A Health Emergency Risk Profile of the South-East Asia Region

Trees, a symbol of resilience

The book uses the tree of life, which is an archetypal symbol in many spiritual traditions, as a metaphor for the WHO South-East Asia Region. The tree as a symbol is used to illustrate the interconnected nature of the environment and its various components. It conveys notions of growth, vitality, and continuity, highlighting the need to nurture and care for the tree of life. The book emphasizes the resilience of the tree, which can survive through wars, pandemics, and disasters, continuing to grow and bear fruit.

The oak tree used on the cover is known for its strength and resilience. Different tree motifs are used as separators. The pine tree is rooted in high altitudes but can survive in extreme climates, symbolizing adaptability and sustainability. The mangrove tree can resist floods, and bamboo does not break easily with strong winds. The use of these motifs serves as a reminder of the need to strengthen the roots of the tree, symbolizing health systems, workforce, infrastructure, and capacities for health emergency risk management.

This book provides a well-researched, documented, and illustrated analysis of risks, threats, vulnerabilities, and coping capacities in the event of disasters, epidemics, and other calamities in the countries of the WHO South-East Asia Region.

These risks are then analyzed through the lens of health status and capacity for emergency management across several hazards. The book aims to draw up action points and recommendations to enhance the resilience of the region, making it stronger and more prepared for future challenges.
Roots for Resilience

A Health Emergency Risk Profile of the South-East Asia Region

World Health Organization
Regional Office for South-East Asia
Roots for resilience: a health emergency risk profile of the South-East Asia Region
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## Abbreviations

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<td>AADMER</td>
<td>ASEAN agreement on disaster management and emergency response</td>
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<td>AAR</td>
<td>after action review</td>
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<td>ACAPS</td>
<td>assessment capacities project</td>
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<td>AMR</td>
<td>antimicrobial resistance</td>
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<td>AMU</td>
<td>antimicrobial usage</td>
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<tr>
<td>APDIM</td>
<td>Asian and Pacific Centre for the Development of Disaster Information Management</td>
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<td>APEC</td>
<td>Asia Pacific Economic Cooperation</td>
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<td>APSED</td>
<td>Asia Pacific Strategy for Emerging Diseases</td>
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<td>ARIs</td>
<td>acute respiratory infections</td>
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<tr>
<td>ASEAN</td>
<td>Association of South-East Asian Nations</td>
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<td>BIMSTEC</td>
<td>Bay of Bengal Initiative for Multisectoral Technical and Economic Cooperation</td>
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<tr>
<td>CCHF</td>
<td>Crimean-Congo haemorrhagic fever</td>
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<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
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<tr>
<td>CDERA</td>
<td>Caribbean Disaster Emergency Response Agency</td>
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<tr>
<td>CRED</td>
<td>Centre for Research on the Epidemiology of Disasters</td>
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<td>CZS</td>
<td>Congenital Zika syndrome</td>
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<tr>
<td>DAISY</td>
<td>Disease attribute intelligence system</td>
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<td>DALYs</td>
<td>disability-adjusted life years</td>
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<td>DENV</td>
<td>Dengue virus</td>
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<td>DFID</td>
<td>Department for International Development</td>
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<td>DHF</td>
<td>Dengue haemorrhagic fever</td>
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<tr>
<td>DPRK</td>
<td>Democratic People's Republic of Korea</td>
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<td>DRR</td>
<td>disaster risk reduction</td>
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<td>EAS</td>
<td>East Asia Summit</td>
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<td>ECHO</td>
<td>European Civil Protection and Humanitarian Aid Operations</td>
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<td>ECO</td>
<td>Economic Cooperation Organization</td>
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<td>EIDs</td>
<td>emerging infectious diseases</td>
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<tr>
<td>ECTAD</td>
<td>Emergency Centre for Transboundary Animal Diseases</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>EM–DAT</td>
<td>The emergency events database</td>
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<td>EMPRES</td>
<td>Emergency prevention system</td>
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<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<td>GAR</td>
<td>Global assessment report</td>
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<td>GBD</td>
<td>Global burden of disease</td>
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<td>GDP</td>
<td>Gross domestic product</td>
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<td>GHSA</td>
<td>Global health security agenda</td>
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<td>GIS</td>
<td>Geographic information system</td>
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<td>GLOF</td>
<td>Glacial lake outburst flood</td>
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<td>GMS</td>
<td>Greater Mekong sub region</td>
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<td>GOARN</td>
<td>Global outbreak alert and response network</td>
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<td>HFA</td>
<td>Hyogo framework for action</td>
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<td>H5N1</td>
<td>Avian Influenza A</td>
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<td>IASC</td>
<td>Inter-agency standing committee</td>
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<td>IDSP</td>
<td>Integrated disease surveillance programme</td>
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<td>IGOs</td>
<td>Inter-governmental regional organizations</td>
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<td>IHR</td>
<td>International Health Regulations</td>
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<td>IPC</td>
<td>Infection prevention and control</td>
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<td>JE</td>
<td>Japanese encephalitis</td>
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<td>JEE</td>
<td>Joint external evaluation</td>
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<td>LDI</td>
<td>Livestock density index</td>
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<td>LSUs</td>
<td>Livestock units</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and evaluation</td>
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<td>MERS</td>
<td>Middle East respiratory syndrome</td>
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<td>NCDs</td>
<td>Noncommunicable diseases</td>
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<td>NDM-1</td>
<td>New Delhi Metallo-beta-lactamase-1</td>
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<td>NTDs</td>
<td>Neglected tropical diseases</td>
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<td>OCHA</td>
<td>Office for the Coordination of Human Affairs</td>
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<td>PCA</td>
<td>Principal component analysis</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>PDNA</td>
<td>post disaster needs assessment</td>
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<td>PHEIC</td>
<td>public health emergency of international concern</td>
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<tr>
<td>PoC</td>
<td>proof of concept</td>
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<td>PPP</td>
<td>public private partnership</td>
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<tr>
<td>SAARC</td>
<td>South Asian Association for Regional Cooperation</td>
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<td>SAFTA</td>
<td>South Asian free trade area</td>
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<td>SARI</td>
<td>severe acute respiratory infection</td>
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<tr>
<td>SARS</td>
<td>severe acute respiratory syndrome</td>
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<td>SDGs</td>
<td>sustainable development goals</td>
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<td>SEA</td>
<td>South-East Asia</td>
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<td>SEAR</td>
<td>South-East Asian Region</td>
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<td>SEARHEF</td>
<td>South-East Asia Regional Health Emergency Fund</td>
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<td>SEARO</td>
<td>South-East Asia Regional Office</td>
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<td>SFDRR</td>
<td>Sendai framework for disaster risk reduction</td>
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<td>UHC</td>
<td>Universal Health Coverage</td>
</tr>
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<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>UNECAFE</td>
<td>United Nations Economic Commission for Asia and the Far East</td>
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<td>UNESCAP</td>
<td>United Nations Economic and Social Commission for Asia and the Pacific</td>
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<tr>
<td>UNICEF</td>
<td>United Nations Children's Fund</td>
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<td>UNISDR</td>
<td>United Nations International Strategy for Disaster Reduction</td>
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<tr>
<td>VHF</td>
<td>viral haemorrhagic fever</td>
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<td>VBDs</td>
<td>vector-borne diseases</td>
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<td>WAHIS</td>
<td>World Animal Health Information System</td>
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<tr>
<td>WHE</td>
<td>WHO's health emergencies programme</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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<tr>
<td>WPRO</td>
<td>WHO Western Pacific Region</td>
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<td>ZVD</td>
<td>Zika virus disease</td>
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Preface

The WHO South-East Asia Region is often referred to as “vulnerable”, “prone” and “high-risk” for certain events whether they are earthquakes, cyclones, epidemics or social conflict. And indeed, the Region has experienced its fair share of disasters and epidemics. However, quantification of this risk using existing information and databases, including past events and future trends, has not been undertaken. This publication brings together information from several sources, and seeks to provide a comprehensive analysis. It also brings a focus on explaining the inter-relationship of the terms vulnerability, hazards and capacities to quantify risk. More specifically, the publication attempts to put the perspective of health – health systems capacities and risks to health – to each event caused by these hazards.

The aims of the publication are three-fold. It provides a solid base for quantifying risks by defining methodologies with existing tools and data sets. These risks, across several hazards, are then analysed through the lens of health status and capacities. Lastly, it aims to draw action points and recommendations to address these risks in the immediate, medium or long term.

This publication provides a combination of innovative approaches, including:

- Tapping on the global knowledge base and existing information systems. These include:
  - Use of the INFORM Index for risk, vulnerability and capacities are applied to understand the risk profile of the Region.
  - Application of the UHC Index to assess the health profile vis-à-vis risks.
  - Application of a methodology to examine biological/infectious risks through specific syndromes as well as the way in which emerging diseases or certain priority pathogens may manifest.

- Linking existing initiatives that assess vulnerabilities, capacities and risk assessments. These are the Monitoring and Evaluation Framework for IHR and emergency preparedness using the SEA Region Benchmarks that the Member States of the Region have conducted for a decade. Moreover, the recent momentum on health security with various global and regional initiatives has also been incorporated in the narrative and analysis.

- Providing direct calls to action to readers. The main audience of this book – policy-makers and programme managers – is provided suggested paths for action using information in the book.

In this publication, it is demonstrated that for most countries managing noncommunicable diseases and ensuring access to services is a central part of their preparedness and response. The UHC indices show that in most countries these require further investment and attention. Whether it is in the aftermath of a cyclone, an earthquake or in the midst of floods, these are two health system issues that will be of paramount importance.
With regard to possible epidemics, preparedness prioritization can be analysed in terms of syndromes vis-à-vis priority diseases. Here we see the Region is vulnerable to epidemics of various etiologies owing to the homogeneity of endemic disease, vectors and capacities related to the International Health Regulations (IHR) 2005.

Generating knowledge and evidence without commensurate action is irresponsible public health practice. The book takes a step beyond by providing several specific recommendations for countries to take forward and conduct risk analysis at the subnational levels. By doing so, there is a clearer picture of where work for risk reduction and preparedness can be prioritized in a more stratified manner – whether by area or population. Preparedness and risk reduction plans can then be more targeted to the most vulnerable. Understanding and managing risks, especially at the local level, are priority aims of the Sendai Framework. It is also a means to the end of achieving the overarching Sustainable Development Goal that “no one is left behind”. Policy formulation, reinvestment in preparedness and risk reduction can also follow as per findings per country.

The longer term end goal of the publication is to use the information for action towards resilience. Correct information and knowledge are the bases for proper and prompt action. Without appropriate risk profiles and analyses, our actions for resilience may be less effective, miss the target, or remain inefficient. Indeed this publication provides the roots for and the routes towards resilience.

To illustrate this message, the book uses the tree of life as a symbol. The tree of life is an archetypal central theme across all cultures including in this Region. It represents the cycle of destruction and creation; of birth and death; and of care and neglect. The tree of life also symbolizes knowledge, enlightenment and achievement. This is appropriate in the context of the book as:

- it pertains to the cycle of disasters resulting in recovery,
- it pertains to destruction resulting in opportunities for rebuilding,
- it pertains to knowledge resulting in good action.

To put it plainly, the tree is a symbol of resilience – with its well-entrenched and nourished roots, it can survive wars, pandemics and catastrophes and continue to grow, shoot new leaves, and bear fruit.

In all countries living with multiple risks, the knowledge this publication provides can bolster existing efforts at their root and help multiply them for more action in the future – for communities that are healthy and resilient.

Dr. Poonam Khetrapal Singh
Regional Director, WHO South-East Asia Region
Context and background for a systematic risk assessment for the Region
Towards better preparedness: looking anew at disasters, emergencies and outbreaks

The South-East Asia Region of WHO is vulnerable to different types of emergencies and disasters. Most countries of the Region are low- or low–middle-income countries, with several competing priorities in the overall area of development and growth. The health sector in general remains underfunded, particularly the public health-care system. In addition to the changing epidemiological and disease profile (double burden of infectious and noncommunicable diseases), there are challenges in integrating the health sector’s emergency preparedness with the overall national disaster preparedness and response agencies and plans. The concept of investment and management across the different phases of the emergency/disaster (prevention, mitigation, preparedness, response and early recovery) is yet to capture the imagination of policy-makers.

The idea of disaster risk management (and not just disaster management), adopted by the Sendai Framework in 2015, is still new. The “all-hazards” approach (natural, chemical, biological, radionuclear, humanitarian conflicts, etc.) to risk management is yet to be institutionalized in most countries of the Region. In addition, the majority of these countries do not have adequate health systems and human resources to progress towards universal health coverage, a key pillar and means of achievement of Sustainable Development Goal 3. Emergency risk management needs coordinated action across local, national, regional and international levels.

