900	**248,100**	5,093,000	0.77
Brunei	412,000	0	0	636,000	1.54

Sources: World Health Organization 2014; For Brunei, data for DALY reflects 2010 data and was derived from Shepard et al. 2013

Assessing Regional Health Security Frameworks: Implications for ASEAN

Since the SARS epidemic in 2003, regional health security strategies have tended to prioritise communicable diseases that have epidemic potential (Caballero-Anthony and Amul 2015). As communicable diseases have high health and socioeconomic burdens, dengue cooperative strategies and frameworks have developed in the region. As such, intergovernmental strategies from global (World Health Organisation) and regional (ASEAN) actors to multi-sectoral collaborations and networks are all part of the regional health security framework for dengue. One co-benefit is the growth of multi-sectoral collaborations to combat dengue that has been noteworthy so far in terms of capacity building and innovation. One way to utilise this is to mobilise funding for innovative and sustainable strategies against dengue involving governments, the pharmaceutical industry, the private sector and non-government organisations through a focal point such as a regional dengue ambassador.

There has been emphasis given to prioritising dengue control activities at a regional level mainly because of geographical proximity (Spiegel et al. 2005, 280). Increasing globalisation has led to larger movements of people, improved modes of transportation and hence greater interconnectivity between endemic and non-endemic countries. Although dengue prevention and control is focused at the community level, transmitting dengue from one country to another is easy, as tourists can travel by trains, boats, buses or aeroplanes. Southeast Asian governments are very much aware of the epidemic potential of dengue and given its numerous and porous borders, there have been regional efforts to stem dengue under the ASEAN community building processes contained in the ASEAN Charter and the ASEAN Socio-Cultural Community (ASCC) Blueprint. The main challenge for intergovernmental health security frameworks is funding sustainability. As many strategies aim to contribute to the aspirations of the ASEAN Socio-Cultural Community of the wider ASEAN Community by 2015, the progress and targets of these strategies and interventions need to be reviewed. Such a review can help funding agencies, national governments and non-state actors to prioritise and earmark funding not only for dengue prevention and control but also for vaccine research and development. This report aims to provide an initial assessment of these regional interventions.

WHO Strategies: Global to Regional

From a global health perspective, it is important to consider the work of the WHO and its regional offices on vector-borne diseases. It has already laid out the necessary regional and global frameworks for dengue prevention and control. The *WHO's Global Strategy for Dengue Prevention and Control (2012-2020)*

highlights reducing the dengue burden by at least 50 per cent in terms of mortality and at least 25 per cent in terms of morbidity by 2020 (WHO 2012). The WHO presence in the region is spearheaded by its Western Pacific Regional Office (WPRO) and the Southeast Asia Regional Office (SEARO). These have initiatives spanning communicable diseases, family health and research, health systems development, and sustainable development and healthy environment. WPRO and SEARO developed a bi-regional *Dengue Strategic Plan for the Asia-Pacific Region 2008-2015* based on the *Strategic Framework for the Asia Pacific Dengue Partnership,* which forms part of the WHO Global Strategy, the *Asia-Pacific Dengue Strategic Plan (2008-2015).*

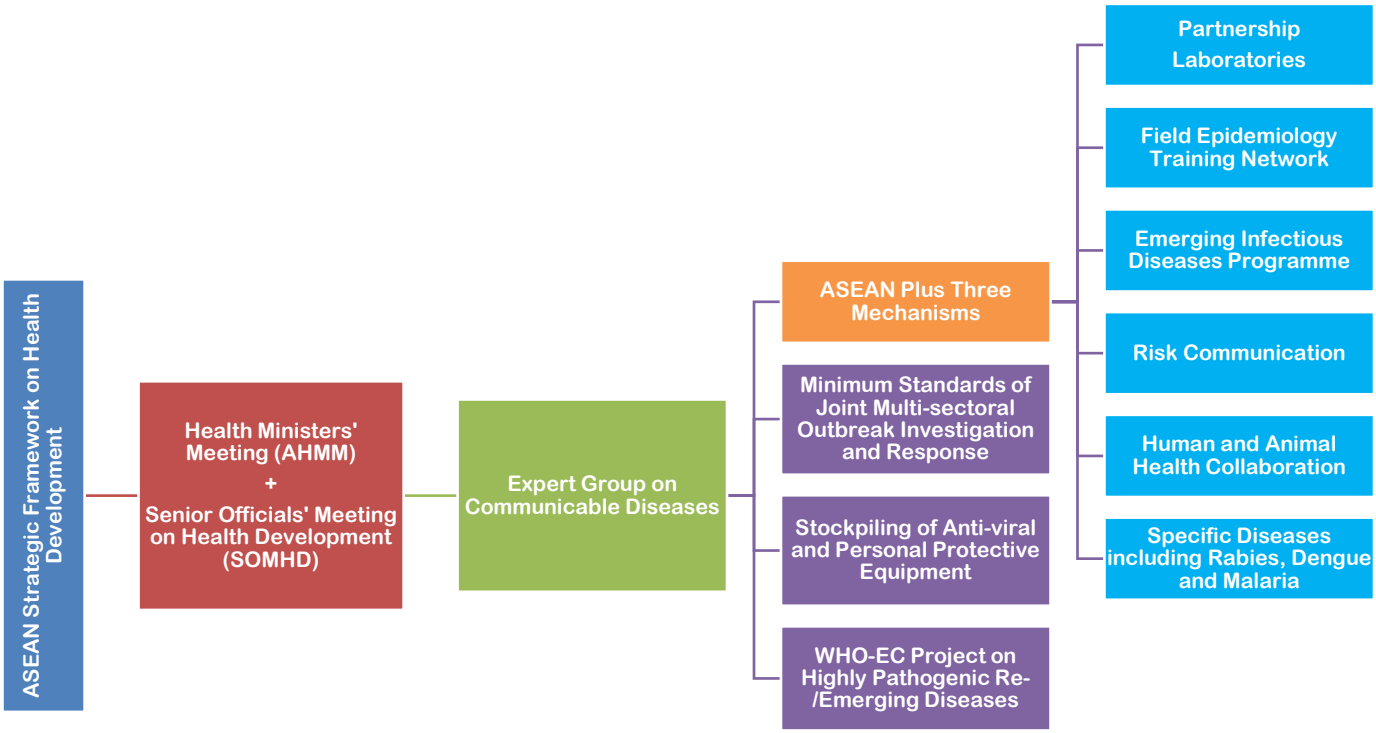
Figure 1 WHO Framework for Dengue

This is further supported by the Asia Pacific Strategy for Emerging Diseases (APSED), another bi-regional strategy aimed at 'strengthening national and regional capacities to manage and respond to emerging disease threats, including dengue.' The APSED addresses the capacity-building requirements mandated by the revised 2005 International Health Regulations (IHR) (See Figure 1). The IHR has included dengue as one of the diseases that may constitute a public health emergency of international concern (PHEIC) with implications for health security due to disruption and rapid epidemic spread beyond national borders (WHO 2009). In 2013, under the APSED, the WHO WPRO with WHO collaborating centres including the Environmental Health Institute of Singapore, established an External Quality Assessment (EQA) programme for dengue and successfully conducted the programme in 19 national public health laboratories in the region, where 84 per cent were able to accurately detect dengue virus and antibodies.

The ASCC Blueprint and Regional Dengue Prevention and Control

ASEAN forms the main regional health security framework in Southeast Asia, particularly through its Strategic Framework for Health Development. The Expert Group on Communicable Diseases serves as the main health subsidiary body tasked with planning regional interventions on communicable diseases including dengue. For the specific disease component on dengue, there is the ASEAN Dengue Day under the ASEAN Medium Term Plan on Emerging Infectious Diseases (2012-2015). Since 2011, the Southeast Asian regional entity has been observing ASEAN Dengue Day alongside their national dengue day to raise public awareness. This was in line with the 2011 *Jakarta Call for Action on the Control and Prevention of Dengue* to strengthen regional cooperation through: "enhancing regional preparedness and capacity strengthening national and regional alert and response capacities; sharing information, experiences and best practices in improving access to primary health care by people at risk and; encouraging the close collaboration and creating networks among the public and private sectors and civil society." The 2014 ASEAN Plus Three (APT) Partnership Laboratories Work Plan now includes facilitating pathogen information sharing for dengue virus serotypes, enterovirus genotype and multi-drug resistant tuberculosis. The APT Field Epidemiology Training Network (FETN) has also initiated collaboration in developing case studies on dengue outbreak investigation, hosted by Singapore in 2011.

Figure 2: ASEAN Framework for Communicable Diseases

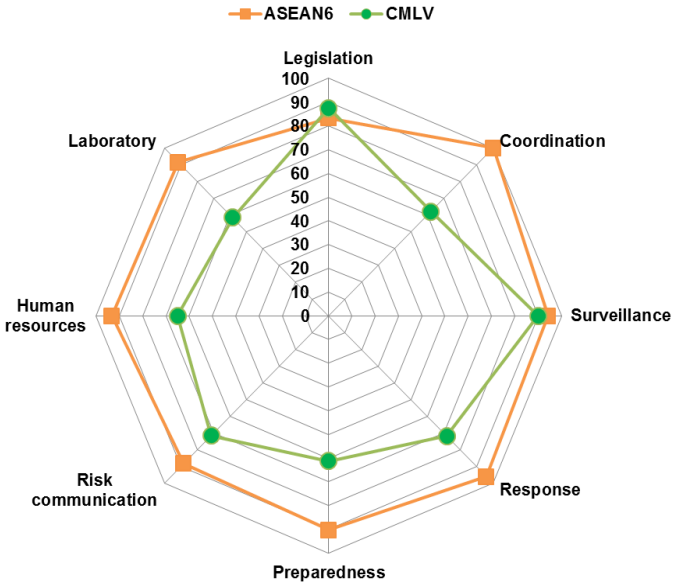


The ASCC Blueprint (2009) has several action lines related to dengue, specifically under objective B5: Improving capability to control communicable diseases. This includes initiatives to "consolidate, further strengthen and develop regional cooperative arrangements through multisectoral and integrated approaches in the prevention, control, preparedness for emerging infectious diseases in line with International Health Regulation 2005 and the Asia Pacific Strategy for Emerging Diseases (APSED)."

Despite the WHO-led Asia Pacific Strategy for Emerging Diseases (APSED) that supported ASEAN programmes for capability building in communicable disease control, the International Health Regulation (IHR) core capacity gaps within ASEAN remain of substantive concern. Based on the ASCC Blueprint objective, the less developed CMLV group needs to be integrated with the more developed ASEAN6 (Brunei, Indonesia, Malaysia, Philippines, Singapore and Thailand). In terms of the eight core capacities, Cambodia, Myanmar, Laos and Vietnam (CMLV) as a group is almost on par on average with the ASEAN6 group on surveillance and legislation, but the gap in terms of coordination, preparedness, response, laboratory and human resources is still substantial (see Figure 1). The CMLV group is also almost at par with ASEAN6 in terms of zoonosis and food safety, but it still has considerable capacity-building needs for chemical and radionuclear health hazards and public health events at points of entry (see Figure 2).[8] Gaps in critical capacities such as coordination and preparedness, and capabilities for public health events at points of entry pose serious threats to regional health security, as migration occurs within and across borders posing challenges to the prevention and control of vector-borne diseases such as dengue and malaria.

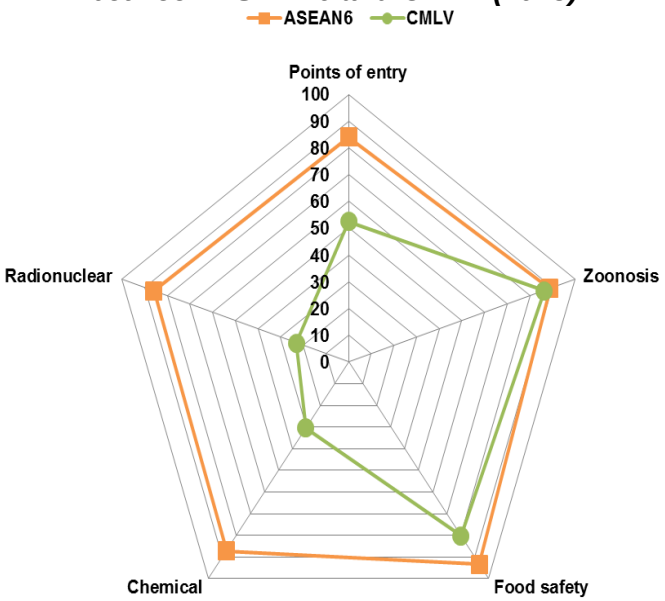
[8] This analysis and the corresponding figures were originally published in "Reinforcing Health Security in ASEAN" (Centre for Non-Traditional Security (NTS) Studies, 2015).

Figure 3. IHR Core Capacity Gaps between ASEAN6 and CMLV (2013)



Source: World Health Organization, *Global Health Observatory Data*, 2013

Figure 4. Gaps in Capacity for Health Hazards and Public Health Events at Points of Entry between ASEAN6 and CMLV (2013)



Source: World Health Organization, *Global Health Observatory Data*, 2013

Multisectoral Collaborations and Networks

There are a number of multi-sectoral collaborations and networks in Southeast Asia. In line with the ASCC Blueprint's action line on infectious disease surveillance, there is the United in Tackling Epidemic Dengue (UNITEDengue), which was jointly founded by the Ministry of Health (Malaysia), the National Environment Agency's Environmental Health Institute (Singapore) and the Universitas Andalas, Padang, West Sumatra (Indonesia). [9] The network's focus is cross-border sharing of dengue surveillance information and knowledge on dengue control via the network's website.

The ASCC Blueprint's action line to "promote collaboration in research and development on health products especially on new medicines for communicable diseases including neglected diseases commonly found in ASEAN Member States," covers initiatives toward dengue vaccine development and biological vector control. There are three main collaborations on dengue vaccines in the region, the Dengue Vaccine Initiative (DVI), the ASEAN Network for Drugs, Diagnostics, Vaccines and Traditional Medicines Innovation (ASEAN-NDI) and the ASEAN Member States Dengue Vaccination Advocacy Steering Committee (ADVASC). The DVI, a consortium of organisations[10] aimed towards dengue vaccine decision making and introduction in endemic areas, came into being through the 2001 Pediatric Dengue Vaccine Initiative. The Asia Pacific Dengue Prevention Board is composed of medical and public health experts from the University of Indonesia's Faculty of Medicine, University of Malaya Medical Centre's Faculty of Medicine, Singapore's DSO National Laboratories, the Vaccine Trial Center at the Mahidol University's Faculty of Tropical Medicine, the National Epidemiology Center of the Department of Health in the Philippines, the Department of Medical Research in Myanmar and the Institut Pasteur du Cambodge in Cambodia, among others (Dengue Vaccine Initiative 2015).