There is consensus now on the need to improve the resilience of new and existing critical infrastructure, including hospitals, to ensure that they remain safe, effective and operational during and after disasters, to provide life-saving and essential services; establish a mechanism of case registry and database of mortality caused by disasters to improve the prevention of morbidity and mortality; and enhance recovery schemes to provide mental health and psychosocial support services for all people in need. WHO’s primary objective in an emergency and with all health authorities, is to reduce avoidable loss of life and the burden of disease and disability. To achieve that goal, it is pertinent to look anew at the hazards, risks and capacities in a way that is comprehensive and not in separate silos. This approach will lead to a clearer strategy in terms of risk reduction, preparedness and investments in such capacities.

This publication, developed by the WHO Health Emergencies Programme of the South-East Asia Regional Office, is a step in this direction. This section provides an overview of the scenario, the efforts that have been made so far and how the Region needs a systematic risk assessment before it can sharpen its response on the ground.
Throughout history and till as recently as 2017, untoward events, calamities, epidemics and disasters have continued to take a heavy toll on mankind across the world. Despite advancements in preparedness and mitigation, there have been no guarantees to assure the safety and well-being of people, their property and livelihood, from such calamities. Whether it is large-scale weather events caused by climate change or displacement due to emergencies, some of which may have even surpassed the Second World War in scale and magnitude, the future certainly does not look very promising. Without doubt, almost all events contribute to accentuating poverty and, on the flip side, poverty also becomes a determinant of the individual’s and/or community’s vulnerability. In a developing country scenario where density of population is higher and infrastructure gaps more glaring, the severity of any calamity is graver.

While there are many definitions of disasters, for the purpose of this book the most apt would be the one cited by the World Health Organization (WHO) that defines a disaster as, “a sudden ecological phenomenon of sufficient magnitude to require external assistance”. At the community level, this can be defined operationally as any “community emergency that seriously affects people’s lives and property and exceeds the capacity of the community to respond effectively to that emergency”. Looking at the nature, scale and magnitude of disasters, one has to view this in the perspective of a range of hazards: an epidemic that cannot be fully comprehended and contained by the individual and community such as the outbreak of the Ebola virus disease and, on the other end of the spectrum, natural disasters such as the Tsunami of 2004 which swept large coastal areas of South Asia with wide-ranging consequences. Between these two examples lie a range of natural, human and biological disasters, which would be taken up in this book, especially with respect to the highly vulnerable, at-risk and hazardous scenarios that exist in the countries that go into making the WHO South-East Asia (SEA) Region.1

**Beyond statistics: an inextricable connect between hazards and health**

Hazards are unwarranted and undesirable at all times and inescapable often enough. Indeed, hazards, whether natural (earthquakes, landslides, tsunamis, cyclones, floods or droughts), biological (epidemic diseases, infestations of pests), technological (chemical substance, radiological agents, transport crashes) or societal (conflicts, stampedes, acts of terrorism), end up placing the health of populations at risk. Not just people, they also have the potential to cause even greater harms to public health.

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1 The South-East Asia Region of the WHO is among the most densely populated regions of the world. It comprises 11 countries: Bangladesh, Bhutan, Democratic People’s Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste.
Figure 1.1: Deconstructing disasters

Natural

Geophysical
- Earthquake
- Volcano
- Landslide
- Tsunami

Climatological
- Forest fire

Meteorological
- Cyclone

Biological
- Viruses
- Pandemic diseases
- Epidemic diseases

Hydrological
- Flood

Complex Emergencies

Conflicts

Food Insecurity

Industrial Mishaps

Technological

Chemical spills and radio-nuclear accidents

Transport Accidents

Displaced Population
The severe acute respiratory syndrome (SARS) outbreak of 2002–2003 killed 774 among the 8,098 people infected from 37 countries, with the majority of cases being in Hong Kong (9.6% fatality rate). It was the first new disease that highlighted the damage possible in a globalized world and made people sit up and take notice of the threat of infectious diseases that loomed large over the horizon. It also exposed how vulnerabilities of countries increased even as the world became more closely interconnected, borders shrunk and communications improved (WHO 2003).

The avian influenza A (H5N1) virus epidemic of 2003–2004 re-emerged after the first report of infection in humans in 1997 during a poultry outbreak in Hong Kong, later spreading to the People’s Republic of China and parts of Asia, Europe and Africa. It seriously impacted livelihoods, food security, economy and international trade. From among the 15 countries that reported human cases of A (H5N1), Bangladesh, Myanmar, Indonesia and Thailand were from the South-East Asia Region. During this period, 181 fatalities were reported from this Region. To control circulation of H5N1 virus in poultry, risk of human infection had to be reduced. As H5N1 virus continued to circulate in some poultry populations, its control required long-term commitments from Member States and strong coordination between animal and public health authorities.

The November 2007, Supercyclone Sidr which was triggered by climate change had direct health effects through various vector and waterborne diseases, but arguably more important indirect effects as well. Signs of deterioration were seen in the general and mental health of populations in affected areas. There was an increase in diarrhoea, skin diseases, hepatitis (jaundice) and other infectious diseases. The May 2009, Cyclone Alia that hit the Sunderbans was also attributed to climate change, pollution and shortsighted development. It left 190 people dead and 3.8 million affected in India and Bangladesh. Over 240,000 houses were decimated and 370,000 partially destroyed. Apart from the loss that was quantified, there remained much that could not be fully assessed and measured.

The April 2015 earthquake in Nepal practically crippled the Nepalese economy and set back whatever gains that had been made in infrastructure development of the last many years. According to the Nepal Government, overall damage was estimated at about US$ 10 billion, which is nearly half of the nation’s gross domestic product (GDP) of US$19.2 billion. Estimated costs for rebuilding homes, roads and bridges were calculated at US$ 5 billion. The health-care sector was severely affected with 462 health facilities – that included hospitals, primary health centres and health posts – completely destroyed. Unfortunately, around 84% of these were in the 14 most severely affected districts causing even greater hardship to families affected by the quake. The estimated value of damages and losses was to the tune of US$ 7 billion.

The December 2004 Tsunami claimed over 250,000 lives across 14 nations. The flood waters and displacement and destruction of water supply systems and sanitation created havoc with the lives of millions. From acute malnutrition and micronutrient deficiencies to increased incidence of communicable diseases (waterborne, vector-borne, airborne and dust-related disease), there were also diseases such as salmonellosis, typhoid, cholera, hepatitis and shigellosis, particularly in the temporary camps that lacked the sanitation needed to accommodate increasing numbers of displaced people. Measles and acute respiratory infections also resulted in high mortality amongst disaster survivors.
Disasters have an effect on nearly all aspects of human life. Even the least severe of disasters have the potential to damage infrastructure and physical assets, disrupt access to goods and services and slow down governance and decision-making processes. A disaster can also curtail the ability of the people to exercise their citizenship – limiting their movement in a containment effort or within the confines of a camp. More importantly, it may slow down priority development policy objectives and increase risks and vulnerabilities. While some of these are quantifiable, given the many new scientific and technological tools in use today, there remain certain areas that are difficult to map and quantify.

In estimating the economic value of a disaster, one has to go beyond the immediate set of losses that arise from the disaster and which continue until the achievement of full economic recovery and reconstruction, which could last for several years. Typical losses include decline in output in practically all productive sectors of human endeavour such as agriculture, livestock, fisheries, industry, commerce and services, especially travel and tourism. Drop in demand and disposable incomes pushes up prices of essential services, education, health, water and sanitation, electricity, transport and communications. An increased expenditure for the management of new risks arising from the disaster and increased fiscal expenditures, all play their part in adding to the suffering of those already aggrieved.

Each of the disasters mentioned above affected the local populations and landmass differently. Given the different social, economic and health situations, the disaster management efforts mounted for each of them, first aimed to assess the needs of disaster-affected populations before allocating resources to manage them. Proper planning and execution of medical response programmes, therefore, requires knowledge of the types of disasters that might occur, the morbidity and mortality that might result and the consequent medical care and public health services that are likely to be needed. This will help evaluate the effectiveness of any relief programme and help plan for future disasters.

**Measuring capacities to refine emergency risk management efforts**

Prompt action in the wake of a disaster is possible only with good levels of preparedness. A country is said to be in a state of preparedness if it has the ability to quickly and appropriately respond when required. Preparedness levels would be deemed satisfactory if the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals help them effectively to anticipate, respond to and recover from,
the impacts of likely, imminent and/or current hazard events or conditions. Preparedness then is based on a sound analysis of disaster risks and good linkages with early warning systems and includes contingency planning, stockpiling of equipment and supplies, development of arrangements for coordination, evacuation and public information and associated training and field exercises duly supported by formal institutional, legal and budgetary capacities.

Capacity assessments must form part of the social and governance processes before restoring and providing access to basic services. A good understanding of capacities is also critical for developing a plan to enhance the capacity of a country or sector to recover from disaster and advance its development goals. A good capacity assessment for recovery will help plan institution-building and reform and simultaneously create an enabling environment for service delivery.

The increasing frequency of disaster events in recent times has put pressure on governments and organizations to improve post-disaster reconstruction and recovery efforts. The slogan “Build Back Better (BBB)” was coined specially to emphasize the need to improve the physical, psychosocial and economic aspects of communities in the post-disaster period of reconstruction and recovery.

The post disaster needs assessment (PDNA), a key commitment articulated in the joint agreement on post crisis cooperation signed between the European Union, the World Bank and the United Nations Development Group, is an inclusive, government-led and government-owned process. Following a people-centred human recovery approach, it analyses disaster effects and disaster impact for the purpose of identifying recovery needs, defined from a human, sociocultural, economic and environmental perspective.

The reconstruction and recovery effort post the Gujarat earthquake of January 2001 is today recognized as a good example where post-disaster recovery efforts were well planned and executed. The earthquake of seven magnitude resulted in entire cities getting flattened, over 8 000 villages wrecked, 20 000 people killed and a million others rendered homeless. But the State rose, literally from the rubble and created the “rebirth” of cities including Bhuj. What was a departure from the norm was that aid and government grants were put to good use and efforts of multiple agencies consolidated. The Government of Gujarat’s programme for reconstruction and rehabilitation through the Gujarat Disaster Management Authority looked at housing, physical and social infrastructure, urban reconstruction, livelihood restoration, social rehabilitation,
community participation and long-term disaster management. Homes were rebuilt using earthquake resistant technology, the local economy was revived and more sustainable incomes regenerated with sops for agriculture, industries, small businesses and handicrafts. A Health Action Plan for preparedness was initiated by the Department of Health and basic health facilities provided on a long-term basis to those impacted by the quake.

As part of preparedness, simulation exercises, contingency plans, identification of agencies for contact and communication and a plan of action for procuring medicine and sourcing of suppliers and equipment in an emergency were taken up at the district and subdistrict levels. Also, emergency response centres were set up and their capacities built. To gather evidence, several disaster mitigation studies were commissioned and research undertaken on disaster risk and vulnerability, seismic microzonation, building codes, early warning and damage/loss methodologies.

The International Health Regulations (IHR, 2005) are designed to assess country capacities to prevent, detect and rapidly respond to public health threats, independent of whether they are naturally occurring, deliberate or accidental. The Review Committee on Second Extensions for Establishing National Public Health Capacities and IHR Implementation in 2014 recommended moving from exclusive self-evaluation to approaches that combine self-evaluation, peer review and voluntary external evaluation. The proposed new IHR Monitoring and Evaluation Framework has four components:

1. State Parties Annual Reporting that has replaced the self-evaluation questionnaire which was reported by Member States yearly.

2. Qualitative after action review (AAR) of actions taken to respond to an emergency as a means of identifying best practices, gaps and lessons learned.

3. Simulation exercise which uses practice, training, monitoring or evaluation of capabilities involving the description or simulation of an emergency, to which a described or simulated response is made.

4. Joint External Evaluation Tool, which is an external evaluation process that measures country-specific status and progress in achieving targets. It allows countries to identify most urgent needs within their health security system, prioritize opportunities for enhanced preparedness, response and action and engage with donors and partners to target resources effectively.
Better preparedness with better understanding of risks

Emergency situations in recent times have shown how they have cut across international borders with long-lasting social, economic and development impacts, particularly when the complex interplay of factors which determine risk get undermined. Estimating hazards, vulnerabilities, risks and capacities is the only way to pre-empt some of the natural and human-induced disasters. In this context, disasters are often described as a result of a combination of the exposure to a hazard, conditions of vulnerability that are present and insufficient capacity or measures to reduce or cope with potential negative consequences. The terms, “hazards”, “vulnerabilities”, “capacities” and “risks” are keywords when it comes to determining and assessing lesser known aspects of disasters. Hazards cover the entire spectrum of biological, geological, hydro-meteorological, natural, socionatural and/or technological events.

According to the standard definitions developed by the United Nations International Strategy for Disaster Reduction (UNISDR), hazards cause serious disruption in the functioning of a community or society involving widespread human, material, economic and/or environmental losses and impacts. Often, these impacts exceed the ability of the affected community or society to cope using its own resources. This gap in the impact and coping mechanism of the affected persons exacerbates their exposure and vulnerability to risks. The risks by themselves result from a combination of hazards and vulnerabilities. Both risks and vulnerabilities are associated more strongly with poverty and the inability of communities to deal with it, largely due to capacity issues. These capacities could be a combination of all strengths, attributes and resources that are available within the community, society or organization to manage and reduce the risks, while simultaneously strengthening their resilience to withstand the onslaught of the disasters and hazards that they may have to encounter.

Major shift in approach: investing more in preparedness and risk reduction than response

Large-scale events in the Region in the last decade, combined with global frameworks and action plans, have brought about a major shift in the way we perceive, manage and prepare for disasters. The 2003 SARS outbreak had significant economic repercussions in the Region. It triggered a revision of the IHR, incorporating key paradigm shifts in the overall approach to dealing with communicable diseases. These included moving away from efforts to control borders and

A disaster occurs when a hazard has an impact on vulnerable people. It is the lethal combination of hazard, vulnerability and inability to reduce the potential negative consequences of risks that results in disaster. In the form of an equation this translates as Risk = Hazard x Vulnerability/Capacity.

The equation clearly brings out the tenacious link between capacity and risk and vulnerability. Both are deeply intertwined. As capacity increases, vulnerability decreases and conversely with poor capacity, consequences of loss to mankind are grave and sometimes unquantifiable.
towards containment efforts at source; from a prescribed set of diseases towards an emphasis on all public health threats; and from the use of preset measures towards the use of adapted responses. Such shifts were driven by the recognition that if the range of potential public health threats were identified and risks addressed early, then adverse outcomes could be more readily prevented and/or managed.

Since then, globally, a number of frameworks and charters have been formulated, placing the mandate of disaster mitigation and preparedness on nation states and subsequently on other key stakeholders. Shortly after the devastating 2004 South Asian Tsunami, the Hyogo Framework for Action (HFA) 2005–2015 was widely adopted, representing the culmination of long-term efforts to strengthen emergency preparedness and response. Among its objectives, this voluntary but strongly supported framework called upon countries to “integrate disaster risk reduction planning into the health sector; promote the goal of hospitals being safe from disasters by ensuring all new hospitals are built with a resilience that strengthens their capacity to remain functional in disaster situations; and implement mitigation measures to reinforce existing health facilities”.

Following the HFA, the Sendai Framework for Disaster Risk Reduction 2015–2030 (Sendai Framework) was formulated. It called for enhanced cooperation between health authorities and stakeholders at global and regional levels to strengthen country capacity for disaster risk management for health, implement IHR (2005) and to build resilient health systems. Upon the request of the UN General Assembly, intergovernmental negotiations were held in 2015 wherein a decision was taken to designate UNISDR with the mandate of implementation, follow-up and review of the Sendai Framework. As a 15-year, voluntary, non-binding agreement, the Framework recognizes that the State has a primary role to play to reduce disaster risk and that this responsibility must be shared with the local government, the private sector and other stakeholders. Now, it is the Sustainable Development Goal (SDG) 3 that drives most of the work in this area.

The Goal stipulates the need to “ensure healthy lives and promote well-being for all at all ages”. Further, Goal 3d calls for “strengthening the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks”. This approach brought about another much needed change, namely earmarking investments more for the pre-event phase rather than during an outbreak or event.
Support provided by SEARHEF 2009-2017

Complex interplay of hazards, vulnerabilities and capacities

The South-East Asia Region of the World Health Organization is among the most densely populated regions of the world. A majority of the countries here are low- or middle-income and undergoing demographic transition. The SEA Region Member States host 40% of the world’s poor, who face multiple challenges, making them highly vulnerable to a range of extreme events that include humanitarian emergencies and disease outbreaks. Haphazard and unplanned urbanization, development in and around high-risk areas, overcrowding and poor housing, migration, poverty, climate change and poorly functioning health systems all aggravate risk factors and impede recovery.

Maintaining a precarious balance between risk and protection, they continue to be exposed to a broad range of disasters from natural hazards including floods, cyclones, earthquakes, tsunamis, landslides, volcanoes, heat waves and drought spells, among others. Additionally, they remain constantly exposed to outbreaks and epidemics of emerging and re-emerging diseases including waterborne, vector-borne, vaccine-preventable, respiratory and zoonotic infections. In addition to the epidemics, there is the high endemicity of dengue and chikungunya.

There have been some lessons from recent outbreaks too. The 2003 SARS epidemic showed how rapid and coordinated interventions could produce effective results. The Ebola outbreak pointed towards the need for response to outbreaks and emergencies to start and end at ground level. This translated into certain key capacities being in place before launching a response, including leadership and coordination, technical support, logistics, management of human resources and communications. The Region has witnessed several outbreaks of new and emerging infections as new microorganisms continue to appear and some of the existing ones alter their characteristics to promote their survival at the expense of human health.

Post-event analysis of most recent outbreaks in the Region have included Influenza A (H1N1), MERS, avian influenza A (H5N1), A (H9N2), Nipah virus, Japanese encephalitis and Crimean–Congo haemorrhagic fever (CCHF), pointing towards the fact that early warning of emerging and re-emerging infections depends on the ability to identify the unusual as early as possible. Apart from the high intensity impact of natural disasters, recent years have seen new disease outbreaks and emerging infectious diseases (EID) assuming pandemic proportions, causing social and economic disruption and ultimately becoming endemic. This is what had also happened in
the case of HIV/AIDS, which spread from a remote part of Africa to all other continents and was further entrenched across the world. Population growth and movement, urbanization, changes in food production, agriculture and land use, water and sanitation have further contributed to the emergence of infectious diseases, which have to a large extent modified transmission of endemic infections.

**Reducing risks by measuring gaps**

The obvious question, post any disaster, is: “can risks be reduced and lives saved?” The answer clearly lies in reducing risks by building people’s resilience to face them and then equip the system to deal and manage the crisis when it occurs. To get a grip on the kind of risk that a community is exposed to during a health crisis or disaster, it is critical to anticipate where and why a crisis is likely to occur. Knowing countries that already have high levels of risk would help them get prioritized for increased crisis and disaster prevention, preparedness and response. Tools are now available globally to assess ground realities and measure capacities.

In the context of natural hazards and humanitarian crises, this is now possible with the INFORM Risk Index. Countries are classified based on their current level of risk and the trends over previous years. The overall INFORM Risk Index identifies countries at risk from humanitarian crises and disasters that could overwhelm national response capacity across the dimensions of hazards and exposure, vulnerability and lack of coping capacity. It is the first global, objective and transparent tool for understanding the risk of humanitarian crises and disasters. Designed as an open-source risk assessment, it has the potential to support decisions related to prevention, preparedness and response, allowing policy and programme managers to understand and measure the risk of humanitarian crises and disasters and how conditions leading to them affect sustainable development. Simplifying risk-related information, the Index uses 50 different indicators to measure hazards and peoples’ exposure to them, vulnerability and the resources available to help them cope. Creating a risk profile for every country and rating them between 0 and 10 makes assessment and comparisons possible.

Monitoring coverage of essential health services is a key component of the WHO/World Bank framework for monitoring Universal Health Coverage (UHC) which has been adopted as Target 3.8 of the Sustainable Development Goals. One approach to summarizing coverage of essential health services is to compute an index which combines tracer indicators of health service
Learning from recent disasters

Nepal’s efforts to rebuild itself: In spite of the massive devastation caused by the Nepal earthquake in 2015, a series of steps taken as part of the preparedness measures helped the country minimize losses and rebuild itself. From hospital retrofitting, which involved everything from repairing cracks in walls to installing seismic belts and roof bracing to having a hospital emergency preparedness plan where people knew what to do, where to meet and how things would flow when the earthquake happened – all this brought some order and method into what was a very disruptive time. Undertaking training in triage management and putting into practice guidelines and strategies in mass casualty management systems also ensured good on-the-spot decisions.

Bangladesh succeeds in reducing cyclone related deaths: One of the most impactful risk reduction case studies is that of Bangladesh which saw three cyclones of the same magnitude but achieved a major reduction in number of deaths. Bangladesh’s vulnerability to cyclones due to its geographical location, sea-level geography of coastal areas, high population density and lack of coastal protection systems saw more than 500,000 people dying in the 1970 cyclone and over 140,000 in the 1991 cyclone. A near 100-fold reduction in the number of deaths was seen in the 2007 cyclone compared with the one in 1970 when deaths dropped to 4,234. This was attributed to a clutch of measures that included modernizing early warning systems, developing shelters and evacuation plans, constructing coastal embankments, maintaining and improving coastal forest cover and raising awareness at the community level. Cyclone preparedness also improved following the launch of the Cyclone Preparedness Programme by the Bangladesh Red Crescent Society in 1970. Efforts are still ongoing especially with respect to technological advancements and these will in the coming years further minimize the magnitude of damage to human life.

The UHC is a priority goal for many countries and monitoring its progress on the following areas is critical: intervention coverage, financial risk protection and integrating an equity dimension. It cushions the impact of shocks on communities and fosters more productive, cohesive and equal
communities. The index developed by health systems experts in the WHO Regional Office is based on a definition of UHC that focuses on ensuring that everyone receives the care they need, irrespective of their ability to pay and no one experiences undue financial hardship. By measuring UHC across two vital criteria, the new index examines access to health-care through the lens of less poverty and resilience. In addition to assessing country progress towards UHC, the index helps evaluate the impact of government programmes and reforms.

**Efforts to build capacities in emergency risk management**

Today, the range of threats to public health faced by countries worldwide is broad and diverse. It includes infectious disease outbreaks, unsafe food and water, chemical and radiation contamination, natural and technological hazards, wars and societal conflicts and the health consequences of climate change. To meet these and other challenges, countries must strengthen their national capacities for emergency risk management, incorporating measures for prevention, mitigation, preparedness, response and recovery. Moreover, monitoring and reporting on human health aspects of disasters, as part of measures to improve risk assessment, prevention, preparedness, response and recovery will hold the key to a stronger disaster risk management response.

The 2016 World Disasters Report shows that over the past decade the South-East Asia Region has contributed to 26.8% of global mortality due to disasters. Disaster risks in the Region have got further amplified by increasing vulnerabilities due to unplanned urbanization, changing socioeconomic and demographic profile, development in and around high-risk areas, climate change and environmental degradation and health service challenges of accessibility, affordability, quality and safety. If not addressed adequately, disasters seriously threaten the Region’s sustainable development.

Considering the socioeconomic impact of emergencies and disasters in the SEA Region, the Regional Director identified “strengthening emergency risk management” as one of WHO’s Flagship Priorities whose five objectives include advocacy, information management, technical and operational support, preparedness and response and partnerships. The Flagship Area will be building from capacities of the WHO SEA Region. The Region’s solid initiatives will be the foundations for further scaling up capacities of countries. For capacity assessments, the SEA
Region Benchmarks have been used. This is a tool that has been used for nearly a decade and has informed many plans for risk reduction and preparedness of countries. Another initiative is the innovative, quick, easy access financing mechanism to address the fund gap in the early days and weeks of any emergency, namely the South-East Asia Regional Health Emergency Fund (SEARHEF). The SEARHEF has provided support to 33 emergencies in nine countries in the past 10 years and has recently embarked on setting up a preparedness funding stream.

The WHO Programme that is responsible for this Flagship has also recently been strengthened. The redesign of WHO’s work in emergencies has been guided by several evaluations and assessments conducted in the aftermath of the Ebola outbreak in West Africa in 2014. Based on these inputs and processes in the organization, WHO has set up a Health Emergencies Programme that includes the following core areas: infectious hazards management; country health emergency preparedness and IHR (2005); health information and risk assessments; emergency operations and programme management; and administration and external relations. The common structure of WHO’s Health Emergencies Programme (WHE) adopted at the Sixty-ninth World Health Assembly reflects WHO’s major functions in health emergency risk management, covering each of these aspects. Through this programme, WHO advocates and supports Member countries to continue efforts and investments in planning for and responding to emergencies and making risk management capacities pervasive, with the objective of saving human lives. By reducing underlying risk factors, disaster preparedness for effective response is continually strengthened.

**Securing the world from global health threats: an ongoing endeavour**

It is preparedness and the ability to detect and respond to a disease outbreak that is critical for national, regional and global health security. Few events in recent history have had such severe and widespread impact on South-East Asia as the Tsunami of 26 December 2004. In a matter of hours, six countries in the Region were devastated by giant waves which killed thousands and affected millions in more ways than one. The unprecedented scale and intensity of the disaster led health sectors of many countries to review their delivery systems to meet similar and emerging health challenges. Local health capacity and infrastructure systems were fortified,
local people trained in skills and destroyed hospitals rebuilt. Governments and health agencies realigned themselves from a position of managing emergencies to managing risks. They worked closely with health-care teams, measuring their capacities to lead, developing capacity and making due investment in training. Finally, they began allocating budgets for timely investment in pre-events instead of focusing solely on responding during and after the event. The SARS outbreak in 2003, the avian influenza (H5N1) outbreak in 2005 and most recently the Ebola virus disease outbreak in West Africa in 2014, provided very similar storylines as well. From disastrous events opportunities emerged, partnerships within and across sectors were forged and capacities invested in, to complete the repeat cycle for preparing for another outbreak.