In 2009, the ASEAN-NDI was founded to promote research and development, to develop North-South and South-South partnerships to support capacity-building and to establish strategic research networks, in line with the objectives of the WHO Global Strategy and Plan of Action on Public Health, Innovation, and Intellectual Property (GSPA-PHI). It was adopted by the ASEAN Committee on Science and Technology

[9] Other members include the Ministries of Health of Brunei, Cambodia, Philippines, Thailand, Vietnam and Sri Lanka, as well as the Chief Minister Secretariat of Pakistan and the Aga Khan University (Karachi, Pakistan) (WHO and NEA, 26 August 2014; UNITEDengue 2014).

10 These organisations include the International Vaccine Institute, the WHO Initiative for Vaccine Research, International Vaccine Access Center of the Johns Hopkins University Bloomberg School of Public Health, The Sabin Vaccine Institute.

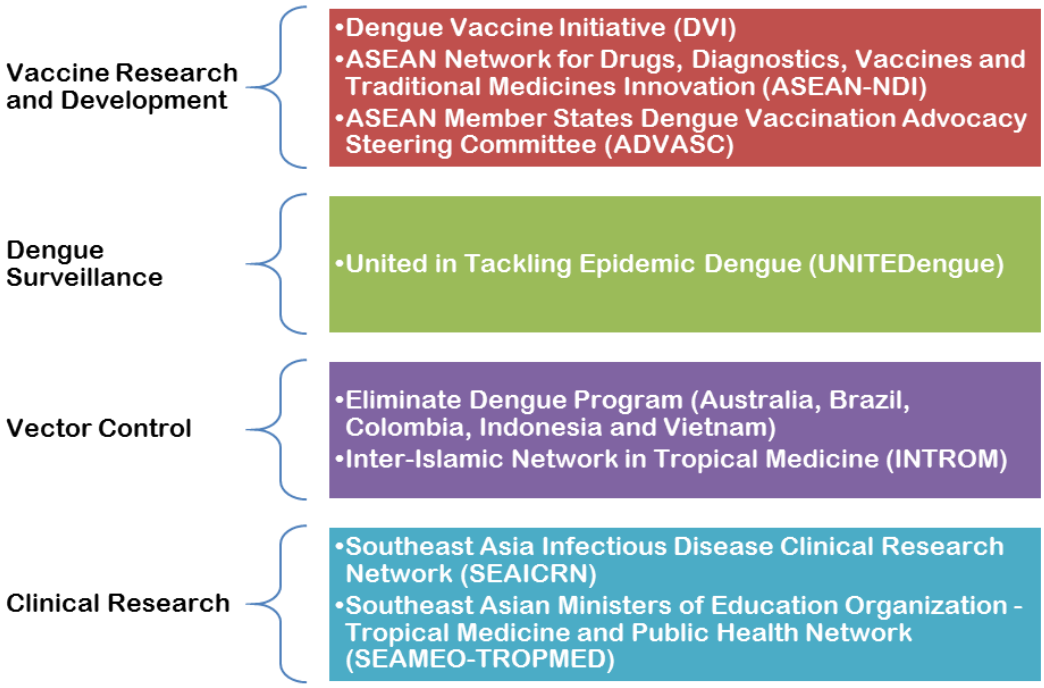
(COST) as its own initiative through the ASEAN Sub-Committee on Biotechnology.[11] It maintains a database on drug, diagnostics, vaccine and traditional medicine development for dengue, and other diseases in the region (ASEAN-NDI 2011). There is also the ASEAN Member States Dengue Vaccination Advocacy Steering Committee (ADVASC), a regional independent scientific and educational committee that aims to disseminate information and come up with practical recommendations in preparing for the dengue vaccine introduction in ASEAN countries established in 2011, and supported by an educational grant from Sanofi Pasteur. In 2014, it published a number of recommendations on how to streamline and harmonize surveillance and diagnostic capacities in ASEAN as well as the need to reconcile and harmonize the different WHO guidelines in terms of dengue case definition and surveillance (Thisyakron et al. 2014).

There is also the Eliminate Dengue research program that aims to biologically control dengue, particularly its vectors. According to the Eliminate Dengue website (2015), the program enjoys community and regulatory support as a scientific and multi-sectoral collaboration which brings together scientists from Australia, Brazil, Colombia, Indonesia and Vietnam, as well as philanthropic groups such as the Bill and Melinda Gates Foundation, Wellcome Trust, the Tahija Foundation in Indonesia, the Australian federal and Queensland state governments among others. The research program is studying how Wolbachia bacteria can be utilised as an effective strategy to disrupt dengue transmission between people by targeting the dengue virus transmission by *Aedes aegypti* mosquitoes. In line with the ASCC Blueprint action line to "strengthen regional clinical expertise through professional organisations' networks, regional research institution, exchange of expertise and information sharing," there are a number of existing networks including the Southeast Asia Infectious Disease Clinical Research Network (SEAICRN), the Inter-Islamic Network in Tropical Medicine (INTROM) and the Southeast Asian Ministers of Education Organization - Tropical Medicine and Public Health Network (SEAMEO-TROPMED). The SEAICRN is one of the most successful collaborative clinical research networks of hospitals and research institutions in Thailand, Vietnam and Indonesia supported by the National Institutes of Allergy and Infectious Diseases (US) and the Wellcome Trust (UK) and founded in 2005. The SEAICRN has been instrumental in improving the quality of clinical laboratories in the region with a programme to have each hospital clinical laboratory accredited by local and international bodies. The network also enabled the renovation of a number of laboratories to house a molecular diagnostic laboratory (MDL), and staff training in molecular diagnostics and external quality assurance (EQA) programmes. All hospitals equipped with such laboratories are encouraged to use the MDL for dengue testing (Wertheim et al. 2010; SEAICRN, 2015). There is also the INTROM, established under the Organisation of Islamic Cooperation to promote collaborative research and training in tropical medicine among Muslim countries.

In 2014, it held a tropical medicine workshop on the "Epidemiology and Identification of Dengue Vectors and Detection of the Virus in Vectors and Humans" to develop capacity-building in vector epidemiology, laboratory capacity and technology (Institute of Medical Research 2014). Lastly, SEAMEO-TROPMED is a network of regional higher education centres, training and research in tropical medicine and public health, based in three sub-regional centres in Malaysia (microbiology, parasitology and entomology), the Philippines (public health, hospital administration, environmental and occupational health) and Thailand (tropical medicine) (SEAMEO TROPMED 2015).

[11] In 2014, it published the results of its "Mapping of Product R&D Landscape for Infectious Tropical Diseases in ASEAN Member States" and identified five major academic and university-associated dengue research centres in ASEAN, including the Laboratory of Molecular Virology, Institute of Molecular Biosciences of the Mahidol University in Thailand, the Oxford University Clinical Research Unity at the Hospital for Tropical Diseases in Vietnam, the Tropical Infectious Diseases Research and Education Center (TIDREC) of the University of Malaya, the Duke-National University of Singapore Graduate Medical School in Singapore and the School of Biological Sciences at the Nanyang Technological University in Singapore (Montoya et al. 2014).

Figure 5. Multisectoral collaborations and networks on dengue in Southeast Asia



With many of these regional health security frameworks and mechanisms established to counter communicable diseases after the SARS epidemic, the region is already well positioned to leverage on these for more effective dengue prevention and control. However, policy frameworks can be encumbered by a number of risk factors that affect dengue incidence in the region. The following section presents an analysis of the strengths, weakness, opportunities and threats to health governance in relation to dengue in Indonesia and Malaysia. It provides a brief stocktaking of what these countries have implemented in terms of accomplishing global and regional targets.

Health Governance and Dengue in Indonesia

Dengue is hyperendemic in Indonesia and all four serotypes are co-circulating in all of its 34 provinces (See Annex A). It ranks as the most vulnerable in Asia among dengue-endemic countries, followed by Vietnam, Thailand, the Philippines and Malaysia (Fullerton et al. 2014). Dengue is the most common cause of febrile illness requiring hospitalisation in Indonesia but hospital diagnostic testing still needs improvement (AFIRE Study Team 2014). Since the first dengue cases were reported in Jakarta and Surabaya in 1968, it has been included in the national disease surveillance system and is reported in the form of cases, outbreaks or clinical and virological studies. Dengue cases can either be suspected, probable or confirmed. Only probable (with supportive dengue serology from blood specimen or with an epidemiological link to a confirmed dengue case) and confirmed (through virus isolation or detection of viral antigen or RNA in serum) are reported to the Communicable Disease Center of the Ministry of Health by district health authorities and further reflected in the surveillance database (Karyanti et al. 2014, 412). To support and improve serotype surveillance, the MOH has established seven sentinel surveillance stations across Indonesia – North Sumatra, Medan, East Kalimantan, Yogyakarta, Manado, Maluku and Mataram.[12] The following section outlines and discusses the findings from a SWOT analysis that looks into Indonesia's health governance in relation to dengue, in terms of political, economic, socio-demographic, technological, environmental and legal factors. This SWOT Analysis is based on desk research during the research period from October 2014 to March 2015 and on key informant interviews conducted in Jakarta, Indonesia from 5 to 9 December 2014.

Box 1. Dengue/DHF in Indonesia	
Annual DHF incidence[a]	**0.05/100,000 in 1968 to 28/100,000 in 2014**
Dengue Virus Serotypes[b]	**DENV-1: genotypes I and IV (most common)** **DENV-2: cosmopolitan** **DENV-3: genotypes I and V** **DENV-4: genotype II**
Annual dengue economic and disease burden[c]	**142,100 (DALYs, 2012)** **USD323,163 million (in medical costs, 2010)**

Sources: a. Tan et al. 2014; b. Eijkman Institute of Microbiology, 2014; c. Shepard et al. 2014

Strengths

Political: Dengue as a priority disease and target incidence rates

As one of the priority diseases in Indonesia, there is a gamut of public health programmes and interventions for dengue prevention and control at the national level. National public health programmes for dengue are led by the Directorate on Disease Control and Environmental Health in the Ministry of Health (MOH), with the Arbovirus and Environmental Health sub-directorates directly involved in policy planning and implementation of dengue prevention and control initiatives. In terms of policy planning, the MOH leads the inter-ministerial national Working Group on Dengue Haemorrhagic Fever or *POKJANAL DBD.*[13] Meeting biannually since 1995, the national working group provides the integrated supervisory, advisory and planning of dengue prevention, control and surveillance strategies.[14] From 2010 to 2014, Indonesia's Ministry of Health carried out intervention programmes and pilot projects as part of its 2010-2014 Strategic Plan, which included the 3M Plus source reduction and prevention programme; vector surveillance through routine larvae monitoring (*jumantik*) programme; vector mapping and epidemiological surveillance; establishing the KLB as an early warning system; produce national guidelines for dengue prevention and control in schools and for larvae monitoring and inspection; and awareness raising campaigns[15] such as the communication for behavioural impact (COMBI) projects, Clean Friday Movement and the annual observance of the Dengue Day which coincides with the ASEAN Dengue Day.

12 Interview with Indonesian official, Jakarta, 8 December, 2014

13 The POKJANAL DBD is composed of of the following ministries and agencies: education, environment, home affairs, housing and infrastructure, women empowerment welfare group, religious affairs, police, attorney general, tourism and transportation, as well as professional organisations and community organisations (Interview with Ministry of Health official, Indonesia, by Gianna Gayle Herrera Amul, 8 December 2014).

14 Interview with WHO official, Jakarta, 5 December 2014

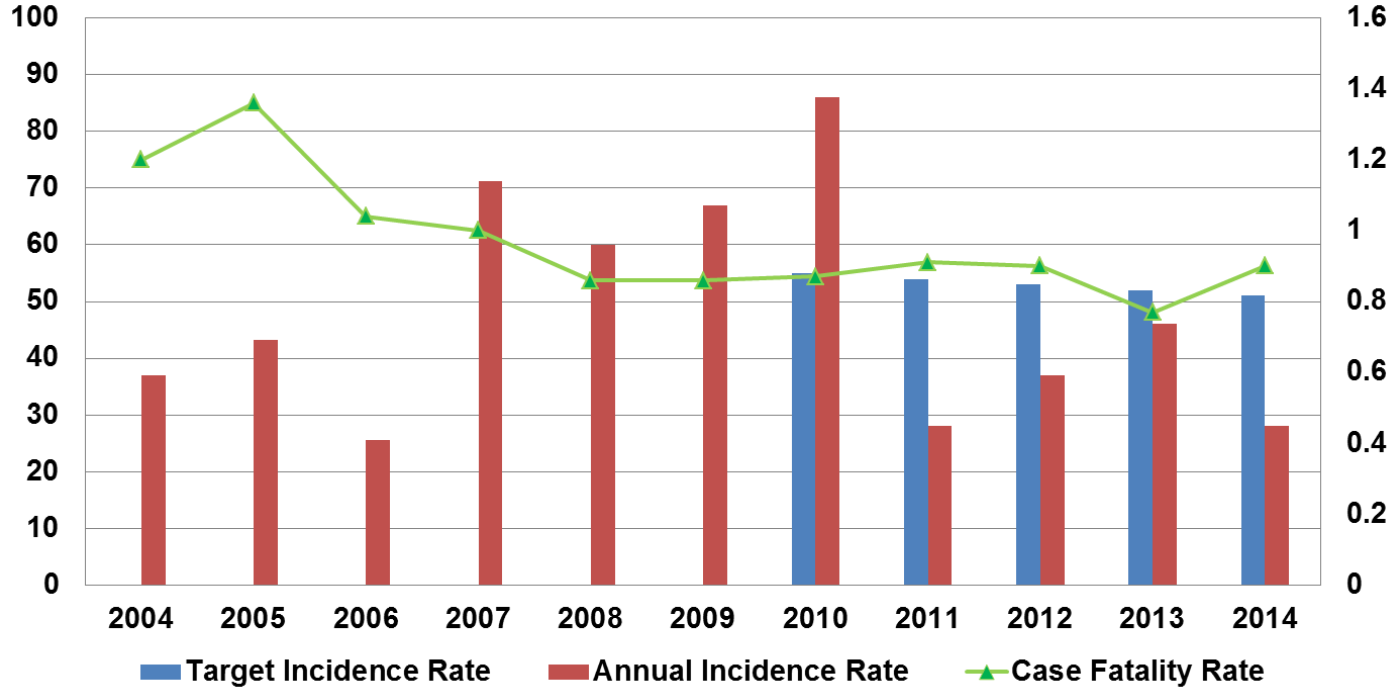
15 Interview with Indonesian officials, Jakarta, 8 December 2014

Indonesia has successfully reached its target incidence rate from its 2010 baseline but its target incidence rate reduction is less ambitious than expected. Based on the annual incidence rates and the nationally-set target incidence rate of 50/100,000 by the end of 2014 (See Figure 3), Indonesia has successfully reduced its incidence rate from the baseline of 86/100,000 in 2010 to 28/100,000 in 2014. However, the government's strategic plan follows a high baseline. The 2010 baseline coincides with the highest peak of incidence in the local dengue epidemic cycle over the past ten years. It is also notable that the government only aims to reduce the incidence rate by 1/100,000 per year illustrating the lacklustre national dengue prevention and control plan.