The experience of the Region with the Tsunami and Nepal earthquake as also outbreaks of emerging diseases including SARS, MERS and Zika virus in recent years has taught valuable lessons about the need for creating a fund that could immediately be made available during such emergencies to provide instant support to relief operations. As the leading global agency for health, WHO actively supports its Member States in moving towards implementation of international frameworks and conventions. In an effort to increase preparedness and response capacities, the WHO SEA Region has developed a set of Benchmarks for Emergency Preparedness and Response which includes standards, indicators and guided questions to measure what is in place for legal frameworks, plans, finance and coordination mechanisms, community capacities, capacity development and early warning.

Member countries are using the WHO Benchmarks for capacity development and assessment for risk management in the health sector. SEARHEF was formally established in 2007 through a resolution of the Sixtieth session of the Regional Committee as an operational fund of the WHO SEA Region. The fund is earmarked for providing support to health sectors of Member States during humanitarian emergencies. At the Sixty-ninth session of the Regional Committee, a decision was taken to expand the scope of SEARHEF to include preparedness to its response function. This was immediately put into action when in 2016, the SEA Region provided much needed financial and technical support to Bhutan, Democratic People’s Republic of Korea, Myanmar and Sri Lanka following floods and landslides.

SEARHEF moves forward by adding preparedness as a funding stream.
Like most other aspects of human life, the world of disasters too is adapting to the mysteries of the unknown. New threats and challenges are facing mankind globally which tend to exacerbate in countries of the Region. We have already seen populations in developing countries getting far more seriously impacted with extreme events. The impacts of climate change on human health that are likely to occur via changes in the magnitude and frequency of extreme events will also be far more grave in these countries. We have already seen the impact of climate change on higher temperatures, changing landscapes, rising seas, increased risk of droughts, fires and floods, more vehement storms and higher economic losses. Today more than ever before there is the need to understand how some of these inevitable disasters will occur and how we must quickly recover from them. Another threat that mankind is facing relates to antimicrobial resistance (AMR), which is being recognized as one of humanity’s core political, social and economic challenges of the 21st century. High antibiotic uptake and density of at-risk individuals in health systems is putting pressure on patients and health-care workers alike. While AMR is another Flagship Priority of the Region, WHO has been able to solicit high political commitment from Member States and is supporting to build the national capacity to address the same.

Recognizing the merit of evaluations to strengthen country efforts in detection, prevention and control of communicable diseases and biological threats, as well as to provide a mechanism to match gaps in capacity to resources, the Global Health Security Agenda (GHSA) was launched in 2014. A set of 11 targets were developed with an external assessment tool to measure progress towards increased capacity and a continued, transparent and objective assessment process. The momentum that the GHSA generated will eventually help prevent and mitigate the impact of naturally occurring outbreaks and accidental or intentional releases of dangerous pathogens, rapidly detect and transparently report outbreaks when they occur and employ an interconnected global network that can respond effectively to limit the spread of infectious disease outbreaks in humans and animals, mitigate human suffering and the loss of human life and reduce economic impact.

A systematic risk assessment

Every new threat, whether biological, natural or manmade, reveals challenges for managing health risks and effects of emergencies and disasters. Deaths, injuries, diseases, disabilities, psychosocial problems and other health impacts can be avoided or reduced by emergency risk management measures involving health and other sectors. The traditional focus of the health sector has been
on the response to emergencies. The current challenge is to broaden the focus of emergency risk management for health, from that of response and recovery to a more proactive approach which emphasizes prevention and mitigation and the development of community and country capacities to provide timely and effective response and recovery. Resilient health systems based on primary health-care at the community level can reduce underlying vulnerability, protect health facilities and services and scale up the response to meet the wideranging health needs in disasters. This is perhaps why emergency risk management has emerged as a core element of sustainable development and an essential part of a safer world in the 21st century. Reducing risk is therefore a long-term development process, managed by communities and individuals working together.

For the most part there is a science to preparedness and it begins with understanding risks and its key elements. However, other complexities define whether an emergency will turn into a disaster or not. Where the event happens (urban or rural) and when (time of day) also has an impact on health outcomes. It is around these other complexities that scenarios can be developed and preparedness further fine-tuned. Therefore, emergency risk management/preparedness must be based on evidence that feeds into the kind of coordinated action that is required across local, national, regional and international levels.

**First-of-its-kind systematic mapping of risks**

So far, disasters occurring in the Region, both natural and biological as well as human-generated, have not been mapped or quantified. The current mapping exercise undertaken by the South-East Asian Regional Office and conducted by researchers and experts in the Region attempts to comprehensively cover all risks caused by key hazards, both natural and biological. Given the drastic change in the complexion of recent disasters and crisis management scenarios, two major changes have been seen:

i) A shift in events wherein epidemics have turned into disasters and disasters have caused epidemics with global impact. This was seen during the Ebola outbreak in West Africa and conversely in conflict areas of Syria, Afghanistan and in areas of Nigeria that witnessed polio cases.

ii) A shift in responding to these emergencies from being event-based to risk-based.
This calls for intense and swift action governed by a more proactive rather than reactive approach. To meet this challenge, implementation agencies and those responsible for steering national programmes have expanded their horizons: whereas earlier they were addressing single hazards there is now a more “ALL” hazards-focused approach that views the emergency from a more “whole-of-society” and multisectoral lens. This also brings agencies together to address complex situations, drawing in communities and going beyond the scope of the health system.

The book aims to define a methodology with existing tools and datasets to quantify risks and analyse these risks through the prism of health status and capacities. It aims to draw key action points and recommendations to address these risks in the immediate, medium or long-term. This first-of-its kind “risk atlas” has been developed in the Region to map risks in a way that the results and findings can serve as a tool for policy-makers to prioritize risk management in vulnerable areas. This risk assessment exercise includes two studies carried out by independent groups of researchers and epidemiologists. One pertains to a vulnerability profile of communicable disease threats in the Region while the other looks at multi-hazard vulnerability and capacity and risk analysis for the Region.

The first study, which is a multi-hazard vulnerability study, includes all countries of the SEA Region. An overview of hazards and risks in the Region is provided by developing a profile of the Region and analysing these against capacities that are available. Based on findings, next steps have been suggested on addressing these vulnerabilities while drawing attention to select innovations in the area of health in disaster risk reduction (DRR) and the SEA Region. The study uses INFORM Methodology to analyse risks pertaining to natural disasters and outbreaks of conflict. It studies six disasters, namely earthquakes, tsunamis, floods, cyclones, droughts and projected human conflicts. For another set of five disasters, calculation through a general formula of risk has been used with quantifiable indicators. The risk matrix has been developed by depicting scores of applicable hazards, potential vulnerabilities and coping capacities or lack of them. The overall Risk Index score is calculated after normalization and aggregation of data.

The second study looks at the vulnerability profile of communicable disease threats in the SEA Region which is a hotspot for EIDs including those with pandemic potential. The vulnerability mapping for priority communicable diseases was done using a combination of qualitative and semi-quantitative methods. Priority syndromes and representative diseases such as
Communicable disease hazards for the SEA Region were identified using a modified Delphi technique which is widely accepted as a structured communication technique. Two rounds of Delphi were conducted to arrive at priorities and a syndromic approach was followed to capture the vulnerability due to communicable disease threats. The Disease Attribute Intelligence System (DAISY) risk assessment tool was applied to each of the priority hazards in the 11 countries of the Region to assess the risk of their emergence by country. Weighted vulnerability scores were calculated for each of the countries and for each identified priority disease for the Region. Vulnerability assessment was then done based on the weighted scores.

While drawing attention to the health impacts of disasters, the book provides valuable insights into aspects related to health system resilience and monitoring and surveillance of disease through other policy instruments and scientific methods such as the IHR (2005). Using scientific assessment tools and strong graphics and visuals, it presents information and knowledge which can be used by programmers and policy-makers as they strategize and plan actions that can help reduce risks especially for vulnerable populations before any event, paving the way for a less demanding response. More importantly, such actions allow communities to expediently bounce back from a disaster in a more resilient and sustainable way.

The conviction with which this book has been developed is based on the fact that there is no need to build back better if we simply build better with our knowledge of risks which in turn will inform our actions.
2

Threat of natural disasters in South-East Asia: a risk profile
**Summarizing the rationale for the risk assessment and its findings**

The World Disaster Report 2016 seems to have the last word on disasters. It says, “there is no way to stop a natural disaster from occurring, but there are ways to prevent it from becoming a catastrophic event”. It is precisely this thread that we have tried to capture with a study on multihazard vulnerability and capacity risk analysis for the South-East Asia Region, which has historically been exposed to nearly all kinds of natural hazards. These range from earthquakes and landslides in the Himalayas in the north, to droughts and floods in the plains and cyclones and storms that originate in the Indian Ocean and Bay of Bengal. What makes countries in the Region increasingly vulnerable is that some of them share common geological formations and river basins as well as coastal belts, forcing natural hazards to inevitably transcend national boundaries. Other disasters include periodic typhoons, tropical cyclones, floods, droughts, earthquakes, tsunamis, volcanic eruptions, landslides, forest fires, haze and pandemics, in addition to experiencing agricultural and resource risks, as well as risks associated with rapid urbanization, migration and socioeconomic changes. With the continuing increase in the scale and frequency of disasters, the economic costs associated with them too are increasing, along with a larger number of casualties.

The multihazard vulnerability study includes all 11 countries of the WHO South-East Asia Region. It provides an overview of the hazards and risks in the Region through a profile that is based on a scientific analysis of risks against available capacities.

The findings help identify gap areas, with specific suggestions on how to address some of the vulnerabilities in ways that are contextual to the countries of the Region. The INFORM Risk Index was applied to analyse risks pertaining to five natural hazards – earthquake, tsunami, flood, cyclone and drought. The study looked at vulnerabilities aggregated through geometric averages. Lack of coping capacity was aggregated by a geometric mean of two categories across institutional and infrastructure-related indicators, with the difference between them signifying the stages of the disaster management cycle that they were focusing on. Scores were calculated with respect to applicable hazards, potential vulnerabilities, lack of coping capacities and overall Risk Index. Low risk scores indicated positive performance, while high scores depicted negative performance, in terms of managing overall risks. To take this further, the Region universal health coverage (UHC) Index was applied to these risk index findings. From this it became possible to map the most suitable risk reduction and preparedness actions.
The many faces of disasters in the South-East Asia Region

South-East Asia is a Region diverse in terms of its landmass, population, geography, natural resources, sociocultural legacy, languages, colonial experience, stage of development and system of government. Each of the 11 Member States of the WHO Region is exposed to all types of hazards and has been coping with their effects for hundreds of years. The last decade and recent years in particular have seen an increase in the frequency and severity of disasters, particularly those of geological and hydro-meteorological origin. Significant strides have been made in managing these disasters with most countries finalizing their national policies and plans for disaster risk management.

Population is a critical dimension when it comes to considering the range of contexts while carrying out the overall risk mapping of a country and while developing and implementing any DRR or health-care strategy for the Region as a whole. The Region includes about one fourth of the world’s population, or an estimated 1.8 billion people. Three of its countries have a population that exceeds 100 million: India (1.25 billion), Indonesia (250 million) and Bangladesh (156 million). Countries with a population of less than two million include Timor-Leste (1.78 million), Bhutan (754 000) and Maldives (345 000). SEA Region Member countries host 40% of the world’s poor, who face multiple challenges including poverty, education, unemployment, gender inequality, lack of access to safe drinking water and sanitation, migration, urbanization and globalization. Indeed, the Region is diverse in geography, population and cultures. Against the background of new drivers of risk – such as unplanned urbanization, new patterns of population movement and climate change – the Region is also exposed to a more diverse range of hazards, vulnerability and, consequently, risks.

Understanding vulnerability, hazards and coping capacities in the context of disasters

How an individual, community or nation responds to a disaster depends on how vulnerable it is to threats and risks presented by the potential disaster. It also depends on the hazardous nature of the event and finally the extent to which it can cope, given its capacity to prepare itself prior to the event, during the event and post the event. In the context of disasters and as per standard explanations in the UNISDR, vulnerability is defined as “characteristics and circumstances of a community, system or asset that makes it susceptible to the damaging effects of a hazard”.

New drivers of risk are contributing to heighten the frequency and severity of disasters in the Region.
The level and extent of vulnerability varies within communities based on their economic conditions, awareness and timeframe. To understand all dimensions of vulnerability, one has to see its physical, social, economic and environmental aspects. Hazards, on the other hand, are classified based on their being geophysical, hydro-meteorological, biological or human induced. Hazards are basically threats with the potential to cause damage and are defined as “potentially damaging physical events, phenomena and human activity that are likely to cause loss of life or injury, property damage, social and economic disruption or environmental degradation”\(^1\).