Socio-demographic: Mobilisation of youth, women and faith-based organisations

Young people, students, faith-based, community and women's organisations are mobilised for mosquito larvae inspection in households and localities. Aside from primary schools, local political authorities, district and community health centres, environmental affairs departments and public utility departments at the district and city levels, a number of actors are further incorporated into dengue prevention and control, particularly vector control through larvae inspection and elimination. There are the women's associations (PKK), representatives of community environmental health forums (*forum lingkungan*) and non-government organisations that can be utilised (Tana et al 2012). Most of these organisations are already integrated into the district level working group on DHF (POKJANAL DBD). One example of community-based vector control is the 1997 *Piket Bersama* campaigns[16], which led to the formation of dasawisma (ten-house) groups, led by the housewives, mothers or wives of local authorities or from PKK, organised to take turns in inspecting each other's households on a weekly basis (Kusriastuti et al. 2004; Spiegel et al. 2005). This practice has since been institutionalised into the mosquito larvae monitoring (*jumantik*) programme and integrated into the government's 3M Plus strategy.

Figure 6: Target and Actual Incidence and Case Fatality Rates, 2004-2014



Note: From 2014 to 2017, the target incidence rate is from 51/100,000 to 50/100,000.
Sources: Ministry of Health Indonesia. *Formulir 2, Rencana Kerja Kementerian/Lembaga (Renja-KL) Tahun Anggaran 2014*, http://www.depkes.go.id/resources/download/laporan/rencana-kerja/p2pl/F21.pdf; Daftar Program Dan Kegiatan Tahun 2014, http://www.depkes.go.id/resources/download/laporan/rencana-kerja/p2pl/Unit_Reff.pdf

[16] This campaign started in Purkowerto City in Central Java and as of 2004, has expanded to 14 more cities (including Palembang, Cirebon, Solo, Kudus, Surabaya and Bali) in Indonesia through funding from Rotary International and the Center for Disease Control (US).

Public-private partnerships in the dengue vaccine clinical trials give Indonesia advantages in terms of the value it puts on virus sovereignty. It is now mandated by the government that all research conducted with virus samples from Indonesia needs to be conducted with a government research institute – not only to strengthen technical capacity but also to reinforce Indonesia's virus sovereignty. In 2012, a Memorandum of Understanding (MOU) on Synergy Research and Development of Vaccines and Drugs and Raw Materials was signed by 16 institutions in academia, business and government. The MOU amplifies Indonesia's goals of self-reliance and self-sufficiency particularly in developing Indonesia's biopharmaceutical production and strengthening the country's national pharmaceutical industry by harnessing in-country raw materials (Biofarma 2012). As such, the Eijkman Institute of Microbiology under the Ministry of Research and Technology, a non-profit, government-funded research institute focused on the molecular epidemiology, genetics and biological characteristics of dengue in Indonesia and is the main partner for multinational pharmaceutical companies in conducting dengue vaccine clinical trials.[17]

There are numerous sectors involved in the development of dengue treatment and dengue vaccine particularly pharmaceutical companies and health consumer goods producers, that partner with government institutions and universities[18] in Indonesia. Sanofi Pasteur has been collaborating with the Eijkman Institute of Microbiology for the development of a dengue vaccine and in conducting clinical trials in Indonesia.[19] In October 2014, along with other researchers from the Philippines, Vietnam, Malaysia and Thailand, the CYD Study Group and Sanofi Pasteur[20] released the third phase of vaccine efficacy trial results, which showed that the dengue vaccine is efficacious when given as three injections to children aged 2-14 in endemic areas and has a good safety profile (Capeding et al. 2014). In addition, the HDI Group of Companies in Indonesia conducted clinical trials for a propolis honey-based treatment for dengue from 2010 to 2014. According to their website, their product HDI Propoelix is already available on the market and is recommended as a supplement to patients with DHF (HD Indonesia 2015; Osman 2014). These multi-sectoral partnerships, if successful, can fill the gap for a much-needed dengue vaccine in the region. This presents an opportunity for the Indonesian government to be both a pioneer and beneficiary of dengue vaccine development.

Environmental: Indonesia Climate Change Trust Fund and climate vulnerability mapping

The Indonesia Climate Change Trust Fund (ICCTF) provides funding for priority sectors, including health. It was noted that ICCTF funding is acquired through competitive proposal reviews managed under the United Nations Development Programme and the Ministry of National Development Planning Agency (BAPPENAS). The ICCTF serves to attract investment on mitigation and adaptation programmes integrated into national investment strategies. In 2014, the Environmental Health Directorate of the MOH acquired ICCTF funding to conduct assessments on dengue, dengue haemorrhagic fever and malaria vulnerability to climate change particularly the impact of humidity, temperature and rainfall on mosquito breeding sites and patterns in West Sumatra, Jakarta, East Java, Timor, Bali and West Kalimantan.[21] One study projected and mapped climate-induced dengue haemorrhagic fever in 20 districts and cities and associated the increased incidence of DHF with the amount of rainfall and the increase in temperature in these provinces (Haryanto et al. 2014).

The Environmental Health Directorate is responsible for the creation and development of vulnerability maps as information and advocacy materials on environmental health for local government officials. Local government officials find these useful in terms of crafting policy on climate and health which also provide them with evidence-based policy recommendations such as identifying vulnerable or hotspot areas for

[17] This was made possible when in 2006, Indonesia, asserting its virus sovereignty, refused to share samples of the H5N1 bird flu virus with the WHO for surveillance and vaccine development. This was only resolved in 2011 with the WHO Pandemic Influence Preparedness Framework. This framework established a pandemic influenza virus sharing mechanism in the access to vaccines and the operationalisation of the Standard Material Transfer Agreement.

[18] Some university-private sector partnership-based research on dengue treatments are mired with controversy because of perceived lack of transparency and credibility in the conduct of clinical trials (Sumedi 2013; RIKEN, 2015; Jakarta Post, April 22, 2014; Asian Scientist, January 2, 2014; Melaleuca Alfernifolia Research 2014; Jakarta Post, January 15, 2015).

[19] The University of Indonesia's Medical School, the Hasan Sadikin Hospital-Faculty of Medicine of the Padjadjaran University in Bandung, the School of Medicine of the Udayana University in Bali are involved in these clinical trials.

[20] Aside from Sanofi Pasteur, other pharmaceutical companies such as Takeda is set to begin the third phase of its clinical trials, while Novartis, Merck and GlaxosmithKline are also developing their own vaccine candidates (Research and Markets 2014).

21 Interview with Indonesian officials, Jakarta, 8 December, 2014

priority interventions.[22] Scaling up the creation of vulnerability maps for all provinces will prove useful not only for local government officials but also for the national government in terms of expanding and targeting sites for adaptation and environmental health initiatives. Climate vulnerability mapping also contributes to the development of community empowerment tools for dengue prevention and control.[23] These tools have been utilised for COMBI planning but their success needs to be assessed alongside the community ownership of the core of dengue prevention such as the 3M Plus and the *jumantik* programme. Increasing public awareness through improved health communication strategies not only by public health workers but also by medical professionals on the risks associated with dengue to their patients are deemed not only necessary but can also be a more cost-effective strategy.

Legal: Dengue outbreak reporting system

Reporting a state of emergency for dengue haemorrhagic fever is mandated under Indonesian law. Dengue fever and dengue haemorrhagic fever are legally acknowledged as diseases that local government officials can declare as an 'extraordinary situation' or kejadian luar biasa (KLB) status if there is an outbreak that can lead to an epidemic (Ministry of Health Regulation No 949, 2004). A KLB can be declared if one of the following criteria is met: (1) emergence of an illness that did not exist before; (2) a two or three-fold increase in the number of new cases in a month and; (3) a 50 per cent rise in the fatality rate in a particular period (Aruperes and Susanto 2015). A KLB also requires that a regency or district assess whether its finances and human resources can respond to the extraordinary situation.

Weaknesses

Political: Limited public health funding

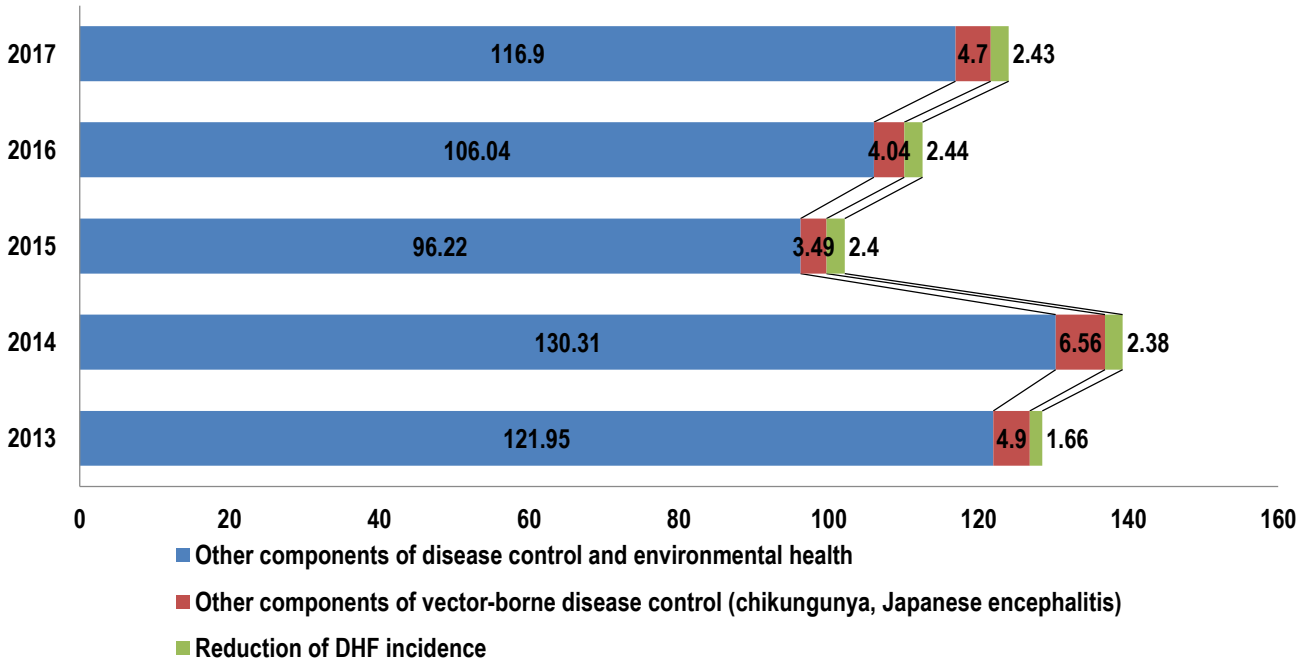
Varying and limited public health funding influence the amount allocated for dengue prevention and control. Indonesia's Health Law mandates that 5 per cent of the total national budget be allocated for health but currently, health only gets 3.7 per cent (70 trillion rupiah) of the national budget (Dharmawan 2014). In 2012, only 39.6 per cent of the total health expenditure came from government spending (World Bank 2014). The national government allocated approximately USD130 million in 2013 for its disease control and environmental health programmes, under which dengue prevention, control and surveillance falls (See Figure 4). The estimated funding needed slightly increased to approximately USD141 million for 2014 (Ministry of Health Indonesia 2014).

The Ministry of Health allocated at least six to seven per cent of its budget to disease control and environmental health from 2013-2014. However, the estimated budget allocated for 2015-2017 is comparably less than the budget for 2013-2014, the lowest being that for 2015-2016 which comprises about 4.9 per cent of the ministry's budget. With the decreased allocation for disease control and environmental health in 2015, the national budget allocated for arbovirus control that covers three vector-borne diseases - dengue haemorrhagic fever, chikungunya and Japanese encephalitis - increased from about USD100,328 in 2013 to about USD712,531 every year from 2014-2017. With these fluctuations in public funding, it is evident that there is an issue of sustainability and revolving funding sources for dengue interventions.

22The Environmental Health Directorate has a three-pronged strategy in terms of addressing the impact of climate change on the health sector: scientific studies and assessments; mapping vulnerabilities; and the development of public information and communication materials. Most of the scientific studies and assessments in relation to health and climate change had been done in collaboration with the Ministry of Environment as well as in collaboration with scholars and experts from the University of Indonesia's Research Centre for Climate Change and the Institut Pertanian Bogor. (Interview with officials from Ministry of Health Indonesia by Gianna Gayle Herrera Amul, December 8, 2014)

[23] Packaged as information kits that focus on the impact of climate and weather patterns on mosquito breeding density, the number of breeding sites and the needed change in the community's behaviour towards their environmental health conditions, these tools are useful for planning interventions at the local level.

Figure 7. Allocated and Projected Public (Ministry of Health) Funding for Disease Control and Environmental Health, 2013-2017, in USD million



Source: Ministry of Health Indonesia 2014. Accessed January 23, 2015. http://www.depkes.go.id/resources/download/laporan/rencana-kerja/p2pl/F23.pdf

Such limited and varied funding is also evident at the local government level. For example, Jambi was among the provinces with the highest case fatality rates from 2012-2013 but its case fatality rate was reduced to 0.90 in 2014 from 2.82 in 2013. This reduction can be attributed partly to the increase in the public health expenditure in Jambi – from 39,992 million rupiah in 2013 to 175,601 million rupiah in 2014 (Ministry of Health Indonesia 2014). Moreover, Jambi has a USD6 per capita discrepancy to meet the demand for minimum health services[24] – Jambi only spends USD19.13 per capita to meet minimum health services but the estimated demand cost for minimum health services is at USD25.17 per capita (Ensor et al. 2012). Jambi's dengue problem can also be largely associated with its environmental health as biofuel plantations are prevalent in the province and are all-year breeding grounds for *Aedes aegypti* mosquitoes (Creutzig et al. 2013).

Economic: Gaps in National-Local Health Coverage

There are substantial gaps in national-local health coverage that is exacerbated by considerable challenges in poverty reduction. With more than forty per cent of its population living in multidimensional poverty, and with health depravity contributing about thirty-five per cent to overall poverty, Indonesia's poor are in dire need of social protection (UNDP 2012). The national health insurance program or BJPS already covers dengue fever (BPJS 2014). The coverage for dengue-related medical costs is determined through tiered socioeconomic clusters.[25] However, there are problems associated with the supposedly complementary nature of locally-funded health insurance for those not covered by the national program for poor households (Sumarto et al. 2014). Thus, local government performance in terms of providing universal health coverage varies depending on budget capacities and constraints. There are claims at the national level that accountability of local health outcomes rest on local government leaders. However, there is little discretion given to local governments over the use of public health funds which are still determined by the central government (Heywood and Harahap 2009). Indonesia has 34 provinces, five of which (Aceh,

24 Minimum health services package or the Standard Pelayanan Minimal (SPM) comprises maternal and neonatal care, family planning, infant and child health (including routine health checks and care for children suffering from malnutrition, diarrhoea and respiratory infections) and priority communicable diseases (tuberculosis, malaria and dengue).

25 Interview with Indonesian officials, Jakarta, 8 December 2014

Jakarta, Yogyakarta, Papua and West Papua) have greater legislative privileges and a higher degree of autonomy from the central government.[26] The impact of decentralisation on health in Indonesia varies considerably in terms of national and local fiscal capacities. Local governments' priorities will not always be aligned with national public priorities in terms of health.

Socio-demographic: Rural-to-urban migration and health system deficits

The growth of rural-to-urban migration is a cause for concern as there is consensus among Indonesian health officials that dengue is highly attributable to urbanisation. There is local evidence that demographic changes impact age distribution of cases and period of incidence. A recent study confirmed that there is a clear annual geographical distribution of DHF incidence concentrated in densely populated areas and that DHF incidence has been increasing in over 15 year olds (Karyanti et al. 2014). This upward shift from under five year olds was partly explained by decreasing birth and infant mortality rates since 2003, influenced by rapid urban population growth (Karyanti et al. 2014). Consequently, rapid and uncontrolled urbanisation driven by rural-to-urban migration and high population density also drive the higher incidence of dengue in Indonesia (Fullerton et al. 2014).

Current rates of urbanisation and population density in Indonesia show no signs of decreasing. At an urban population growth rate of 2.5 per cent, it is estimated that 65 per cent of Indonesians will be urban residents by 2025. Indonesia's population density increased from 107 per km^2 in 2000 to 130 per km^2 in 2013 (BPS Statistics Indonesia). This figure however does not show how dense Indonesia's islands are becoming. Among the top provinces with the highest population densities include provinces with the highest dengue incidence particularly Jakarta (15,063/km^2), West Java (1,285/km^2), Yogyakarta (1,136/km^2), Central Java (996/km^2), East Java (801/km^2) and Bali (716/km^2) (BPS Statistics Indonesia 2015). The provinces with the highest number (more than 100) of dengue deaths from 2012 to 2014 are also concentrated in Java, with Central Java recording about 182 deaths in 2013, the highest number of dengue-related deaths during this period. This is mainly attributed to Java's urban population density and uncontrolled urbanisation.

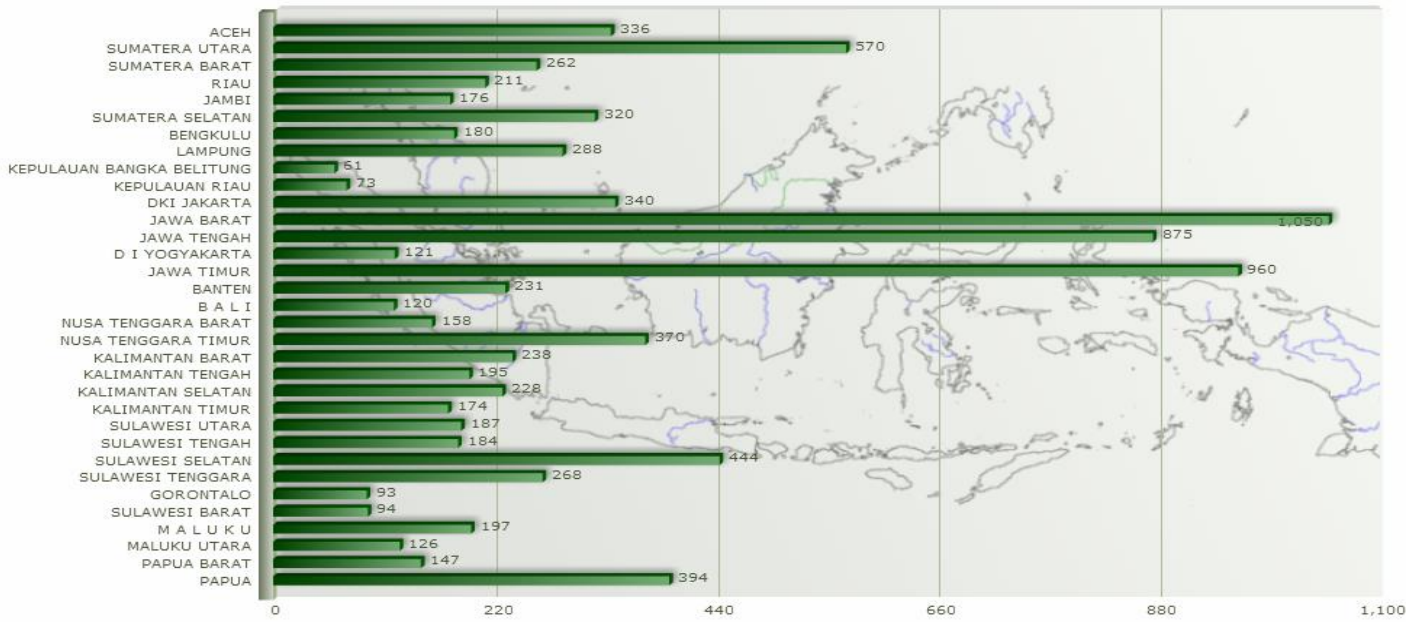
At present, Indonesia's health system and infrastructure is limited and needs drastic improvement to fulfil implementation of a universal healthcare system. Indonesia has only 1603 hospitals: 864 are public (MOH, provincial and district) hospitals of which 771 are general hospitals, and only 93 specialist hospitals, and 739 private-run hospitals of which 539 are general hospitals and 200 specialist hospitals (Ministry of Health Indonesia 2015). This means that there is less than 1 hospital per 100,000 people. Consequently, there is approximately only 1.12 hospital bed per 1,000 people (Ministry of Health Indonesia 2014).

In 2011, the Health Ministry estimated that dengue outbreaks already cost Indonesia about USD 363 million annually with about USD 40 million in medical expenses (Faizal 2011). This does not cover expenditures on vector control, vaccine research and development, or health personnel costs. Such constraint is further exacerbated by the deficit in health infrastructure quantity and quality. Indonesia's health system remains insufficient and inefficient to provide an adequate level of service to a population of about 250 million. There are about 9,719 primary health care centres (puskesmas) around the archipelago. The puskesmas have already integrated dengue prevention and control activities as part of their core functions and have served as vital nodes for initial diagnosis and dengue case referral to hospitals.[27] However, the majority of the primary health care centres in Indonesia are concentrated in Java because of population density (Figure 5).

[26] There was a major transfer of administrative, political and financial authority to the district/municipality in 2001, when the 1999 decentralisation law took effect. The districts and cities, with their own local parliaments, were given responsibility for several policy areas including health. Provincial governments became representatives of the central governments, with supervisory and coordinating functions with the revision of the decentralisation laws in 2004. There are now 399 districts, 98 municipalities, 6,793 sub districts and 79,075 villages.

27 Interview with Indonesian official, Jakarta, 8 December 2014

Figure 8. Distribution of Primary Health Centres in Indonesia per Province (as of February 2015)



Source: Ministry of Health Indonesia 2015

Environmental: Under-utilisation of climate vulnerable disease mapping

There is still under-utilisation of climate-related data for a dengue early warning system. Despite the recognition that climate change affects public health and collaboration between the MOH and the Meteorological Climatological and Geophysical Agency (BMKG), few regulations are implemented to address the impact of climate change on health like the *Health Sector Adaptation Strategy to the Impact of Climate Change* (2011) and the *Guidelines for Identifying Health Risk Factors due to Climate Change* (2013). BMKG analysis for an early warning system on climate change impact on 10 climate-vulnerable diseases identified by the Ministry of Health, including vector-borne diseases like dengue was proposed as early as 2010, with a case study of Jakarta (Sasmito et al. 2010). However, it was only in 2014 that provincial assessments and the mapping climate vulnerable diseases such as dengue and malaria were made available through ICCCTF funding.

Opportunities

Political: Positive incentives and multi-sectoral public health interventions

Further expansion of peer awards can institutionalise the 3M Plus programme beyond the public sector. A good local example of this is Bali's Healthy City programme which includes dengue-awareness raising campaigns and clean and healthy lifestyle (*Perilaku Hidup Bersih dan Sehat PHBS)* campaigns in markets that target housewives, free distribution of abate powder, mosquito larvae eradication program (PSN) and the *jumantik*, community health education or *Penyuluhan Kesehatan Masyarakat(PKM)* and a yearly performance-based competition among POKJANAL DBD at the district level (Bali Provincial Government 2010). This competition coincides with another for city cleanliness awards, especially in Denpasar. The awards criteria are based on environmental health indicators including: number of dengue cases and number of dengue-related deaths; the participation of residents, young people and women's associations (PKK, pendidikan kesejahteraan keluarga) in PSN activities; free larvae index and; waste, parks and drainage management.[28] Denpasar's 2015 target in reducing morbidity from DHF to 500 per 100,000 is coupled with a free larvae index target (angka bebas jentik) of more than 95 per cent and conducting an

[28]Monetary awards at the village level range from 2 million rupiah (USD163) to 3.5 million rupiah (USD286); at the district level, from 3 million (USD245) to 11.5 million rupiah (USD 941), and the overall winner from village and district level can be awarded by 20 million rupiah (USD1,638) (City Health Office Denpasar 2013).

epidemiological investigation within 24 hours of reported cases or outbreaks. According to the Denpasar City Health Office's Strategic Plan (2010), these targets are to be accomplished mainly by community spraying and fogging to prevent mosquito breeding. Denpasar has at least 474 *jumantik* monitoring residential areas and advising people to regularly conduct 3M (*Jakarta Post*, May 9, 2014). These targets were based on 2009 reported outputs, where the City Health Office of Denpasar (2010) reported achieving 93.17 per cent of the free larvae index, 100 per cent reporting of KLBs but only reaching 59.4 per cent of its 80 per cent target of communities practicing PHBS.

National and local governments can loop a variety of actors into public and environmental health interventions. Some of these actors include public-private research networks, intergovernmental health organisations and civil society organisations. Aside from government agency-conducted research, public-private research collaborations can support clinical research and supplement training and education. An example is the Clinical Epidemiology and Evidence-based Medicine (EBM-ICE) Network, a medical research network which is composed of representatives from both public and private medical schools and hospitals. Established in 2011 to develop medical education, training and research towards the improvement of quality health care, clinical research, community health service and health information systems, the network has the Ministry of Health, Ministry of Education and Ministry of Research and Technology as members of its advisory board (Ministry of Health Indonesia 2011). The existence of such networks already provides an important node for regional collaborative efforts to exchange expertise, and share information in line with the ASEAN Strategic Framework on Health Development.

There is also the Indonesia Research Partnership on Infectious Disease (INA-RESPOND), a collaboration between US and Indonesian government institutions and universities towards high quality infectious disease clinical research, particularly those prioritised by the Indonesian Ministry of Health: malaria, avian influenza, dengue, HIV-AIDS, tuberculosis (MADAT) and neglected infectious diseases.[29] In addition, Indonesia's major public hospitals, the Dr Cipto Mangunkusumo Hospital (Jakarta), the Dr Wahidin Soedirohusodo Hospital (Makassar) and the Dr Sardjito Hospital (Yogyakarta) are among the research sites of the SEAICRN. The INA-RESPOND is also a network partner of the SEAICRN. The involvement of INA-RESPOND in a regional network such as the SEAICRN shows the potential for more collaboration in the region.

The above examples of university-private sector-government collaboration shows that Indonesia already has existing nodes for multi-level and multisectoral collaboration especially for clinical research. University collaborations and networks need to be encouraged not only for scientific and clinical research but also for building a community of practice that continuously trains experts who can introduce innovations in the field. For example, the Vector and Reservoir Control Research Unit of the National Institute of Health Research and Development (LITBANGKES), under the Ministry of Health of Indonesia and the Directorate General of Communicable Disease Control and Environmental Health collaborate in investigations of dengue and dengue haemorrhagic fever outbreaks in Indonesia. The results of their research are publicly available online in the local language however the rate by which these studies are actually shared at the local level and considered by local policymakers has been minimal. However, it is through these university collaborations where standardised, quantitative and qualitative impact evaluation can be developed to enable policymakers not only to target interventions but also to solidify the evidence that the target communities actually benefit from these interventions. Bridging science, policy and the people together would be one important contribution of university-based collaborations and initiatives.

Given the scarcity of health professionals in Indonesia, several civil society organisations have been supplementing government awareness raising campaigns on dengue, particularly on the 3M Plus programme. The Indonesian Red Cross (Palang Merah Indonesia), particularly its youth arm, aside from disaster preparedness and emergency responses in conflict and disaster situations works closely with the Jakarta local government on dengue and bird flu prevention (Goodwin and Martam 2014). Muhammadiyah,

29 Its partners include the National Institute of Health Research and Development (NIHRD, LITBANGKES), US National Institutes of Health, National Institute of Allergy and Infectious Diseases (NIH-NIAID), US Centers for Disease Control and Prevention, the Eijkman Institute for Molecular Biology in Jakarta, researchers from the University of Airlangga/Dr Soetomo Hospital (Surabaya), University of Diponegoro/Dr Kariadi Hospital (Semarang), University of Gadjah Mada/Dr Sardjito Hospital (Yogyakarta), Hassanudin University/Dr Wahihdin Sudirohusodo Hospital (Makassar), University of Indonesia/Dr Cipto Mangunkusumo Hospital (Jakarta), University of Padjadjaran/Dr Hasan Sadikin Hospital (Bandung), University of Udayana/Sanglah Hospital (Bali), Prof Dr Sulianti Saroso Infectious Diseases Hospital (Jakarta), and the Persahabatan Hospital (Jakarta). For more information, see the INA-RESPOND website: http://www.ina-respond.net/

the largest faith-based organisation in Indonesia, has branches in the top provinces with the highest incidence rates. Muhammadiyah's institutional reach starts from the central, to the provincial, to the regional, to the district to the subdistrict level.[30] Much of Muhammadiyah's activities in relation to dengue are on advocacy and awareness-raising, particularly through its women's arm – the Aisyiyah. For example, the SITKES Aisyiyah Yogyakarta (College of Medical Sciences) collaborates on awareness-raising campaigns with the Eliminate Dengue project in Indonesia. The Muhammadiyah University of Yogyakarta on the other hand has been hosting an annual International Medical Summer School for the past ten years that focuses on tropical diseases, particularly malaria and dengue fever (Muhammadiyah 2014).