The capacity of a country to cope with a major disaster is judged by the extent of investment made in public policy to protect people, property and community resources. This must be through adoption and implementation of mitigation, preparedness, emergency response and recovery and reconstruction measures and regulations. It is defined as “a combination of all strengths, attributes and resources available within a community, society or organization to manage and reduce risks and strengthen resilience”.

**Efforts in improving national emergency preparedness by developing IHR core capacities**

Risk profiling of the SEA Region based on vulnerability and coping capacity is an important step in consolidating action plans to cope with hazards that have the potential to turn into big disasters. WHO supports countries, enabling them to meet provisions of the legally binding IHR (2005) to prevent, protect against, control and provide a public health response to the international spread of infectious diseases. The 13 core capacities for IHR that need to be monitored include surveillance, legislation, coordination, response, preparedness, risk communication, human resources, laboratory capacities, point of entry, zoonotic infections, food safety, chemical and nuclear events.

As of 2016, the new IHR Monitoring and Evaluation (M&E) Framework is being used to review progress in implementing IHR Core Capacities in States Parties. The Regional Office has initiated support to Member States to conduct a comprehensive assessment of these core capacities.

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for emergencies with specific focus on joint external evaluation (JEE) and State party annual reporting (SPAR) followed by an after-action review and simulation exercise. The self-assessment questionnaires provide 20 global indicators for monitoring the development of IHR core capacities for Member States to report annually to the World Health Assembly. Based on these self-assessment questionnaires, all Member States are making progress with establishing their National IHR Focal Points; increasing legislation related to IHR coordination and transparency in reporting events; ensuring a more systematic use of early warning systems; achieving better communication and collaboration between animal and human health sectors and establishing emergency response and coordination structures and improved international mechanisms to share information for rapid response.

The frequent and recurring nature of disasters in the SEA Region has highlighted the importance of improving national emergency preparedness. Responding to this concern, the WHO Regional Office along with its 11 Member States formulated 12 Benchmarks on emergency preparedness and response in the year 2005 after the Tsunami of 2004. These Benchmarks integrate multisectoral concerns at community, subnational and national levels. Grouped into four categories (legal, community, capacity-building and early warning), they provide a comprehensive view of emergency risk management in the country’s health scenario.

**Methodology adopted for risk profiling of disaster dynamics**

The risk pertaining to natural disasters and outbreaks of conflict are quite difficult to predict. The factors that lead to them are numerous and complex and often the risk assessment tools are either organization-specific or prohibitively expensive. For assessing risk accurately and to undertake a detailed analysis of ground realities, getting a quantifiable dataset is critical.

A scientific risk profiling was done during March–June 2017 with the aim of getting deeper insights into the disaster dynamics of countries in the SEA Region. The study aims to provide an overview of the hazards and risks in the Region by developing a profile for the SEA Region and analysing these against the capacities that are available. It also describes the next steps on how to address these vulnerabilities.
### Table 2.1: INFORM Risk Index of natural hazards

<table>
<thead>
<tr>
<th>Country</th>
<th>Hazard and exposure</th>
<th>Vulnerability</th>
<th>Lack of coping capacity</th>
<th>INFORM risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Earthquake (0-10)</td>
<td>Flood (0-10)</td>
<td>Tsunami (0-10)</td>
<td>Tropical cyclone (0-10)</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>8.7</td>
<td>10.0</td>
<td>8.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Bhutan</td>
<td>7.4</td>
<td>5.2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>DPR Korea</td>
<td>0.9</td>
<td>7.7</td>
<td>3.2</td>
<td>6.6</td>
</tr>
<tr>
<td>India</td>
<td>7.9</td>
<td>8.5</td>
<td>8.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>8.4</td>
<td>8.2</td>
<td>9.6</td>
<td>6.4</td>
</tr>
<tr>
<td>Maldives</td>
<td>0.1</td>
<td>0.1</td>
<td>8.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Myanmar</td>
<td>9.3</td>
<td>10.0</td>
<td>8.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Nepal</td>
<td>9.9</td>
<td>6.5</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>0.1</td>
<td>6.2</td>
<td>8.2</td>
<td>3.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.4</td>
<td>8.9</td>
<td>6.8</td>
<td>4.9</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>5.7</td>
<td>1.9</td>
<td>5.0</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Source: INFORM Index 2016

For the purpose of this review, the risk profiling of the Region is based on the INFORM Risk Index methodology which is an open-source platform of global risk assessment for humanitarian and disaster crises. The methodology is used for disasters, covering earthquakes, tsunamis, floods, cyclones, droughts and projected human conflict. For the purpose of this profiling, only natural hazards were included and a calculation using a general formula of risk used. All important criteria for calculating risk were included, covering the three main dimensions of hazard and exposure, vulnerability hazards and lack of coping capacity. These were then conceptualized in a counterbalancing relationship that looked at the risk of what (natural hazard) and the risk to what
A multiplicative equation has been modified from UNISDR’s equation of risk to accommodate the “Vulnerability variable” which is split into three dimensions. If any of the dimensions are zero, risk equals zero.

To derive the risk profile, index value for each dimension has been derived through various indicators that have been explained in the subsequent sections of this book.

The equation is:
\[
\text{Risk} = (\text{hazard and exposure})^{1/3} \times (\text{vulnerability})^{1/3} \times (\text{lack of coping capacity})^{1/3}
\]

The five key components have been aggregated with a geometric average of earthquakes, tsunamis, floods, tropical cyclones (cyclonic wind and storm surge) and droughts (historical impact and agricultural drought probability).

(population). The aspects of physical exposure and physical vulnerability were integrated in the hazard and exposure dimension, while the aspect of the fragility of the socioeconomic systems became INFORM’s vulnerability dimension, while lack of resilience to cope and recover was treated under the lack of coping capacity dimension.

**Hazard and exposure** includes hazards that can turn into disasters. Consequently, it also considers how many people are exposed to that risk. Exposure here is driven by a number of socioeconomic dynamics, such as population growth and density in hazard-prone areas, economic expansion in the Region and concentration of assets and required resources in expanding megacities and rapidly growing secondary cities.

**Vulnerability to hazard** covers aspects related to how vulnerability of communities is judged. The vulnerability of exposed assets is increasing in the SEA Region, primarily due to mismanaged development that undermines the capacity of the population to withstand the impact of hazard events and environmental factors, including climate change.

**Lack of coping capacity** covers resource scarcity that can alleviate impact. Coping capacity is not profound due to the economic condition of the SEA Region and the inadequate investment made in the health sector to help during emergencies; ignorance of the people and lack of interest of the governments.
Table 2.2: Brief outline of risk profiling using INFORM methodology

<table>
<thead>
<tr>
<th>INFORM indicators</th>
<th>Source</th>
<th>Description</th>
<th>SEA Region range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vulnerability indicators</strong></td>
<td>Development and deprivation (50% weightage); Inequality (25% weightage); and aid dependency (50% weightage)</td>
<td>Vulnerability dimension represents economic, political and social characteristics of the community that can be destabilized in case of a hazard event</td>
<td>Most countries were found to have high to medium levels of socio-economic vulnerability requiring the people of the country to become more resilient</td>
</tr>
<tr>
<td><strong>Human Development Index (HDI)</strong></td>
<td>Indicators of life expectancy, educational attainment &amp; income combined in a composite index</td>
<td>Least score denotes better access to resources while high score points towards need to strengthen access</td>
<td>As per HDI, health development in the Region varies from 1.9 to 7.4.</td>
</tr>
<tr>
<td><strong>Multidimensional Poverty Index</strong></td>
<td>Assessment of living standards, health and education</td>
<td>Multidimensional Poverty Index identifies overlapping deprivations at household level that are the same as HDI</td>
<td>Most countries fell in the medium category indicating need for more points of access</td>
</tr>
<tr>
<td><strong>Gender Inequality Index (GII)</strong></td>
<td>Value of GII ranges between 0 to 1 with 0 being 0% inequality, 1 being 100% inequality</td>
<td>Reflects gender-based disadvantages in reproductive health, empowerment and the labour market</td>
<td>Most countries scored a medium range denoting variance in one of three indicators</td>
</tr>
<tr>
<td><strong>GINI² index</strong></td>
<td>Measures distribution of a resident’s income among the country’s population</td>
<td>Higher the value, higher is the inequality among genders based on income and index</td>
<td>Most countries appeared in the medium range in terms of inequality</td>
</tr>
<tr>
<td><strong>Public aid per capita</strong></td>
<td>Sum of total official development assistance (ODA) in the last two years per capita published by the Organization for Economic Cooperation and Development (OECD)</td>
<td>Humanitarian crisis and economic instability impact capability of countries to improve basic fundamentals</td>
<td>Thailand and Indonesia have shown zero requirement for public aid. However, countries like Nepal, Myanmar and Maldives are slightly dependent while even lesser public aid is given to Bangladesh, DPR Korea, Sri Lanka and India. Maximum dependency on foreign aid is for Bhutan followed by Timor-Leste</td>
</tr>
<tr>
<td><strong>Net official development assistance</strong></td>
<td>Global humanitarian funding per capita published by the World Humanitarian Summit, United Nations (UNOCHA)</td>
<td>Consists of disbursements of loans made on concessional terms and includes loans with grant element of at least 25%</td>
<td>Range shown in dependency index varied from 0.0 to 6.6 with &gt; 80% being within 3.2 range</td>
</tr>
</tbody>
</table>

1 The Gini coefficient is an important tool for analysing income or wealth distribution within a country or region and is often represented graphically by the Lorenz curve, which shows income (or wealth) distribution by plotting the population percentile by income on the horizontal axis and cumulative income on the vertical axis.
### INFORM indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Source</th>
<th>Description</th>
<th>SEA Region range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Uprooted people</strong></td>
<td>Average of internally displaced people and refugees of country by asylum-seeking status</td>
<td>Vulnerability largely determined by people displaced, suffering poor health and experiencing food crisis and starvation</td>
<td>While no vulnerable groups were found in some countries, vulnerability was high in countries where more people were internally displaced and where refugees had taken asylum</td>
</tr>
<tr>
<td><strong>Other vulnerable groups</strong></td>
<td>Indicators included health conditions, children under five and recent shocks</td>
<td>Health condition of people during a disaster shows their resilience to fight back epidemic and disease outbreaks</td>
<td>Health conditions are not as favourable during/after disasters and most countries need to upgrade their facilities in emergency response. These were found to be of good quality in Sri Lanka and Maldives</td>
</tr>
<tr>
<td><strong>Lack of coping capacity</strong></td>
<td>Institutional capacity (arithmetic average of disaster risk reduction and governance) and infrastructure capacity (arithmetic average of communication, physical infrastructure and access to health systems)</td>
<td>Lack of coping capacity dimension represents how far the government has addressed the issue of increasing the resilience of society and how successful its implementation has been</td>
<td>Range in the Region varies considerably, with most countries in need of and in the process of strengthening it</td>
</tr>
<tr>
<td><strong>Institutional</strong></td>
<td>DRR activity is assessed from score of HFA self-assessment progress report of countries</td>
<td>DRR and government effectiveness included/quantified to assess institutional capacity</td>
<td>Although institutional capacities are in place for most countries, including DPR Korea, Myanmar, Timor-Leste and Nepal, these were found to be average in Maldives, Thailand and Bangladesh. Meanwhile, there is scope for further improvement in Bhutan, India, Indonesia and Sri Lanka</td>
</tr>
<tr>
<td></td>
<td>Governance effectiveness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INFORM indicators</td>
<td>Source</td>
<td>Description</td>
<td>SEA Region range</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>Indicators that quantify communication include adult literacy, access to electricity, Internet users and cellular phone subscriptions. Health infrastructure assessed by density of physicians, health expenditure per capita and measles immunization coverage</td>
<td>Infrastructure represents a country’s basic physical and organizational structure and facilities. Health infrastructure is tested most severely during disasters. Good health-care systems help reduce mortality</td>
<td>Most countries of the Region were found to have the basic infrastructure to deal with disasters, but a lot more would need to be done to improve preparedness further.</td>
</tr>
<tr>
<td><strong>Hazard (exposure)</strong></td>
<td>This dimension comprises two categories with equal weight: Natural hazards and Human hazards.</td>
<td>The hazard &amp; exposure dimension reflects the probability of physical exposure associated with specific hazards.</td>
<td>Most SEA Region countries have significant exposure to all five types of natural hazards, with Bhutan, Maldives and Timor-Leste having exposure to only selective hazards.</td>
</tr>
<tr>
<td><strong>Earthquake</strong></td>
<td>Using INFORM Risk Index for measuring hazard and exposure dimension, only intensity levels of VI–VIII are taken. Variable seismic hazard zones that exist in the SEA Region include high, moderate and low seismic hazards.</td>
<td>Exposure index to hazard found to be highest for Nepal followed by Myanmar and Bangladesh. Least affected countries are DPR Korea, Sri Lanka and Maldives.</td>
<td></td>
</tr>
<tr>
<td><strong>Tsunami</strong></td>
<td>Annual exposure of tsunami taken using the Global Assessment Report (GAR) dataset and indexing it between 0 and 10 as per INFORM methodology. In the Indian Ocean, tsunamis are found to occur in three Regions: Andaman-Nicobar, Sumatra-Java and the Sunda Arc.</td>
<td>Large areas of SEA Region are under threat of tsunamis of varying intensities. Most countries show a high-risk index. Indonesia has the highest risk followed by Sri Lanka and Bangladesh. Other countries also bear high risk while Bhutan and Nepal have zero risk since they are not coastal countries.</td>
<td></td>
</tr>
<tr>
<td><strong>Cyclone</strong></td>
<td>Source of data is GAR. Two hazard zones for each country were extracted for the same return period using two different minimum intensity levels (SS1 and SS3).</td>
<td>Cyclones occur in yearly cycles and affect coastal populations through high wind speeds, storm surges and associated floods and heavy rainfall, sometimes causing riverine floods and landslides. Indonesia and India have highest cyclone mortality risk in the SEA Region, followed by Bangladesh, Myanmar and Thailand. The Region is periodically affected by great cyclonic events. In the remaining countries, cyclone mortality risk is very low.</td>
<td></td>
</tr>
</tbody>
</table>
Threat of natural disasters in South-East Asia: a risk profile