In addition, the WHO in Indonesia provides capacity building from vector control and clinical management to prevention. It also addresses issues of the co-morbidity of dengue with other diseases, such as Japanese encephalitis which is known to cause sub-clinical infections for dengue patients. The WHO's target especially for dengue is to reduce morbidity especially in urban areas to reduce case fatality through better clinical disease management. The WHO provides technical support especially to address specific training requests on dengue case management and community dengue control from the Ministry of Health as well as national evaluations or reviews of their dengue control program. Part of this is in collaboration with the National Institute for Health Research and Development (LITBANGKES) that serves as the WHO Collaborating Centre for Health System Research Management. The Centre is mainly involved in the decentralisation of health services through training researchers and local government institutions. National health officials have been concerned about the impact of decentralisation not only on health but also on environmental policies, as responsibilities fall on local governments to continue to implement nationally-initiated programmes, priorities of which can differ from the Ministry of Health.

Moreover, the WHO collaborates at the regional level with ASEAN in the observance of the annual ASEAN Dengue Day. The WHO in Indonesia emphasises that it is important to look into the dynamics of the disease which would entail not only better health infrastructure but also better reporting capacities. The ASEAN Dengue Day is organised under the principle of regional information sharing as dengue is a priority disease for the Asia Pacific.

Furthermore, the WHO along with the Indonesian Epidemiologists' Association, local governments and donors all contributed to the sustainability of the field epidemiology training programme (FETP). This was in line with its objective to improve the capacity of Indonesia's disease surveillance and response systems. The government then implemented a five-year revitalisation work plan in 2007 to address the requirements of the revised 2005 International Health Regulations. With a governmental decree, the FETP was integrated into the MoH workforce development strategy along with improvements in the curricula, more field-based epidemiological work and the establishment of an FETP Secretariat. Since 2008, FETP students have been actively mobilised for nationwide outbreak investigations for dengue, rabies, leptospirosis and Chikungunya among others.

In this regard, the WHO is thus an important actor not only for awareness raising and capacity building, but also in ensuring that Indonesia's decentralisation leads to better health systems and services at the local level. The WHO needs to further leverage on its capability to raise dengue to the forefront of the global national and local health agendas as it did with focusing on vector-borne diseases for the observance of World Health Day in 2014. Dengue is already endemic in more than a 100 countries and the WHO and ASEAN can propose a World Dengue Day to increase awareness of dengue and push for more effective dengue prevention and control globally. This can also coincide with ASEAN Dengue Day to further promote the involvement of different sectors and stakeholders.

Economic: Engaging tourists and the private sector

Areas with high tourism rates can leverage on associated economic growth to collaborate with the private sector and mobilise communities to improve and sustain interventions at the local level. For example, in Bali, the hotel industry is increasingly acknowledging their role in dengue prevention and control. In November 2014, the Bali Hotels Association, the Ministry of Health and Kyoto University held a workshop

[30] It has an executive General Health Service Council at the Central level, and operates 71 general hospitals, 49 maternity clinics, 117 public health service centres for women and children, 47 polyclinics, and other health services across Indonesia (Muhammadiyah 2014).

on dengue control. The workshop concluded with standard operating procedures (SOPs) for vector control in the hospitality industry which included hotel guest advisory on personal protection from mosquitoes, cooperating with the government and communities and other organisations in keeping surroundings clean, 3M Plus, reducing mosquito larvae breeding grounds and fogging. It was noted that there is a growing interest among hotel industry representatives to collaborate with universities and the government to be kept informed and updated on cost-effective source reduction and vector control strategies.[31] There are regulatory issues in the use of imported and local insecticides identified during this workshop and BTI (bacillus thuringiensis israelensis) was highly recommended to eradicate mosquito larvae but 'regulations and rules on the use of BTI in Indonesia is still being drafted by the Ministry of Health (PHRI Bali 2014).' Such multi-sectoral partnerships are an opportunity to explore especially in major tourist areas.

Tourism targets can be aligned with improving the health infrastructure and creating job incentives for locals in the health or medical tourism sectors. This can also be an incentive for locals to stay in Indonesia for medical treatment. The Ministry of Health and Ministry of Tourism already signed an agreement for the development of health tourism in Indonesia which will include both public and private stakeholders (hospital representatives, spa providers, health associations) to create a work plan for the Indonesia Wellness and Healthcare Tourism working group. The government has already identified Bali, Jakarta, Makassar and Manado as the four hot spots to pioneer health tourism development (*International Medical Travel Journal News*, January 4 2013).

This shows that the private sector is increasingly aware of the dengue burden on general public health and the economy especially in terms of productivity. However, private sector involvement in many awareness raising activities remains short-term and lacks impact evaluation. Both the government and civil society organisations can push for the private sector to integrate dengue prevention and control in their corporate social responsibility strategies. This can be promoted by the co-benefits of working towards dengue prevention to avoid associated productivity losses but also as a holistic public health goal.

In addition, private-sector-led dengue fever insurance mechanisms can complement if not fully integrate into the national health insurance system. For example, combining social security mechanisms and micro-entrepreneurship, the Indonesian Midwives Association (IMA) through the *Bidan Delima* programme partnered with ACA Insurance for a micro-entrepreneurship venture for accredited midwives to offer the Dengue Fever Insurance card that can cover up to USD 100 to USD 200 of medical costs with a premium of USD1 to USD5 (Centre for Health Market Innovations; Reis 2012). This programme is spearheaded and supported by the USAID since 2003, aimed at improving midwifery services in Indonesia. Given that universal health coverage is still in progress, such low-cost supplementary social security or health insurance mechanisms can lessen health expenses.

Technological: Biological control of dengue and awareness raising

Moreover, the Faculty of Medicine of the University of Gadja Mada in Yogyakarta is involved in the biological control project, Eliminate Dengue Indonesia, supported by the Tahija Foundation. Since 2011, it has been in collaboration with Monash University and the University of Melbourne in Australia. It was only in January and December 2014 that field trials began in two sites in Yogyakarta, using adult and egg release methods. The research received approval from the Yogyakarta Provincial Government and was reviewed by the internationally-accredited Institutional Review Board at the University of Gadja Mada (Eliminate Dengue 2015). It is thus one of the projects that indicate that there is political support for research and technology that aim to prevent and biologically control dengue in Indonesia. The Tahija Foundation has disbursed USD8 million for the project (Haraito 2014). This project built on existing dengue research involving 500,000 people in a larviciding intervention project also supported and implemented by the Tahija Foundation and Gadja Mada University (Eliminate Dengue, February 20, 2012). This project is the most promising of ongoing research collaborations in Indonesia, with increasing public acceptance of biological control as a method to support dengue prevention and control activities. The research team meets with communities to explain their research to the residents and seek their support combined with government approval before conducting any field trials (Eliminate Dengue, August 4, 2014). The project is increasingly becoming a public-private-people initiative and the success of this project can provide a best

31 Interview with public health researcher, Singapore, 21 January 2015

practice for long-term interventions that involves different sectors at different levels including the community. Scaling up such projects can slowly be introduced to other provinces.

There can be an increased use of social media and mobile technology to improve disease surveillance for case and outbreak reporting. Such tools can be developed for raising awareness and early warning. With the ubiquity of mobile phones, mobile technology platforms are emerging as valuable tools for real-time surveillance. For example, in Semarang, the local health agency, health promotion department, public health faculty of Diponegoro University, BAPPEDA and the Bintari Foundation launched a project in 2013 (to 2015) to strengthen Semarang's health information system and develop a health early warning system (HEWS) especially for dengue fever response mechanisms (ACCCRN 2013). The project piloted an SMS-based surveillance and health information system at the local level. This was a project launched by Rockefeller Foundation through the Asian Cities Climate Change Resilience Network (ACCCRN) to strengthen Semarang's climate resilience through the prevention of vector-borne diseases. This provides an opportunity not only to tap mobile technology but also funding opportunities for cities to strengthen climate resilience in Indonesia.

Mobile technology and consumer products were also mediums to raise public awareness on dengue as was demonstrated by the Project Zero campaign launched by the Pikoli Foundation in 2011. It strongly supports the Ministry of Health's 3M Plus campaign through promoting and involving the private sector, particularly, manufacturers of consumer goods in dengue awareness through printing prevention messages on their product packaging (Sagita 2011). Among Project Zero's sponsors and partners are telecommunication companies (Indosat, Telkomsel), mass media companies (Rajawali Citra Televisi Peduli), supermarkets and convenience store chains (Alfamart, Giant, Carrefour), consumer goods companies (Nestle, Coca Cola, GarudaFood, Mayora), advertising companies (Fortune PR, WarnaWarni Advertising), motor vehicle manufacturer (Suzuki) and a bank (Bank Central Asia, BCA). Another example is Telkomsel's partnership with the Ministry of Health in a health information and family-based programme as part of the "War on Dengue" campaign. It was piloted in 2009 (until 2011) in 14 districts and municipalities, including Medan, Bandar Lampung, Jakarta, Depok, Bekasi, Cimahi, Yogyakarta, Surabaya, Mataram, Balikpapan, Manado, Makassar and Sorong (Ministry of Health Indonesia 2009).

Legal: Mosquito breeding fines or local taxes

As a last resort, fines or local taxes mandated by law can be gradually and progressively applied on commercial sites where breeding grounds for mosquitoes are found. Among the localities with the highest incidence rates, local governments have been implementing their own dengue prevention and control programmes. One is the Jakarta Health Environment Development Programme which aims to have a higher number of aedes aegypti larvae-free houses and buildings through weekly mosquito nests eradication programme (PSN) by the *jumantik* (larvae monitors) and weekly 30-minute observance of 3M Plus every Friday in government offices and schools (*Jakarta ByLaw No1* 2008). The Jakarta Health Office also set a target for Jakarta to be dengue-free by 2020, with hopes that a dengue vaccine being developed by Sanofi Pasteur with the Eijkman Institute of Molecular Biology will be available in the market by 2015 (Busyra 2014). In addition, the Jakarta Department of Health has existing bylaws on dengue fever control (No 6/2007) and regional health services (2009). The 2007 bylaw allows the government to impose sanctions with verbal and written warnings and fines of up to 50million rupiah (USD 4,110) for harbouring mosquito larvae (*Jakarta Globe*, February 1, 2010). Local taxes imposed can be utilised for the formal employment of mosquito larvae monitors, which are mostly voluntary, contractual and dependent on local-government allowances.

Table 5 shows that there are a number of MoH training modules and technical guidelines on dengue prevention particularly the elimination of mosquito breeding grounds, larvae monitoring and clinical management of dengue fever but legally-binding regulations are scarce, in fact only one relates to declaring a state of emergency or KLB in relation to dengue. Arguably, Indonesia needs more legally-binding regulations from the national to the local level. The implementation of legally-binding regulations however would need resources - both in human resources and infrastructure that Indonesia still lacks.

Table 5: Legislation and Ministerial Regulations/Guidelines and Modules in relation to dengue from 1990-2015.

Intervention Period	Ministerial Regulations/Guidelines/Modules
1990-2000	Technical guidelines for epidemiological investigation, necessary prevention and mass spraying for the eradication of dengue haemorrhagic feve, 1992
	(Mobilize communities in eradication of dengue fever mosquito nests (PSN-DBD), 1996
	Module on the Eradication of Dengue Fever, 1997
	Community mobilization in 3M to eradicate dengue haemorrhagic fever, 1998
2000-2010	Standards in monitoring health programs for the eradication of DHF, *2003*
	Dengue mosquito nest eradication by larva monitoring (JUMANTIK programme), 2004
	Clinical management of dengue infection in health care facilities, 2005
	Minister of Health of the Republic of Indonesia Number 406 / Menkes / SK / III / 2004 on the Establishment of the conditions of extraordinary events (KLB) of dengue fever in Indonesia
	Eradication of Dengue Mosquitoes in Urban Areas, 2004
	Mosquito Nest Eradication (PSN) in Urban Areas, 2006
	Management of Dengue Fever in Indonesia, 2006
	Guidelines for entomology survey for DHF, 2007
	Clinical management of dengue infection in health care facilities, 2008
	Training Module for Trainers of Dengue Mosquito Nest Eradication through Communication for Behavioural Impact (COMBI), 2008
2011-2015	Module on the Control of Dengue Fever, 2011
	Technical Guidelines for Larva Monitoring Team (JUMANTIK), 2012

Note: These are translated titles of official documents accessed online via Perpustakaan Kementerian Kesehatan, with the keyword “dengue”
Source: Ministry of Health, Indonesia, http://www.perpustakaan.depkes.go.id/?q=searchresult&keywords=dengue&koleksi=printed&cari=Cari+Koleksi#searchresult, 30 January 2015.

Threats

Economic: Dengue in tourist areas

High dengue incidence rates are reported in major tourism areas. From 2013-2014, Bali had the highest incidence rate in Indonesia although from 2012-2014, East Kalimantan and Jakarta were a constant in the list of provinces with the highest incidence rates (See Table 3). Bali’s incidence rate in 2012 was 66/100,000 which significantly shot up by about 250 per cent in 2013 with incidence rates of 168/100,000 in 2013 and 172/100,000 in 2014. This poses a serious threat to Bali as one of the main tourist destinations in Indonesia.

In a global airport-based risk model for the spread of dengue, airports in Manila, Jakarta, Bangkok, Ho Chi Minh City, Singapore, Surabaya, Kuala Lumpur are among those in the top 25 destination risk airports for dengue (Gardner and Sarkar 2013). Given that Indonesia received about 9.4 million tourists in 2014 alone, the risk of dengue transmission is also high. Bali alone received 3.76 million tourists in the same period, with 991,923 tourists from Australia, 586,300 tourists from China, 225,572 tourists from Malaysia, 217,402 tourists from Japan and 179,719 tourists from Singapore (*Jakarta Post,* February 3, 2015). The Bali provincial government has recently opened a visa-free facility to tourists from China, Japan, South Korea, Russia and Australia in order to reach its target of 20 million foreign visitors by 2019 (*Bali Times,* February 2, 2015).

Table 6: Provinces with the highest incidence rates, case fatality rates and number of dengue-related deaths in Indonesia

	2012	2013	2014
Provinces with the highest Incidence Rates (IR)	1. Central Sulawesi 2. Bangka Belitung 3. East Kalimantan **4. Jakarta** 5. Lampung	**1. Bali** **2. Jakarta** **3. Yogyakarta** 4. East Kalimantan 5. Central Sulawesi	**1. Bali** 2. West Kalimantan **3. Jakarta** 4. East Kalimantan 5. North Kalimantan
Provinces with the highest Case Fatality Rates (CFR)	1. West Papua 2. Maluku 3. Gorontalo 4. Bangka Belitung 5. Jambi	1. Jambi 2. Bangka Belitung 3. East Nusa Tenggara 4. West Kalimantan 5. Gorontalo	1. Maluku 2. South Kalimantan 3. Bangka Belitung 4. Gorontalo 5. Riau
Provinces with the highest number of deaths	**1. West Java** **2. East Java** **3. Central Java** 4. Lampung 5. North Sumatra	**1. Central Java** **2. West Java** **3. East Java** 4. Lampung 5. South Sulawesi	**1. Central Java** **2. West Java** **3. East Java** 4. West Kalimantan 5. East Kalimantan

Source: Ministry of Health, Indonesia, December 2014

For example, it has been reported that more than half of the overseas acquired dengue cases in Australia from 1999 to July 2012 came from Indonesia (Knope et al. 2013). Australia recorded sharp increases in dengue cases which coincided with the introduction and boom of budget travel especially to destinations like Bali. Between 2006 and 2012, 93 per cent of all Australian tourists that entered Indonesia were said to have visited Bali. There is thus a strong correlation between the increase in travel to Indonesia and increase in Indonesia-acquired dengue cases notified in Western Australia. Official statistics from the Department of Health in Western Australia (June 2013) suggest an increase from 56 per cent to 80 per cent from 2006 to 2012.

A recent study noted that Indonesia serves as major hub for dengue genetic diversity, noting how the cosmopolitan genotype of the dengue virus that emerged in Bali in 2011 to 2012 was also found among travellers returning to Western Australia (Ernst et al. 2015). Overseas-acquired dengue infections are also becoming a trend in Taiwan and China. Imported dengue cases reported in Taiwan were mostly from Indonesia (27 per cent) and Thailand (24 per cent) in 2013. About 40 per cent of these cases were identified at fever screening at airports (Yang et al. 2014). In November 2014, the Taiwan's Centre for Disease Control reported that most of the imported cases reported in Taiwan were from Malaysia (28 per cent) and Indonesia (26 per cent).

Socio-demographic: Shortage of human resources in health

The shortage of health professionals and health workers can cripple overall health security. Indonesia has a serious scarcity of health professionals. Having 2.5 health care providers (doctors, nurses and midwives) per 1000 population is already an indicator of a critical shortage of providers. If midwives are not included, Indonesia has less than 2 health care providers per 1000 population. According to 2013 data, there are about 94,000 medical personnel in Indonesia including general practitioners, specialists and dentists and about 288,405 nurses. Accordingly, there are 38.1 general practitioners per 100,000 population while there are 116.1 nurses per 100,000 population. There is an average of 16 specialists, 10 general practitioners and 74 nurses on duty for every government hospital. On average, there are only 1.84 general practitioners for every puskesmas. The puskesmas in the archipelago are severely understaffed: 30.8 per cent of them have no sanitarian, 30.2 per cent have no dietician, and 55 per cent have no medical technologist.

Most specialists and general practitioners are practicing in both the public and private sector, usually in two or more clinics or hospitals – which usually translates to less time for patients, clinical practice and public hospital visits as most of them would prefer private practice. Retention of health professionals in the public

sector is difficult – more than 900 puskesmas outside Java have no assigned general practitioners. This became a problem since medical school graduates are no longer required or bonded to render a mandatory public service of two to five years at a puskesmas as was the practice in the 1970s. Even with the Pegawai Tidak Tetap (PTT) policy or contract physician scheme that was implemented to retain health professionals in the public sector, there is still an uneven distribution with most concentrated in urban areas.

Environmental: Climate change and urban heat island effect

The increased DHF incidence has been associated to the increase in the amount of rainfall and to the increase in temperature. Due to Indonesia's closeness to the equator, it maintains a year-long vulnerability to dengue because of moderate to high susceptibility and consistently favourable exposure conditions such as urbanisation and loss of green space that increase ground temperature (Fullerton et al. 2014). Each city, region or province shows different seasonal peaks of transmission but archipelago-wide infection peaks from January to March. The impact of climate change on dengue incidence varies by location. Higher temperatures have been found to increase both the density of the *A. aegypti* population and life cycle while relative humidity affects the survival of the adult mosquito. Both high temperatures and high humidity also lead to an increase in biting rates and to shorter incubation time for viral transmission (Cromar and Cromar 2014, 170-172). The urban heat island effect can exacerbate problems in eradicating mosquito larvae breeding grounds. The increasing number of high-density buildings poses threats for public health, especially as the increase in temperature will also increase the number of mosquito breeding grounds. It has been observed in Indonesia that there are significant variations from the eastern to the central and to the western provinces as the average temperature in cities and districts also varies. Despite variation, the increased incidence of DHF has been associated to the increase in the amount of rainfall and to the increase in temperature in at least five provinces in Indonesia: West Sumatra, Jakarta, East Java, Timor, Bali and West Kalimantan. The Environmental Health Directorate of the Ministry of Health estimates that the increase of dengue incidence will continue along with the increase in community vulnerability to dengue, particularly with current projections of increased rainfall and temperature (Haryanto et al. 2014). As of 2 February 2015, four provinces have declared a KLB or outbreak status.[32]

Legal: Passive surveillance system and lack of evaluation

Indonesia's national dengue strategy adopted the 2009 WHO Dengue guidelines for diagnosis, treatment, prevention and control and coordinates with the WHO in the development of its national strategic plan for dengue. Indonesia also complies with the WHO global and bi-regional (SEARO/WPRO) dengue strategic plan for the Asia-Pacific region (2008-2015).[33] Despite Indonesia adopting international guidelines, the practice on the ground is still inadequate, not only because of the lack of health professionals or clinicians, but also because of unwillingness to go beyond reporting clinically diagnosed dengue cases as most doctors would prefer not to have cases confirmed in diagnostic laboratories. This and Indonesia's passive surveillance system leads not only to underestimation of reports and but also to deficiencies in virus and serotype surveillance (Karyanti et al. 2014, 412).

Government programmes however still need to be monitored and evaluated through the amount of funding for such programmes, the increase in the quality of health services and the increase in the number of beneficiaries. The *jumantik* programme for example is promoted by the national government for local government adaptation. However, the *jumantik* programme funding varies by province, city and district, depending highly on local government priorities. Such measures promoted by the national government are often utilised and implemented at the local level only during peak seasons or when the local government declares a KLB but strict observance would usually dissipate once the outbreak has died down.

32 Those four provinces, namely: 1) East Java Province as many as 18 districts / municipalities (Banyuwangi, Jombang, Kediri, Kediri City, Madiun, Madiun City, Mojokerto, Probolinggo, Sumenep, Trenggalek, Tulungagung, Lamongan, Magetan, Nganjuk, Ngawi, Pamekasan, Ponorogo and Situbondo); 2) South Kalimantan Province as much as 10 districts / municipalities (Hulu Sungai Selatan, Hulu Sungai Utara, Hulu Sungai Tengah, Balangan, Banjar, Banjar Baru, Tabalong, Tanah Bumbu, Tanah Laut dan Tapin); 3) Central Kalimantan Province (Kapuas District); and 4) Southeast Sulawesi Province (Wakatobi District). For more information: see: 'Nationally, Dengue Hemorrhagic Fever has not been into outbreaks categories,' Kementerian Kesehatan Republik Indonesia, http://www.depkes.go.id/article/view/15020600001/secara-nasional-dbd-belum-masuk-kategori-klb.html#sthash.GgXudbjp.dpuf, accessed 6 February 2015.

33 Interview with WHO official, Jakarta, 5 December 2014

Health Governance and Dengue in Malaysia

Cheah et al. (2014) argue that it is possible to identify all of the four serotypes of dengue (DENV 1, 2, 3 and 4) in Malaysia. This circulation of all serotypes implies that Malaysia suffers from dengue hyperendemicity. According to the WHO (2015) the cumulative number of dengue cases in Malaysia in 2015 is 58% greater at 18,351 than those reported in the country during the same period in 2014. In the past, different serotypes have dominated the country during different periods such as DEN 4 from 1967 – 1969 and DEN 3 from 2008 – 2009 (Cheah et. al, 2014). In 2013 in Malaysia, the incidence rate for dengue was 143.27 (per 100,000 population) and the mortality rate was zero (MOH Malaysia, 2015). For Dengue Haemorrhagic Fever (DHF), the incidence rate was 2.60 and the mortality rate was 0.31 (MOH Malaysia, 2015).

Box 2. Dengue/DHF in Malaysia	
Annual DHF incidence[a]	411/100,000 in 2000 to 4,031/100,000 in 2010
Dengue Virus Serotypes[b]	DENV-1 (most common in 2010-2011) DENV-2 DENV-3 DENV-4 (least common, less than 20% of serotypes)
Annual dengue economic and disease burden	US$103.4m per year

Sources: a/b. Mohd-Zaki et al 2014 c. Shepard et al 2013

Table 7 : States with the highest incidence rates, Case fatality rates and highest number of deaths from Dengue in Malaysia

	2011	2012	2013
States with the highest Incidence Rates	1. Selangor 2. WP Kuala Lumpur and Putrajaya 3. Pulau Pinang 4. Negeri Sembilan 5. Terengganu	1. Selangor 2. WP Kuala Lumpur and Putrajaya 3. Kelantan 4. Perlis 5. Perak	1. Selangor 2. Perlis 3. Melaka 4. WP KL and Putrajaya 5. Johor
States with the highest Case Fatality Rates	1. Sabah 2. Johor 3. Negeri Sembilan 4. Pulau Pinang 5. Terengganu	1. Perlis 2. Kedah 3. Nergeri Sembilan 4. Sabah 5. Perak	1. Sabah 2. Pulau Pinang 3. Melaka 4. Johor 5. Perlis
States with the highest number of deaths	1. Selangor 2. Johor 3. Penang/Negeri Sembilan 4. Perak/WP KL and Putrajaya/Sabah 5. Pahang/Terrenganu/Kelantan	1. Selangor 2. Perak/WP KL and Putrajaya 3. Kedah 4. Negeri Sembilan/ Sabah 5. Perlis/Penang/Johor/Pahang/Sarawak	1. Selangor 2. Kelanatan 3. Perak 4. WP KL and Putrajaya 5. Johor

Note: Rates for 2013 were calculated using data from the Department of Statistics, Malaysia. Sources: For 2011, 2012: Chong and Abbas 2013 For 2013: 'Situasi semasa demam denggi di Malaysia', MOH, accessed 9 March 2015, http://www.moh.gov.my/index.php/database_stores/store_view_page/17/621.

Table 8: Top 5 states in Malaysia, according to the number of dengue cases in 2014

State	Number of dengue cases in 2014
Selangor	54,290
Kelantan	14,456
Perak	7,525
WP KL and Putrajaya	7, 185
Johor	6, 323

Source: 'Situasi semasa demam denggi di Malaysia', Ministry of Health Malaysia, translated by Ms Nur Hazwani binti Mokzi, accessed 9 March 2015 http://www.moh.gov.my/index.php/database_stores/store_view_page/17/621

The following section outlines and discusses the findings from a SWOT analysis that looks into Malaysia's health governance in relation to dengue, in terms of political, economic, socio-demographic, technological, environmental and legal factors. This SWOT Analysis is based on desk research during the research period from September 2014 to March 2015 and on key informant interviews conducted in Kuala Lumpur, Malaysia from 11 February to 12 February 2015.

Strengths

Political: Government Programmes and Interventions

There is a national-level commitment displayed towards eradicating dengue, demonstrated in the form of a Dengue Task Force headed by the Deputy Prime Minister. The Dengue Task Force holistically approaches dengue prevention and control through its National Blue Ocean Strategy. As a part of this strategy, all ministries and agencies as well as NGOs like 1Malaysia for Youth (Im4u) meet bimonthly to discuss issues of critical importance, including health.[34] There are dengue monitoring mechanisms in place at the district, state and national levels. As a part of the strategic plan surveillance mechanisms have been developed, such as the following:

1. An online database system called eDengue: It contains information about the number of cases, lab test results such as IgM and NS1, prevention and control measures, vector indices, places of outbreak, health awareness programmes and dengue mapping using Geographical Information Systems (Chong and Abbas, 2013).

2. From a regional perspective, Malaysia is a founding member of UNITEDengue, an information sharing network for cross border dengue surveillance and knowledge on dengue control. Members include the health agencies and universities in Malaysia, Indonesia, Singapore, Thailand, Brunei, Sri Lanka and Pakistan. Members can access the UNITEDengue web portal, which includes the latest dengue incidence statistics, share data on virus surveillance and use the innovative new Lucid Key, developed by the Environmental Health Institute (Singapore) to identify aedes mosquito larva and adult aedes mosquitos (UNITEDengue, 2015).

The Ministry of Health (MOH) utilises Geographical Information System (GIS) to map disease patterns. MOH also strengthens epidemiological studies of diseases according to age, gender and ethnic groups.[35]

[34] Interview with NGO, Kuala Lumpur, 11 February 2015
[35] Interview with lecturer, Kuala Lumpur, 12 February 2015

The government promotes health education through dengue prevention and control community activities every two weeks to inculcate the "gotong royong" or community spirit and for the longer term the government organises COMBI groups.[36] Early notification about dengue outbreaks comes through both the public and private sectors including hospitals, KKs, clinics and general practitioners. According to Chong and Abbas (2013), the authorities investigate to confirm outbreaks when notified about suspected dengue cases in certain locations within 24 hours. Indoor and outdoor fogging is generally carried out every seven to ten days in dengue hotspots.

Economic: Health budget significant as percentage of GDP

MOH Malaysia (2014) was allocated USD 704,206,000 (8.39 per cent) of the national budget.[37] The average spending on dengue prevention and control measures per year is USD 15,888,900 (The Malaysian Insider, July 16, 2014). Chua and Cheah (2012) argue that the Malaysian healthcare system scores well as a percentage of GDP expenditure (5 percent), percentage of out-of-pocket health expenses (below 40 percent) and a public health system that is financed through taxes. In 2013, MOH Malaysia identified 139 hospitals and 9 special medical institutions in Malaysia. These hospitals have a total of 34,576 beds and the special medical institutions have a total of 5,152 beds. Further there are 1,039 health clinics (including maternal and child clinics in the country) and 1,821 community clinics or *klinik desa*. There are also 212 mobile health teams and 8 helicopters for the flying doctors service.