Brief outline of the UHC Index

The UHC and health security are two sides of the same coin. The UHC has been adopted as Target 3.8 of the SDGs, which will require regular reporting on progress. It is a process of progressive realization in which all people receive quality essential health services without being exposed to financial hardship. This year, 400 million people (1 out of 17) – mostly the poor and women and children – around the world remain without access to health-care. Strong health systems will not only be our best defence but also be critical to attain the SDGs. Monitoring UHC therefore requires measuring health service coverage and ensuring financial protection against the cost of health services within countries, including among disadvantaged populations, to track equity.

The UHC Index, developed by WHO SEARO, is an index of service coverage defined as the average coverage of essential health services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, noncommunicable diseases and service capacity and access, among the general and the most disadvantaged. The UHC service coverage index has been developed as part of the WHO-World Bank UHC Monitoring Framework. It is based on 16 largely familiar indicators that can be combined into an index. The tracer indicators were selected following extensive review and discussion. 

<table>
<thead>
<tr>
<th>INFORM indicators</th>
<th>Source</th>
<th>Description</th>
<th>SEA Region range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drought</strong></td>
<td>INFORM Risk Index of SEA Region used for measuring hazard and exposure dimension and presenting country-wise Drought Hazard Table</td>
<td>Predominant economic activity in SEA Region countries is agriculture. Since drought can affect agriculture, it also threatens the livelihood of large numbers of people</td>
<td>Large areas of Bangladesh, India, Nepal, Sri Lanka and Thailand and parts of DPR Korea, Indonesia and Timor-Leste are at risk for drought</td>
</tr>
<tr>
<td><strong>Floods</strong></td>
<td>Using INFORM Risk Index, geo mean taken and indiced to fall within the 0–10 range of annual expected exposure of people and physical exposure to floods</td>
<td>SEA Region prone to frequent and severe disasters with instances and severity of flooding increasing over the years due to mountainous terrain and rivers and tributaries across the Region</td>
<td>Most countries in the Region are prone to floods. Bangladesh, DPR Korea, India, Indonesia, Myanmar, Nepal and Thailand are in the higher risk zone while the remaining countries have low risk</td>
</tr>
</tbody>
</table>
### Table 2.3: UHC health service coverage index in SEA Region countries, 2016

<table>
<thead>
<tr>
<th>Tracer indicators for UHC services coverage</th>
<th>BAN</th>
<th>BHU</th>
<th>DPRK</th>
<th>IND</th>
<th>INO</th>
<th>MAV</th>
<th>MMR</th>
<th>NEP</th>
<th>SRL</th>
<th>THA</th>
<th>TLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reproductive, maternal, child and neonatal health</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family planning coverage (%)</td>
<td>73</td>
<td>85</td>
<td>77</td>
<td>64</td>
<td>79</td>
<td>43</td>
<td>75</td>
<td>56</td>
<td>69</td>
<td>89</td>
<td>38</td>
</tr>
<tr>
<td>Pregnancy care (%)</td>
<td>36</td>
<td>78</td>
<td>97</td>
<td>51</td>
<td>85</td>
<td>90</td>
<td>59</td>
<td>69</td>
<td>96</td>
<td>91</td>
<td>47</td>
</tr>
<tr>
<td>Child immunization coverage (DPT3 %)</td>
<td>94</td>
<td>99</td>
<td>96</td>
<td>87</td>
<td>81</td>
<td>99</td>
<td>75</td>
<td>91</td>
<td>99</td>
<td>99</td>
<td>76</td>
</tr>
<tr>
<td>Care seeking behaviour of suspected pneumonia (%)</td>
<td>42</td>
<td>74</td>
<td>80</td>
<td>73</td>
<td>75</td>
<td>74</td>
<td>58</td>
<td>50</td>
<td>58</td>
<td>80</td>
<td>71</td>
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<td></td>
<td>57</td>
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<td>68</td>
<td>80</td>
<td>73</td>
<td>66</td>
<td>65</td>
<td>79</td>
<td>89</td>
<td>56</td>
</tr>
<tr>
<td><strong>Infectious diseases</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculosis detection and treatment (%)</td>
<td>53</td>
<td>72</td>
<td>73</td>
<td>44</td>
<td>27</td>
<td>30</td>
<td>61</td>
<td>69</td>
<td>58</td>
<td>42</td>
<td>48</td>
</tr>
<tr>
<td>HIV antiretroviral therapy coverage (%)</td>
<td>15</td>
<td>23</td>
<td>…</td>
<td>44</td>
<td>9</td>
<td>19</td>
<td>46</td>
<td>31</td>
<td>19</td>
<td>65</td>
<td>…</td>
</tr>
<tr>
<td>Insecticide treated bednets or Indoor residual spray coverage for malaria prevention (%)</td>
<td>67</td>
<td>100</td>
<td>28</td>
<td>25</td>
<td>55</td>
<td>…</td>
<td>83</td>
<td>100</td>
<td>…</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>Access to improved sanitation (%)</td>
<td>61</td>
<td>50</td>
<td>82</td>
<td>40</td>
<td>61</td>
<td>98</td>
<td>80</td>
<td>46</td>
<td>95</td>
<td>93</td>
<td>41</td>
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<td></td>
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<td>30</td>
<td>38</td>
<td>66</td>
<td>56</td>
<td>47</td>
<td>63</td>
<td>58</td>
</tr>
<tr>
<td><strong>Noncommunicable diseases</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence of normal blood pressure level in population (%)</td>
<td>51</td>
<td>44</td>
<td>64</td>
<td>49</td>
<td>53</td>
<td>51</td>
<td>51</td>
<td>41</td>
<td>55</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>Mean fasting plasma glucose (mmol/L) (Rescaled value)</td>
<td>82</td>
<td>65</td>
<td>99</td>
<td>76</td>
<td>100</td>
<td>98</td>
<td>100</td>
<td>83</td>
<td>86</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
<td>Cervical cancer screening (%)</td>
<td>…</td>
<td>64</td>
<td>…</td>
<td>…</td>
<td>…</td>
<td>4</td>
<td>…</td>
<td>25</td>
<td>…</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tobacco non-use (%)</td>
<td>57</td>
<td>75</td>
<td>…</td>
<td>65</td>
<td>64</td>
<td>80</td>
<td>59</td>
<td>69</td>
<td>75</td>
<td>73</td>
<td>44</td>
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<tr>
<td></td>
<td>62</td>
<td>61</td>
<td>79</td>
<td>62</td>
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### Tracer indicators for UHC services coverage

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<td>Access to essential medicines (%)</td>
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<td>Health security: IHR compliance (%)</td>
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<tr>
<td>Overall essential health services coverage index (scale of 0 to 100)</td>
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</tbody>
</table>

Source: Health in the sustainable development goals: Where are we now in the South-East Region? What next?–WHO-SEARO 2016

... Unavailable data

There is currently very limited data on service coverage for noncommunicable diseases. In fact, service coverage data for high blood pressure and diabetes do not exist. Hence currently population prevalence of raised blood pressure and raised blood glucose levels are being used instead as proxies for service coverage. All indicators are defined so that they range between 0% and 100%, where 100% implies full coverage. The service coverage index is computed for each country by averaging coverage values across the 16 indicators.

The INFORM Risk Index overlaid with the UHC Index shows the risk of natural hazards and the health issues and health system areas that need to be addressed before, during and after a disaster caused by a natural hazard.
Multiple factors contribute to India’s high vulnerability to natural and man-made disasters
India is prone to all major natural hazards and has experienced a number of disasters that have seen an increasing trend in terms of events and casualties over the last four decades. About 60% of its landmass is prone to earthquakes of varying intensities, over 8% to floods, 75% of the coastline is prone to cyclones and 68% of its area is susceptible to drought. Direct losses resulting from disasters are estimated to be in the region of approximately 2% of the country’s GDP, which is considered very high.

Sri Lanka tries to tide over a conflict-ridden past and vulnerability to cyclones and floods
Sri Lanka’s geographical and climatic diversity exposes it to a number of nature-induced risks, with the majority of hazard events being floods, droughts and cyclones. The country still recalls the chilling impact of the 2004 Indian Ocean Tsunami. Overall, floods have cumulatively affected more than 10 million people, while droughts have affected over 6 million in the past. Droughts occur three to four times a decade causing enormous economic setbacks. Though less frequent, cyclones have impacted the lives of those living along the coastal belt. The country has had its share of landslides in the hilly central highlands. Sri Lanka’s bitter past had several conflicts and unrests, leading to riots and violence that have taken a toll on the social and economic health of the nation.

Sea level rise puts Maldives at even more risk
Maldives is vulnerable to storms, tsunamis, excess rainfall and sea level rise. It is situated in the Indian Ocean with an archipelagic group that comprises 1 196 coral islands grouped in 26 atolls, of which 200 islands are inhabited and exposed to cyclones. While high impact events are relatively infrequent, the country has experienced major disaster events, including the 2004 Indian Ocean Tsunami and is confronted with a series of challenges related to sea level rise. Maldives is the lowest-lying country in the world and resultantly, sea level rise will impact the protective capacity of its coral reefs, increase the salinity of its groundwater resources, besides increasing the strength of cyclones, flooding and inundation on its shores.

Bangladesh’s strong disaster history guides its future planning efforts
Bangladesh has faced numerous disasters in the past and continues to remain highly hazard-prone, due to earthquake zoning and physical exposure to flood, cyclone and tsunami. The country is also vulnerable to existing health conditions, high population density, narrow roads, congested industries in cities and extreme events. Overall, the country has come a long way in its efforts to manage and control disasters and should continue to strengthen disaster planning in its long-term development goals and practices.

Earthquakes and extreme weather events threaten the tranquility of mountainous Nepal
Nepal is a landlocked country with diverse geographical and climatic features that expose it to a number of natural hazards. The country frequently experiences landslides, debris flows, floods, earthquakes and glacial lake outburst floods. In recent years it has faced some of its worst earthquakes, landslides and floods, weakening its fragile economy. It is located in a seismic Zone V (highly hazard prone) area. The 2015 Great Himalayan Earthquake in Nepal caused immense damage to life and property. Recurring floods, avalanches and windstorms are the other reportable disasters. Lately, experts are cautioning the impact of climate change and extreme events on Nepal.
DPR Korea’s vulnerability to disasters requires scaling up of capacities
The Democratic People’s Republic of Korea is located in East Asia. Due to extreme weather conditions, it experiences some of the most frequent disasters, including flooding, torrential rains, typhoons and storm surges, year after year. This has led to soil erosion and sedimentation bringing on landslides, droughts, duststorms and sandstorms. A number of major flood events have occurred in recent years, resulting in economic loss (particularly to agriculture), damage to infrastructure and loss of life and livelihood. Strengthening communication networks, forecasting constraints and local coping capacities are some of its priority areas as it braces itself to withstand and manage disasters and outbreaks in the coming years.

Indonesia’s constant battle with a range of natural disasters
Indonesia is the world’s largest archipelago and its particular geographical and geological characteristics place the country among those which are the most vulnerable to natural hazards. It has more than 500 volcanoes, of which 128 are active. It is subject to a high level of seismic activity, given its location at the intersection of three crustal plates. Most of these occur at sea, bringing in added risks of tsunamis or tidal waves. Many parts of the country are susceptible to droughts and forest fires. Indonesia also has over 5,000 small and big rivers, of which 30% cross a high population density area, posing as flood hazards. Additionally, the country has faced a number of storms in the past.