In 2002, Malaysia established an Epidemic Intelligence Programme (or EIP) to provide training to its in-service medical professionals. However, this has now evolved into an integrated field epidemiology training (FET) programme using world renowned experts and targeted towards publicly funded doctors. One of the most important programmes organised by the EIP is the 'EIP Gives Back' programme, through which the alumni provide training to district health officers as well as state epidemiologists. The programme includes managing outbreaks, surveillance and writing scientific reports (ASEAN Plus Three FETN, n.d.). In 2011, the Singapore field epidemiological training programme and the Malaysian EIP with the WHO organised a joint workshop to develop case studies on infectious disease outbreaks (TEPHINET, 2012).

In Malaysia, officials and staff at the district level manage community-based dengue prevention programmes. This includes disease control for communicable and vector-borne diseases, and the maintenance of hygiene and sanitation (WHO, 2012). The local authorities also have their unique programmes. The *Majlis Perbandarans* (local councils) of different states play an important role in bringing the residents and communities of different areas together in a spirit of '*Gotong Royong'* or cooperation in the community. For example, the Shah Alam City Council (MBSA) has an 'Advokasi Denggi' programme that organises routine monthly awareness drives.[38]In addition to government departments the University of Malaya is very active in dengue research in Malaysia. It founded the Tropical Infectious Diseases Research & Education Centre (TIDREC) in 2008 with a research emphasis on infectious diseases that can have a negative effect internationally (TIDREC, n.d.). TIDREC collaborates with the U.S. Naval Medical Research Unit 2 (NAMRU-2); Baylor College of Medicine, Houston, Texas; National Cheng Kung University, Taiwan; University of Texas at San Antonio, Texas; and ICRES, DengueTools participating institutions. The WHO Collaborating Centre for Arboviruses Reference & Research Malaysia is also under TIDREC and monitors dengue in the Klang valley hotspot. Technologically advanced methods such as ELISA, molecular typing using RT-PCR, quantitative real time RT-PCR and loop-mediated isothermal amplification (LAMP) are used (WHO, 2010). Other universities in Malaysia that research dengue include University Sains Malaysia (Vector Control Research Unit under the School of Biological Sciences), Universiti Kebangsaan Malaysia (departments on medical microbiology and immunology under the Faculty of Medicine), the Universitit Teknologi Mara (with an active Faculty of Medicine) and the UN University International Institute for Global Health in Kuala Lumpur.

Under Malaysia's MOH, the Institute for Health Systems Research (IHSR) is one of the six National Institutes for Health (NIH). It also functions as the National Secretariat for Quality Assurance Programme (QAP). The IHSR is also a WHO Collaborating Centre which investigates health finance and produces

[36] Interview with professor, Kuala Lumpur, 11 February 2015
[37] Figures have been converted to USD using the Oanda currency converter.
[38] Interview with lecturer, Kuala Lumpur, 12 February 2015

policy-relevant research. Another NIH under the MOH is the Institute for Medical Research (IMR), which includes a division of medical entomology and the WHO Collaborating Center for Ecology, Taxonomy and Control of Vectors of Malaria, Filariasis and Dengue specialising in technical knowledge. The WHO has collaborated with the Malaysian government on other fronts as well, such as knowledge management and early detection of dengue (WHO, 2010). It is through centres such as this that greater collaboration can be achieved at the regional level.

Legal: legislative framework for diseases

The Malaysian government has undertaken legal measures, which includes the Destruction of Disease Bearing Insects Act of 1975 (modified in 2000). Under this act, the deliberate breeding of mosquitoes is a punishable offence. There is also a Prevention and Control of Infectious Diseases Act (1988) in place. Schedule 1 of this act outlines 27 diseases that are obligated to be notified. Out of these diseases, nine of them must be reported within 24 hours by telephone (Chong and Abbas, 2013).

Weaknesses

This section discusses the weaknesses in Malaysia's dengue prevention and control efforts. The National Strategic Plan for Dengue 2009 to 2013 was on track until 2012, when the number of cases was almost half compared to 2009 (Chong and Abbas, 2013). However, since 2013 the number of dengue cases has increased, and today the plan shows no signs of reaching its target. There are several contributing factors for Malaysia not reaching its target.

Dengue control techniques such as fogging are not very effective in Malaysia because home owners do not allow the fogging distributors into their homes. As a result when fogging is carried out, mosquitos find refuge inside homes. Secondly, people are wary of inspectors who conduct mosquito checks as they are perceived to be there only to collect fines rather than prevent dengue. Thus, home owners are reluctant to let fogging distributors and inspectors into their homes. As a result, inspection methods are poorly implemented and lack regulatory oversight. Another reason for fogging's ineffectiveness is that it targets only adult mosquitoes. Source reduction is very important as trans-ovarial transmission of dengue virus can occur. One measure that has been discussed in Malaysia to improve the efficiency of fogging is to engage private companies in this work.

However, this measure has not been implemented due to concerns around cost cutting. Private companies may choose to dilute the composition of the chemicals required for fogging. However, this can have dangerous consequences as mosquitoes may develop a resistance to fogging due to the weakness of the chemicals.[39] The Communication for Behavioural Impact (COMBI) initiatives also face some capacity-related bottlenecks including the 'seek and destroy' public engagement initiatives. The instruction and awareness campaigns implemented by the local authorities for COMBI were not able to communicate their messages effectively, which highlighted the high turnover of volunteer staff and lack of innovative ways to engage the public.[40]

According to statistics from the MOH Malaysia (2014), as of 31 December, 2013 there are a total of 46,916 medical doctors in Malaysia. Out of these 28,949 are with the MOH, 6,270 are not with the MOH and 11,697 are private, which means that the ratio of doctors to people is 1: 633. Alongside doctors, there are a total of 89,167 nurses. Out of these 56,503 are from the MOH, 26, 653 are private nurses and 6,011 are non-MOH, which means that the ratio of nurses to population is 1:333. However, considering Malaysia's booming population and rapid globalisation these numbers and the health system's surge capacity need to be improved. Finally, waste management and recycling measures are not properly implemented.[41] In Kuala Lumpur, local authorities noted that contractors with weak credentials didn't collect rubbish frequently and drains were left clogged (The Sun Daily, March 18, 2015). In Penang, the auditor general noted that the amount of solid waste at landfill sites exceeded the limit, rubbish bins were too small for household waste,

[39] Interview with professor, Kuala Lumpur, 11 February 2015
[40] Interview with lecturer, Kuala Lumpur,12 February 2015
[41] Interview with professor, Kuala Lumpur, 11 February 2015

and there were unnecessary delays in responding to complaints (The Malay Mail, April 8, 2014). As a result, in these two locations conditions are conducive for dengue breeding.

Table 9: National Strategic Plan for Dengue, number of cases from 2009-2013

National Strategic Plan for Dengue 2009-2013	**Target**	**Number of cases per year**	
Implemented in April, 2009 Following aspects included under the plan: -Surveillance System - Integrated Vector Management - Dengue Case Management - Communication and Social Mobilisation - Dengue Outbreak Response - Dengue Research - Dengue Strategic Plan for Klang Valley	To reduce the number of cases by half over a period of five years	2009	41,486
		2010	46,171
		2011	19,884
		2012	21,900
		2013	43,346
		2014	108,698

Notes on sources: Number of cases per year from 2009-2012: Dr Rose Nani Mudin, 'Dengue update from Malaysia' (presentation at the early adopter countries for dengue vaccine meeting, Bangkok, 24 October 2013); Number of cases per year for 2013 and 2014: 'Situasi semasa demam denggi di Malaysia', accessed 9 March 2015, http://idengue.remotesensing.gov.my/idengue/page2.php?kandungan=content/statistik.pdf.

Environmental: rural-to-urban migration and natural habitat erosion

In Selangor and Kuala Lumpur an increase in the number of migrants has led to further overcrowding of urban spaces. As a result of greater urbanisation there has been an erosion of natural habitats and more co-habitation between mosquito vectors and humans highlighting the dominance of non-sustainable land-use strategies.[42] For example, Subang Jaya is an area with 80% urban development and 20% vegetation with a significant number of investment properties. Many dwellings are left vacant, unmaintained and unclean. It has become a dengue hotspot in Selangor, and is the most affected in Petaling district.[43] In response, biological control such as toxo mosquitoes which can eat the larvae of *Aedes aegypti* mosquitoes, have been tried in the region. However, toxo mosquitoes need areas with greater vegetation and so have only been effective in 20 percent of Subang Jaya. As a result, these factors have seen the geographical distribution of dengue in this area widen over the past five years.[44]

Legal: Limited scope of regulatory framework

At present, the greatest challenge to accurate and reliable data collection on dengue is that the private sector reporting system isn't robust enough as it lacks investigative tools and mechanisms. There is also an ongoing debate within the MOH of how to strengthen enforcement through the Private Health Care Facilities and Services Act of 1988 and develop greater public-private partnerships at the primary health-care level (WHO, 2010). The MOH believes that dengue prevention and control must be tackled from an integrated and multi-stakeholder environment. At the individual level, maintenance of personal, home and immediate vicinity sanitation and hygiene is of utmost importance. At the community level, it is important to

[42] Interview with lecturer, Kuala Lumpur, 12 February 2015
[43] Interview with lecturer, Kuala Lumpur, 12 February 2015
[44] Interview with lecturer, Kuala Lumpur, 12 February 2015

come together to ensure general neighbourhood cleanliness. The local authorities ensure rubbish collection on a timely and frequent basis, and that drains are not clogged. At the ministerial level, the MOH is the main actor which mandates surveillance, control and prevention actions. This is a part of the integrated vector management programme, outlined in the National Strategic Plan for dengue. However, other agencies have a role to play to ensure general cleanliness and to eliminate vector breeding sites in areas that are under their purview.

Opportunities

Political: Positive incentives and multi-sectoral public health interventions

At the political level, there is an opportunity to further deepen multi-sectoral partnerships. This can be done by analysing and learning from successful case studies of partnerships already in place in Malaysia. There are opportunities to improve public communication and to increase effectiveness of established programmes.

Public-People-Private (or PPP): Non-Governmental Organisations such as 1 Malaysia for Youth (iM4U) provide funding for community projects. iM4U has outreach centres and is linked to about 280 higher education institutions. University students, guided by iM4U, visited 14 dengue hotspot communities in Malaysia such as Lembah Pantai to investigate the challenges there. For example, they have conducted research about housing design and structure that might encourage mosquito breeding in different areas. These findings are then highlighted to the MOH, which has the power to raise them to the Cabinet and other relevant authorities to effect change. The NGO has also partnered with private sector companies such as the BASF, Shieldtox, Tiger Balm and Revive Isotonic. These companies often sponsor events with mosquito repellents, ointments and hydrating drinks to raise awareness of dengue at subsidised rates or free of charge in exchange for positive publicity and product placement.[45] In Costa Rica, the health ministry partnered with Geotecnologias to develop a mobile app., *Reporte Criaderos Dengue*, to enable them to crowd-source mosquito hatcheries. Users log on while at a suspected site and upload photographs and their details to be updated. This can improve the use of pesticides to target aedes mosquito breeding grounds (Griliopoulos, 2014) and contribute to Malaysia's dengue control and prevention strategy.

PPP partnerships come in different forms: In Pasir Tumboh in Kota Bahru, Kelantan 180 out of 400 residents had suffered from dengue. Mosquito breeding occurred as there weren't enough rubbish bins, rubbish collection was infrequent and the drains were clogged with waste such as Styrofoam cups. The village residents were not aware about the connection between their sanitary habits and dengue. Once MOH was informed, they donated large rubbish bins, and iM4U contacted the Ustad to raise awareness in the community about the link between hygiene and dengue, which he did at Friday prayers. Since these measures were taken, the number of dengue cases has dropped in this village.[46] This case study demonstrates that an effective communication strategy is to target audiences and identify key stakeholders to partner with to deliver the message. An example is the Pertubuhan IKRAM Malaysia (IKRAM), a non-profit in Malaysia, which runs kindergartens and pre-schools in the country. iM4U has contributed an interactive learning programme to educate young children about health, hygiene, sanitation and cleanliness.[47]

Deepen inter-ministerial collaborations: Introduce consultation meetings for officials from public health authorities and urban planning agencies to strengthen information sharing on challenges to dengue prevention between them and other relevant stakeholders.

Improve public sector communication with young people: There needs to be an overhaul in the way informative messages and awareness raising campaigns are designed and disseminated.[48] If young people are a target audience it is important to reach out to them through popular social media platforms. For example, iM4U uses infographics on their Facebook page to share the top ten symptoms of dengue, and

[45] Interview with NGO, Kuala Lumpur, 11 February 2015
[46] Interview with NGO, Kuala Lumpur, 11 February 2015
[47] Interview with NGO, Kuala Lumpur, 11 February 2015
[48] Interview with professor, Kuala Lumpur, 11 February 2015

provide daily reminders about times when mosquitoes are most active. iM4U partners with mainstream media, such as the Astro Awani channel and cable television. The NGO also has its own radio station that broadcasts public service announcements in the Klang valley, one of the biggest hotspots for dengue.[49]

Box 3. Opportunities for capacity improvement in Malaysia

- Encourage engagement with community or faith-based organisations to spread awareness regarding dengue prevention and control.
- Promote publication of literature on dengue-awareness in different languages to maximise reach to migrant workers.
- Stimulate improvements in communication methods used by house-inspectors through provision of training.
- Innovate new ways of incentivising doctors and medical professionals to work in rural areas.
- Advocate the use of 'mosquito-unfriendly' building design to prevent breeding of vectors

Economic: Potential activation of tourism sector

Malaysia's tourism hotspots receive a large number of visitors every year. Figures from Tourism Malaysia (2013) reveal that in 2013, Kuala Lumpur alone received 8.5 million foreign hotel guests. High incidences of dengue can adversely impact the economic benefits of a robust tourism industry. Thus, it is important to engage industries such as the hotel industry and the food and beverage industry to create opportunities for dengue prevention and control. Like similar initiatives taking place in tourism hotspots in Indonesia, the Malaysian Association of Hotels (MAH) and the Malaysian Food and Beverage Executives Association (MFBEA) in popular tourist destinations such as Kuala Lumpur, Langkawi, Penang, and Malacca could share SOPs on dengue prevention and control such as advising guests on mosquito-protection measures. The private sector can also be used as a platform to share best practices on dengue prevention and control.

Legal: Mosquito breeding fines or local taxes

There is an opportunity to strengthen case reporting from the private sector through better enforcement of legislation. Currently there is a low level of dengue reporting from the private sector (Mohd-Zaki et al., 2014). Under the Destruction of Disease Bearing Insects Act 1975 (2000 amendment) a company can be fined RM500 per day for not following a directive that identified their site as a breeding ground for Aedes mosquitos (Nazlina, 2014). However, NGOs recognise the 'bold and wise' policy but argue that the compound of RM500 will not compel developers and contractors. Instead they recommend that a minimum fine of RM1000 for commercial sites but households should be warned before a fine is imposed (Izham and Ng, 2014). At the state level, the Perak government has proposed levying fines on local councils whenever Aedes breeding grounds are identified in clogged drains and rubbish piles under their jurisdiction (Chan, 2014).

Threats

Environmental: Poor communication and weak inspection regime

During the 1940s and 1950s there was little linking urban planning and public health, and so there was a communication gap between public health officials and policy makers who often worked in institutional silos (Keiser and Utzinger, 2006); the effects of which are still felt today. Densely populated areas in cities contribute the most statistically to the total number of dengue cases because increased land-use leads to

[49] Interview with NGO, Kuala Lumpur, 11 February 2015

co-habitation of humans and vectors (Bakar and Lim, 2011). If construction sites are not inspected on a regular basis by the Construction Industry Development Board (CIDB) then they become prime breeding grounds for mosquitos, which can facilitate the spread of dengue (Borneo Post Online, February 10 2015). Alongside greater urbanization, climate change contributes to an increase in dengue incidence rates. There are cases in which modeling of climate suitability to dengue transmission has shown that Southeast Asia is at an increasing risk from dengue.[50] In a recent study in Selangor, Kuala Lumpur and Putrajaya, an increase in the minimum temperature and an increase in rainfall from 215mm to 302mm saw the number of dengue cases also increase by 4.75percent (Cheong et al., 2014).

Table 10: Change in urbanisation levels in Malaysia, Indonesia and Southeast Asia

Area	1950	1975	2000	2010	2020 (projected)	2030 (projected)
Malaysia	20.4	37.7	62.0	70.9	77.7	81.9
Indonesia	12.4	19.3	42.0	49.9	57.2	63.0
Southeast Asia	15.5	23.2	38.1	44.5	50.6	55.8

Source: United Nations, Department of Economic and Social Affairs, Population Division, *World Urbanization Prospects: The 2014 Revision*, "Annual Percentage of Population at Mid-Year residing in Urban Areas" data acquired via website, 2014.

Socio-Demographic: Accelerating the spread of dengue

One major socio-demographic threat with dengue in Malaysia is poverty. According to the Malaysia Human Development Report 2013 published by the UNDP, Malaysia suffers from acute income inequality and this has been consistent since 1990. The Employees Provident Fund of Malaysia revealed that 80 percent of Malaysian workers above the age of 55 do not have enough savings to enable them to live above the poverty line of RM800 a month (*The Malaysian Insider*, 2015). Urban poverty and rapid population growth have been cited as primary reasons for an increase in the number of dengue cases (*Astro Awani*, March 5, 2015). Although dengue incidence in Malaysia is not restricted to poorer areas, inhabitants of areas that are lacking in sanitation and hygiene are particularly vulnerable to the risk of contracting dengue.

Dengue is a critical health concern in Malaysia and necessitates a closer look at the preventive measures that can be employed by the Malaysian public themselves against this disease. A study conducted by Al-Dubai et al. (2013) on the factors affecting dengue fever knowledge, attitudes and practices in Malaysia revealed some interesting results. Out of the total number of participants (sampled from urban, semi-urban and rural settings), only 72 percent were aware that dengue could spread through mosquito bites, and 54.3 per cent of the participants believed that dengue was spread through mosquito bites only in the morning. When asked about treatment preferences, 63.3 percent of the participants cited paracetamol as the most suitable medication. These results reveal that a lack of dengue awareness is still prevalent, and can lower the effectiveness of current prevention and control measures in place.

The impact of dengue therefore does not only affect the poor, it also affects other socio-demographic groups like tourists and migrants. In 2014 there were 27.4 million tourist arrivals in Malaysia, a growth of 6.7 percent from 2013 (Tourism Malaysia, 2014). Tourists and other migrants are vehicles through which the different dengue serotypes can spread. For example, if a traveller's native country is home to the primary or secondary dengue vectors, *Aedes aegypti* or *Aedes albopictus* the traveller can carry the mosquito making the spread of dengue easier. As a result, dengue has now overtaken malaria as a more common febrile disease among people returning home from the ASEAN region. From 1996 to 2007 dengue was most often (51% of the time) imported into other places from the ASEAN region (Wilder-Smith, 2012).

Within Malaysia, the increased mobility of the population helped move dengue around the country and contributed to the severity of the 2014 outbreak. As many people work in dengue-prone areas like Selangor, when there was a surge in dengue cases in Kelantan from 17th August to 23rd August,

[50] Interview with lecturer, Kuala Lumpur, 12 February 2015

researchers attributed it partially to the workers who returned to their hometowns to celebrate Hari Raya (Fernandez, 2014). The movement of people is therefore an important catalyst to consider when designing a sustainable dengue response.

Capacity: Ineffective implementation and governance

Corruption is one of the major threats towards effective implementation of dengue prevention and control measures in Malaysia. As dengue prevention and control follows a holistic approach, with officials from different agencies working on different areas such as inspection, surveillance, collection of fines, cleanliness and maintenance in respective jurisdictions etc.; non-performance in any of these areas due to corruption can be very harmful for the ameliorative efforts as a whole. This is a major threat that needs to be addressed from structural as well as socio-cultural perspectives.

A second threat that can prove debilitating to the Malaysian healthcare system in times of outbreak is a weak level of surge capacity. According to the Agency for Healthcare Research and Quality of the U.S. State Department (2006) surge capacity can be defined as “a health care system’s ability to expand quickly beyond normal services to meet an increased demand for medical care”. Both physical and human resources are included as a part of surge capacity (National Association of Public Hospitals and Health Systems, 2007). In times of crisis, there is a burden on the already existing resources. This can prevent a large proportion of the public from accessing necessary medical services.

The increasing rates of urbanisation in Malaysia, and movements of people from rural to urban areas; lead to a situation where the urban healthcare infrastructure isn’t able to cope up with the influx. In terms of human resources, the possibility of healthcare professionals contracting diseases and being unable to perform their duties could worsen an already precarious situation (Malaysia Strategic Plan for Emerging Diseases: 2012-2015, n.d.). Hence, it is crucial that Malaysia prepare for future threats that may emerge as a result of low level surge capacity.

Policy Recommendations

This NTS Report assessed interventions to prevent and control dengue in Indonesia and Malaysia. From a broader perspective, regional arrangements can trigger the appropriate responses to emerging communicable diseases and their potential accelerated spread as a result of urbanisation, migration and climate change. The future prospects appear daunting with local health systems under constant strain and increased migration posing significant challenges. Existing dengue prevention and control mechanisms are necessary for a region that houses several transport and commercial hubs. Below are policy recommendations for the post-2015 ASEAN dengue strategy:

- **Reinforce established APSED and APT mechanisms to achieve IHR core capacities.** Some ASEAN Member States do not have the capacity to prevent and control dengue and other infectious diseases with pandemic-potential. ASEAN needs to utilise and reinforce the established APSED and APT mechanisms for risk communication, partnership laboratories, emerging infectious diseases, animal health and human health, and pandemic preparedness and response.

- **Integrate the UNITEDengue mechanism into the ASCC Blueprint.** UNITEDengue can serve as the main repository of surveillance data and as the information sharing hub to strengthen the regional dengue surveillance system as outlined in the ASCC Blueprint and support the ASEAN EID Mechanism.

- **Promote new diagnostic technology in dengue confirmation and infection.** Rapid diagnostics can alleviate discrepancies in laboratory confirmed dengue cases to address underreported cases critical for disease surveillance. Currently, such technology is under development by Malaysia and Singapore.

- **Promote more public-private partnerships in dengue vaccine development.** ASEAN member states can further advance public-private collaborations in vaccine development especially since dengue is hyperendemic in the region. Sharing virus samples for vaccine development can benefit governments, particularly regarding future dengue vaccine access. This should form part of the ASEAN-NDI and ASEAN Committee on Science and Technology long-term research and development strategy.

- **Expand the collaborative clinical research network of hospitals and research institutions to further strengthen regional clinical expertise on dengue.** SEAICRN and SEAMEO-TROPMED need to expand their network to include other ASEAN member countries, especially Cambodia, Myanmar, Laos and Vietnam. The network expansion would build capacity and stimulate innovation for a stronger regional support system to exchange expertise and share information.

- **Encourage climate data use to support early warning systems and dengue prevention and control policies.** Climate vulnerability mapping of dengue should be promoted since the main vectors, *Ae Aegypti* and *Ae albopictus* are climate sensitive and increased rainfall, temperature and humidity all contribute to vector breeding.

- **Promote dengue prevention and control as a component of corporate social responsibility especially in the tourism sector.** Governments should collaborate with the private sector, especially in the hotel, food and beverage industry and consumer goods manufacturing industries to raise awareness through dengue prevention and control campaigns.

- **Scale up efforts to biologically control dengue.** The Eliminate Dengue programme needs to be expanded beyond Indonesia and Vietnam to further assess the benefits from breeding sterilised or Wolbachia-infected mosquitoes. Continuous transparency in results monitoring from field trials in Yogyakarta would not only be beneficial for Indonesia but also for the region.

- **Advocate for a World Dengue Day.** A global awareness raising campaign about dengue is needed as it is now endemic in more than 100 countries. The globalised movement of people makes it critical that not only people from endemic countries are aware of the health risks but also people travelling between endemic and non-endemic countries. Such a campaign can be promoted by ASEAN which already observes an ASEAN Dengue Day every June 15.

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ANNEX

Actors and Stakeholders in Dengue Prevention and Control in Indonesia

Sector/Level	Prevention and Control	Surveillance and Vulnerability Mapping	Diagnosis and Case Management	Vaccine/Drug Development	Social Security
National Government Level	Ministry of Health Disease Control and Environmental Health Directorate Arbovirosis Control Subdirectorate Inter-Ministerial National Working Group on Dengue Haemorrhagic Fever (POKJANAL DBD) Public hospitals Port health offices and airport quarantines (49) Centre for Disease and Control Epidemiologist Entomologist Sanitarian/Medical Doctor/Public Health Official Ministry of Education Public schools	Ministry of Health Disease Control and Environmental Health Directorate Environmental Health Directorate National Institute of Health Research and Development (LITBANGKES) Vector and Reservoir Control Research Unit Serotype surveillance: sentinel surveillance stations Ministry of National Development Planning (BAPPENAS) Ministry of Health Agency for Meteorology Climatology and Geophysics (BMKG) Indonesia Climate Change Trust Fund (ICCTF)	Ministry of Health Public hospitals	Ministry of Research and Technology Eijkman Institute of Microbiology (virus surveillance/clinical trials) 9 Public Universities PT Bio Farma (Persero) PT Indofarma (Persero) National Institute for Health Research and Development National Agency for Assessment and Application of Technology (BPPT) Indonesian Institute of Sciences (LIPI)	National Health Insurance Program or BJPSa National Health Insurance Program for Poor Households (JAMKESMAS)
Provincial/ District/ Local Government Levels	Provincial, District and Village Level POKJANAL DBDs PSN or *jumantik* PUSKESMAS (primary health centres)	Provincial, district and village level health departments	Initial diagnosis and case referral: Primary Health Centres PUSKESMAS (9719 across the archipelagob)		Local Government Funded Insurance (JAMKESDA)Jakarta: Free third-class inpatient care for dengue patients at designated hospitals
Non-government organisations	Private hospitals Muhammadiyah (awareness raising) SITKES Aisyiyah Yogyakarta Muhammadiyah University of Yogyakarta	Rockefeller Foundation through the ACCCRN project on health information systems and health early warning system in Semarang	Muhammadiyah hospitals and health care facilities		Indonesian Midwives Association (IMA) Bidan Delima and ACA Insurance: Dengue Fever Insurance
Private Sector	Pikoli Cares Foundation: Project Zero: telecom companies (Indosat, Telkomsel), mass media companies (Rajawali Citra Televisi Peduli) etc. Tahija Foundation: Eliminate Dengue Project		Private hospitals Private clinics	Sanofi Pasteur HDI Group of Companies: clinical trials for propolis honey-based treatment for dengue	

Notes:
a. 'Faskes Tingkat Pertama Tangani 144 Penyakit Hapus 'Puskesmas Raksasa,' INFOBPJS Kesehatan, Edisi XI Tahun 2014, p.7, http://bpjs-kesehatan.go.id/bpjs/dmdocuments/1c406147f4e869a66664f9d021e17fb4.pdf, accessed 27 January 2015.
b. There are about 1,050 in West Java, 960 in East Java, 875 in Central Java.

Actors and Stakeholders in Dengue Prevention and Control in Malaysia

Sector/Level	***Prevention and Control***	***Surveillance and Vulnerability Mapping***	***Diagnosis and Case Management***	***Vaccine/Drug Development***	***Social Security***

National Government Level	Ministry of Health
	• Disease Control Division
	  • Environment Health Unit
	• Dengue Task Force headed by the Deputy Prime Minister of Malaysia
	• Public hospitals
	  • Doctors/Nurses
	  • Housemen/medical officers
	
	Ministry of Education
	• Public schools
	• Dengue Control Programme, organised in collaboration with the MOH
		Ministry of Health
		• National Institute of Health Secretariat
		
		- Institute for Medical Research: Division of Medical Entomology
		- Institute for Health Systems Research (IHSR)
		- Clinical Research Centres (CRCs)
			Ministry of Health
			• Public hospitals
				Ministry of Health
				• Conducting clinical tests for a dengue vaccine
					Under the national Malaysian healthcare system, primary care through the system of public hospitals and clinics is to all Malaysian citizens is heavily subsidised

Provincial/ District/ Local Government Levels	• State level Vector Borne Disease Control Unit • State and district level health officers • Local Councils or Majlis Perbandarans • Health Clinics • Community clinics or *klinik desa*	• Reporting and notification of dengue cases by district and community level health-clinics	• Diagnostics done by clinicians at district level health offices		Community health clinics in rural areas provide treatment services almost free of charge
Non-government organisations	• iM4U (Collaborator with people, public sector and private sector) • Malaysian Integrated Medical Professionals Association (MIMPA) • IKRAM- teaches dengue awareness, prevention and control methods in primary schools				Through People-Public-Private partnerships, NGOs help highlight the health problems of people from lower socio-economic backgrounds to the concerned authorities, thus facilitating their access to social security.
Private Sector	• iM4U partnered with private sector companies such as the BASF, Shieldtox, Tiger Balm and Revive Isotonic . • They provided mosquito repellents, ointments and hydrating drinks at subsidised rates or free of charge in exchange for positive publicity and branding.		• Private hospitals • Private clinics	• Sanofi Pasteur	