Indonesia is one of the most resource constrained countries in the SEA region. This limits its capacity to deal with nature’s onslaughts. Its natural geographical conditions make it most vulnerable to natural hazards, including cyclonic storms, floods, earthquakes, tsunamis, forest fires, landslides and epidemics. Having a long coastline along the western part of the country, the Bay of Bengal, Myanmar is regarded as a cyclone vulnerable area. With heavy rainfall, it experiences frequent flood events besides earthquake, landslides and storms.

Thailand is most impacted by floods and tsunamis
Thailand is located in the centre of the SEA peninsula. The country’s global risk rank is 80 as per the INFORM Risk Index, and it ranks eighth in the SEA Region. It is vulnerable to natural hazards, including floods, tsunami, storms, droughts, landslides, forest fires, earthquakes and epidemics. Among natural hazards, tsunami causes the largest number of deaths while floods affect the largest number of people. Droughts have also been a significant hazard in the country. Apart from these, cyclonic storms have caused significant damage. There have been around 30 storms in the past three decades, killing over 1,696 people, affecting more than 3.2 million people and causing an economic loss of $911 million.

Apart from these, cyclonic storms have caused significant damage. There have been around 30 storms in the past three decades, killing over 1,696 people, affecting more than 3.2 million people and causing an economic loss of $911 million.
Synopsis of prominent risks faced by countries in the Region

The SEA Region of WHO is particularly vulnerable to a range of emergencies and disasters that include natural hazards such as floods, cyclones, earthquakes, tsunamis, landslides, volcanoes, heat waves and droughts. Although there has been a significant reduction in the number of people killed and affected by disasters, mortality and morbidity still remain very high. Understanding the nature of some of these disasters and the pattern they follow in their recurrent trend would throw some light on the kind of risks that need to be managed and the coping capacities that must be developed by each of the countries.

Earthquakes marked by variable seismic hazard zones

Earthquakes occur along the edge of oceanic plates, continental plates and fault lines. The severity of an earthquake’s impact is different in each country, depending on the country’s hazard risk vulnerability preparedness and coping capacity. Seeing the trend of earthquakes that have taken place in the Region since 1900, mortality on account of earthquakes has been recorded at more than a 1 000 person death and injury average. The highest death rate recorded was 230 000–280 000 in Indonesia in 2004 when the earthquake of 9.1-9.3 magnitude was generated by the Sumatra-Andaman earthquake in the Andaman-Sumatra Basin. Earthquake mortality was calculated decapitating 100 years data of less than 1000 deaths and injuries of countries due to vulnerability. The impact was found to be very high during 2001 and 2015 respectively.

The SEA Region is marked by variable seismic hazard zones ranging from high seismic hazards associated with the subduction process beneath the Indonesian and Philippine archipelagos to moderately low seismic hazards across a large stable region containing the Malaysian peninsula. The Indonesian island chain is characterized by widespread volcanic and earthquake activity resulting from a sliding of the Indian and Australian tectonic plates beneath the Sunda and Burma tectonic plates. On 26 December 2004, the massive tsunami earthquake saw thrust-faulting on the interface of the Indian and Burma plates. The consequent tsunami killed over 225 000 people and caused huge socioeconomic losses in 14 countries including India, Indonesia, Thailand, Maldives, Myanmar and Sri Lanka. According to the US Geological Society, the Himalayan mountain range and Tibetan plateau have formed as a result of a collision between the Indian Plate and Eurasian Plate which began 50 million years ago and which continues till today. Nepal, particularly prone to earthquakes, sits on the boundary of these two massive tectonic plates. The 2015 Nepal earthquake was a result of one such massive collision.
Map 2.1
Earthquake risk in the South-East Asia Region

Source: INFORM Index 2016
EM-DAT 2016
Map 2.2
Tsunami risk in the South-East Asia Region

Scale of hazard exposure
- 0.0 - <2.0
- 2.0 - <4.0
- 4.0 - <6.0
- 6.0 - <8.0
- 8.0 - <10.0

Indicators (1900-2015)
- Number of events
- Injuries
- Deaths

Source: INFORM Index 2016
EM-DAT 2016

Source: INFORM Index 2016
EM-DAT 2016
The Region has the experience of devastating tsunamis. The 2004 Indian Ocean Tsunami was the worst tsunami in terms of lives lost. The earthquake-generated tsunami swept across the Indian Ocean and within hours hit 14 countries recording maximum damage in India, Indonesia, Sri Lanka, Maldives, Somalia and Thailand.

**Tsunamis of varying intensities**

Large areas of the SEA Region face the threat of tsunamis of varying intensities. Mortality due to tsunami in SEA Region countries has seen massive loss to life and property in the period 1900–2016. A death rate of 230,000–280,000 was recorded in Indonesia in the 2004 Indian Ocean Tsunami, making it figure in the high risk profile for tsunami. Thailand also has high exposure to tsunami with about 500 deaths and over 30,000 injuries recorded in 2004.

Tsunamis occur due to earthquakes along the subduction zone plate boundaries like that of the Pacific Ocean. These tsunamigenic zones[^3] are found in the Indian Ocean, with zones that include the Andaman-Nicobar region, Sumatra-Java region, Makran subduction zone north of the Arabian Sea and the Sunda Arc (Java, Sumatra and Lesser Sunda subduction zone). The latter is one of the most active plate tectonic margins in the world, accommodating 67±7mm/yr, with N11°E convergence (derived from global positioning surveys or GPS) between South Asian and Indian-Australian plates, which arcs 5500 kilometres from Myanmar past Sumatra and Java towards Australia.[^4]

**Floods, frequent and severe**

Floods are one of the most significant natural hazards in the SEA Region which due to its mountainous terrain see several rivers and their tributaries criss-cross. The majority of the population here lives in riverine plains, low-lying coastal plains and delta regions, exposing them to increasing flood mortality risks. Severe floods are seen due to the huge river systems in India, Bangladesh and the Mekong tributaries across Thailand and Myanmar. Countries like Bangladesh, India, Indonesia and Sri Lanka endure the extreme impact of floods in comparison with other nations. Bangladesh, which is situated on a wide deltaic plain with the confluence of several rivers, is the most flood-prone being a low-lying country. The main reason for flooding is attributed to large populations living on the banks of rivers. In case of Bangladesh, vulnerability of

[^4]: Tregoning et al., 1994
The 100-year Centre for Research on the Epidemiology of Disasters (CRED) data shows countries located in the Indo-Gangetic and Mekong regions being highly vulnerable to floods. Studying the data from 1900 to 2016 and considering more than 1 000 total deaths in the Region, two countries were found to be most flood-prone while the graph showed all 11 countries (Bangladesh, Bhutan, DPR Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste) to be at risk of floods every year due to climate change effects. The Risk Index shows Bangladesh, DPR Korea, India, Indonesia, Myanmar, Nepal and Thailand being present in higher risk zone with other countries in low risk zone. Physical exposure of Bangladesh to floods was 10 as per INFORM Risk Index, making it the most exposed to floods.

The population is very high due to the Meghna river causing erosion of its banks and leading to mass displacement of people. According to a UN report, over 9.6 million people are currently affected by flooding in the Region, with 5.3 million of them in Thailand. Recent floods in South-East Asia are a result of typhoons, heavy rains and tropical storms. A combination of tropical storms have prolonged heavy rains, increasing the frequency of floods in Bangladesh, India, Indonesia, Myanmar, Nepal, Sri Lanka and Thailand.

**Deadly cyclones decimate entire landscapes**

The SEA Region has hot and humid climate conditions in the North Indian Ocean region which influences the risk of cyclones, some of which have been most severe and deadly. Tropical cyclones are frequent in a few regions and rare in other. India, Bangladesh and Democratic People’s Republic of Korea have faced more cyclone events in the Region compared with other countries having negligible or no recorded loss. Although Myanmar is also at risk for cyclones, the events have not been as frequent. Cyclones occur in yearly cycles and affect coastal populations through high wind speeds, storm surges and associated floods and heavy rainfall, sometimes causing riverine floods and landslides.

The Region has been periodically affected by great cyclonic storms such as Sidr, Nargis, Bhola, Hudhud and Phailin cyclone in the recent past. The ESCAP/WMO Typhoon Committee is currently composed of 14 Members: Cambodia; China; Democratic People’s Republic of Korea; Hong Kong; Japan; Lao People’s Democratic Republic; Macao; Malaysia; the Philippines; Republic of Korea; Singapore; Thailand; Socialist Republic of Viet Nam and the United States of America.
Map 2.3
Flood risk in the South-East Asia Region

Indicators (1900-2015)

Number of events
Injuries
Deaths

Scale of hazard exposure

Source: INFORM Index 2016
EM-DAT 2016
Map 2.4
Cyclone risk in the South-East Asia Region

Indicators (1900-2015)
Number of events
Injuries
Deaths

Scale of hazard exposure
0.0 – <2.0
2.0 – <4.0
4.0 – <6.0
6.0 – <8.0
8.0 – <10.0

Source: INFORM Index 2016
EM-DAT 2016
To show comparisons in a proportionate manner, the number of deaths and injured were divided in two sections of total deaths <1,000 and >1,000. The number of deaths and injured due to cyclones were maximum for Bangladesh and Myanmar in 1991 and 2008. Deaths were comparatively less for India and almost nil for Indonesia. Although India is at highest risk of cyclones, it has endured fewer deaths, perhaps owing to its preparedness levels. According to the cyclone risk map, Indonesia and India have the highest cyclone mortality risk in the Region, followed by Bangladesh, Myanmar and Thailand. In the remaining countries cyclone mortality risk is very low. The tropical cyclone component is an aggregation of the arithmetic average of physical exposure to cyclonic wind and cyclone surge. The wind hazard maps display different intensity levels of cyclone wind presented in terms of the Saffir-Simpson Hurricane Scale (Category 1–5). Two hazard zones for each country were extracted for the same return period using two different minimum intensity levels (SS1 and SS3). Countries with high exposure to cyclones were India followed by Myanmar and Bangladesh with zero risk for Bhutan and Maldives. DPR Korea came in the medium risk category while Indonesia, Nepal, Sri Lanka, Thailand and Timor-Leste showed low risk of cyclone.

Intergovernmental body established in 1968 under the auspices of the United Nations Economic Commission for Asia and the Far East (UNECAFE) and the World Meteorological Organization (WMO) to promote and coordinate the planning and implementation of measures required for minimizing loss of life and material damage caused by typhoons in the ECAFE Region. Later, in 1974, the Commission was re-designated as the Economic and Social Commission for Asia and the Pacific (ESCAP). Similarly, a panel was established in 1972 chaired by Bangladesh with Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand and Yemen as members.

**Crippling effect of droughts on lives and livelihood**

Large areas of the SEA Region come under the threat of droughts of varying intensities. Droughts affect most countries, including Bangladesh, Democratic People’s Republic of Korea (North), India, Indonesia, Nepal, Sri Lanka, Thailand and Timor-Leste although Bhutan, Maldives and Myanmar have not faced any major drought so far. Droughts affect large populations more than any other hazard. Since agriculture is a predominant activity in the Region, droughts threaten the livelihood of large population groups. Some highly drought-prone areas are also affected by floods, accentuating harsh living conditions of people living in those parts. Droughts have direct and indirect impacts. Direct impacts include reduced agricultural production, depleted water levels
and higher livestock mortality, leading to induced indirect impacts such as reduced farmer income, rural unrest, unemployment and farmer migration. In recent years, the rising number of farmer suicides have been linked to droughts. According to the SEA regional database, from 1966 to 2016, the maximum instances of drought were reported in Bangladesh followed by India, Indonesia and Sri Lanka. More than 500,000 people in Bangladesh have been impacted by droughts in 42 of the last 50 years. In terms of reported deaths, Indonesia was statistically ahead of India. Despite being a small nation, Sri Lanka has seen many droughts. Democratic People’s Republic of Korea, Nepal, Thailand and Timor-Leste have also faced droughts in recent years.

Summary of essential health services coverage

The UHC Index described earlier is especially relevant as it covers critical indicators necessary for better health in a risk reduction and preparedness perspective. Looking at the SEAR UHC Index the following points emerge:

- Maternal and child health needs and services have achieved certain levels of coverage in most countries. It is important to look at how these can scale up in emergencies to address access to safe delivery and neonatal, infant and child care. Addressing reproductive, maternal, neonatal, child and adolescent health (RMNCH+A) needs in emergency settings remains a priority.
Map 2.5
Drought risk in the South-East Asia Region

Scale of hazard exposure
- 0.0 - <2.0
- 2.0 - <4.0
- 4.0 - <6.0
- 6.0 - <8.0
- 8.0 - <10.0

Indicators (1900-2015)
- Number of events
- Injuries
- Deaths

Source: INFORM Index 2016
EM-DAT 2016
Map 2.6
Risk for natural hazards in the South-East Asia Region

Vulnerability
Lack of Coping Capacity

INFORM Risk

0.0 - 2.0
2.0 - 4.0
4.0 - 6.0
6.0 - 8.0

Indicators

Source: INFORM Index 2016

For both Vulnerability and Lack of Coping Capacity the Scale is 0-10.
Map 2.7
Risk for natural hazards with UHC Index in the South-East Asia Region

UHC indicators
- Overall essential health services coverage index (Scale: 1–100)
- Reproductive, maternal, child and neonatal health
- Infectious diseases
- Noncommunicable diseases
- Service capacity and access

Source: INFORM Index 2016
UHC Index 2016
<table>
<thead>
<tr>
<th>Country</th>
<th>Reproductive, maternal, child and neonatal health</th>
<th>Infectious diseases</th>
<th>Noncommunicable diseases</th>
<th>Service capacity and access</th>
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<tr>
<td></td>
<td>Family planning coverage (%)</td>
<td>Infectious diseases</td>
<td>Noncommunicable diseases</td>
<td>Service capacity and access</td>
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<td>TIMOR-LESTE</td>
<td>38 47 76 71</td>
<td>48 - 100 41</td>
<td>45 100 1 44</td>
<td>100 46 - 66</td>
</tr>
</tbody>
</table>

- Family planning coverage (%)
- Pregnancy care (%)
- Child immunization coverage (DPT3 %)
- Care seeking behaviour of suspected pneumonia (%)
- Reproductive, maternal, child and neonatal health
- Tuberculosis detection and treatment (%)
- HIV antiretroviral therapy coverage (%)
- Insecticide treated bednets or indoor residual spray coverage for malaria prevention (%)
- Access to improved sanitation (%)
- Infectious diseases
- Prevalence of normal blood pressure level in population (%)
- Mean fasting plasma glucose (mmol/L) (Rescaled value)
- Cervical cancer screening (%)
- Tobacco non-use (%)
- Noncommunicable diseases
- Insecticide treated bednets or Indoor residual spray coverage for malaria prevention (%)
- Access to improved sanitation (%)
- Service capacity and access
- Density of hospital beds , expressed as % of global threshold, 18/10 000 (proxy for basic hospital access)
- Health worker density, expressed as % of new global threshold, 44.5/10 000
- Access to essential medicines (%)
- Health security: IHR compliance (%)
The capacity to prevent and control communicable diseases is different in countries and depends on the complexity of their own health systems and the nature of communicable diseases that are endemic. SEA Region countries have progressed but a lot needs to be done in this area. Here, IHR mechanisms, including all aspects of the new monitoring framework proposed, can guide the countries in further strengthening their health systems.

The overall concern is the rise of noncommunicable diseases (NCD); which should provide the impetus for a rethink of contingency plans and support whenever there is a disaster. A clear plan for supporting the continuum of care for NCDs, especially those with highest prevalence (for example, diabetes, hypertension, heart disease, etc.) and requiring maintenance medicines and care, should be in place.

In terms of service delivery capacities:

- the resilience of health facilities is key in all its aspects that includes structural, non-structural and functional. Health facilities must withstand any event caused by hazards in their location and remain functional in order to serve the population when it is needed the most. In making disaster resilient health facilities, it is important to intervene in the design and planning stage. Costs for retrofitting health facilities can be very high, while incorporating risk reduction measures at the outset which is more cost-effective, about 1% to 4% of the total value of the hospital.\(^6\) Retrofitting non-structural elements in an otherwise structurally sound facility costs about 1% of the hospital's budget but will protect up to 90% of its value.\(^7\)

- the challenge is building health facilities in areas that are at risk for multiple hazards.

- strengthening the capacity of the health workforce, especially frontline service providers, can be possible by setting up efficient referral systems. The health workforce must be capacitated in mass casualty management and systems that support this. Setting up national emergency medical teams is another area that can contribute to a health workforce that is ready and responsive.

- all essential medicines as per the national list should be freely available in public health facilities and this supply chain management system should be resilient to work effectively in the aftermath of a disaster.

\(^6\) Principles of Disaster Mitigation in Health Facilities PAHO/WHO; 2000
\(^7\) How to safeguard health facilities; World Health Day 2009
many countries in the Region have policies to absorb health expenditure in a response. However, in many countries, disability as a result of disaster can draw resources from out of pocket and aggravate poverty. So an adequate system of health financing makes good sense for resilient communities that can absorb such shocks.

These are the key health and health system issues that need to be addressed in risk reduction and preparedness whether dealing with a disaster from a natural hazard or even an outbreak.

**Recommendations for better disaster risk management**

The current risk assessment indicates that the SEA Region is homogenously at risk of different disasters depending on the geographical and other aspects that are unique to each country in the Region. The variations are driven by inherent characteristics of threats as well as regional and local vulnerabilities, particularly related to their infrastructure and government policies and human resource capabilities. Overlaying the SEA Region HC Index highlights what can be done in the health sector – before, during and after any disaster – in order to minimize health risks. The following recommendations are suggested to strengthen the resilience of countries in the Region to the different disasters that are likely to threaten the health, lives, livelihood and property of their people.

**Strengthen existing national policies, frameworks and regulatory mechanisms and create greater efficiencies in disaster preparedness and mitigation efforts:** First and foremost, there is a need to develop and implement policies that are most suited to the Region keeping in mind its vulnerability to a particular disaster. These should be based on risk analyses, incorporating principles of DRR in the relevant national policy and framework and promoting systematic integration of health into national and subnational DRR policies and plans. Through consensus of experts, key health facilities must be created in safe zones and a health policy for health facilities must further strengthen their capacities during response to a disaster. Health planning and mitigation measures should be part of institutionalized mechanisms and the structural and functional stability of health facilities must be enforced with strict implementation of construction codes. Multisectoral planning and action to manage health risks from all types of hazards, including the implementation of the IHR (2005), should be strengthened. From the findings mentioned above it is clear that health policies that address UHC gaps are required.

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* Bangkok Principles for the implementation of the health aspects of the Sendai Framework for Disaster Risk Reduction 2015-2030
Upgrade disaster plans and mitigation strategies as per latest international guidelines and norms: Integrate disaster risk management plans at all levels (primary, secondary and tertiary) of health-care and related services. Hazard specific approaches are required. In case of earthquakes, for instance, land use patterns and urban planning norms must emphasize the need to include earthquake hazard zoning in city plans. Lifeline structures, especially health facilities, must be assessed regularly, structurally and especially for their functionality to withstand natural disasters. The health sector needs to lead this and work with other sectors.

Focus on strengthening infrastructure: Health facilities at all levels are part of critical infrastructure that need to be seismic resilient. Enhance the safety functionality and resilience of critical health infrastructure and facilities by conducting safety assessments, strengthening the implementation of the Safe Hospital Initiative and applying the principles of “Building Back Better” in recovery and reconstruction, in coordination with communities. Based on findings, expert inputs, recent events and global best practices, specific initiatives must be taken to upgrade and strengthen health infrastructure that is aligned to the local context.

Existing health facilities must be maintained in good working order since disaster events can also come without warning. There are also areas which don’t fall in the purview of the health sector, however, health leaders can advocate for other protective infrastructure to be in place to protect the health of communities and health infrastructure. For example, in case of tsunamis, establishing coastal bioshields (mangrove plantations) and coastal forests will go a long way in protecting communities residing near the coast. Promoting construction of submerged dykes along the stretch of the coast will help decrease the impact of tsunami waves and protect vital installations such as existing health facilities.

In case of floods, enhancing the safety of dams, reservoirs, construction of embankments and levees through periodic checks and regular maintenance must be a priority. In case of cyclones, constructing multipurpose cyclone shelters in coastal areas which are prone to frequent cyclones will provide relief from the initial onslaught while building hazard resistant and safe houses in the coastal belt of the SEA Region will provide a more permanent safeguard. In case of earthquakes, strengthening and undertaking seismic retrofitting of prioritized lifeline structures and buildings must be incorporated at the design stage of architectural planning. In famine-prone areas, developing the culture of fodder storage facilities will help maintain fodder banks while construction of water conservation structures such as check dams and groundwater recharge augmentation systems will serve as a lifeline in the long days and weeks before help arrives.
Strengthen the health system by training and improving the number of health professionals deployed during and post disasters: Integrate DRR into health education and training and strengthen capacity-building of health workers. Set up resource centres to provide adequate support before, during and after an event. Emphasize preparedness of health professionals by clearly designating in advance their roles and responsibilities along with regular exercises/drills to maintain functionality to be replicated in other vulnerable settings. Having well-proportioned resources and rescue teams would be critical in managing the initial impact of the disaster. In cyclone-prone areas for instance, training of ground staff close to coastal areas must be made mandatory and these must be backed with regular refresher trainings on the latest and most appropriate early warning systems and evacuation routes.

Each country must set up emergency medical teams for deployment within the country and possibly the SEA Region in the event of a disaster or outbreak. These teams must be integrated with the different agencies that are called in to manage a disaster or outbreak. Proper coordination between them will be possible only if there is systematic preparation and implementation of an integrated plan, be it for flood, famine, earthquake, cyclone or tsunami.

Create awareness among vulnerable communities and health workers: Local communities must be shown vulnerable zones that are likely to be impacted in the event of a tsunami, flood, earthquake or cyclone. They must know how to safeguard themselves, their cattle and livelihoods in the event of a famine. Educating them on recognizing natural warning signs like the rapid fall in sea level as the ocean recedes, exposing reefs, rocks and fishes on the sea bottom or the unusual disappearance of water or an oncoming wall of water will make them more vigilant and attentive to an approaching disaster. However, communities must be supported with communication channels for early warning and facilities for evacuation will be critical in life-saving.

Promote a community-based disaster management culture: This has to be pervasive and supplemented by joint planning, simulation and mock exercises. Strengthen risk awareness and preparedness at personal, family and community levels, duly supported by governments. Strengthen communication networks to ensure that timely help and rescue is reached to those who are worst affected. Community groups and volunteers must be identified and trained to play a leadership role, especially in areas where disasters are known to strike.

Build partnerships to promote technical aspects: Strengthen cross-border and intersectoral partnerships for assessing and managing risks, such as coordinated vaccination campaigns and disease surveillance. Support from and collaboration with expert agencies must be achieved by striking meaningful partnerships to enhance the efforts of disaster mitigation. Public–private partnerships can be sought to set up suitable water efficient irrigation systems (sprinklers,
drip irrigation, etc.). Technical support can be enlisted to build water conservation structures and drinking water storage facilities. Strengthen coordination bodies, committees and platforms at all levels for emergency and disaster risk management for health, including multisectoral and multistakeholder participation.

**Step up systems that allow identification of sensitive zones:** Regular review and assessment of existing infrastructure and new structures must be undertaken especially in areas that are under threat. Seismic zones of vulnerable locations, cities and towns in the Region and also low-lying and flood-prone areas must be identified. Encourage desilting/dredging of rivers to improve the flow, drainage and floodwater diversion through existing and/or new channels to minimize damage during a flood, cyclone or tsunami. Promote the use of innovative communication approaches for dissemination of early warning messages, including outbreaks and emergencies, particularly to at-risk communities.

**Assess post-disaster loss and damage:** Integrate health needs fully into post-disaster needs assessment and recovery planning. The SEA countries have faced a number of disasters in recent years, but a foolproof mechanism is yet to be in place to assess losses, especially in the health sector. This must be followed by extensive discussions at a multisectoral level to find appropriate safeguards with respect to minimizing losses to individuals, communities and the state governments.

**Make effective use of technology:** Ensure the functioning and use of community radios; HAM radio or “amateur radio” can be extremely effective vehicles of information dissemination at the local level. Institutionalizing satellite-based, Geographical Information Systems (GIS) aligned monitoring mechanisms to prepare timely advisories related to drought forecasts and assessment of water deficits in the Region will help disaster teams to beam messages regularly, on time and to large audiences. Advocate for and support cross-sectoral, transboundary collaboration including information sharing and the deployment of science and technology for all hazards, including biological hazards. Promote the development and application of evidence-based practices through health science and technology and targeted operational research for all-hazards emergency and disaster risk management.

**Make research and documentation an ongoing activity:** Collect and integrate disaggregated data on exposures and vulnerabilities and capacities, for all-hazard risk assessment, including baseline data for planning and monitoring purposes. Take up detailed study of health facilities and identify strengthening requirements that need to be taken up on priority basis in each country. Undertake specific research studies and documentation of processes, strategies and innovations and create sharing platforms for mutual learning, interactivity and engagement. Collect and publicize best practices and case studies on mainstreaming DRR in health.
Where do we go from here

While these recommendations can be seen in the context of the specific country and its existing policy frameworks, infrastructure and resources, a concerted effort has to be made by all agencies and sectors not just within the country but also those they share borders with, to work towards reduction and treatment of the three risk factors, namely, hazards, exposure and vulnerability. Disaster management plans must be instituted and followed at the national level, along with provincial- and district-level plans. Each of these must then address their unique health scenarios in a systematic manner.

This risk analysis has shed light on specific risks, hazards, vulnerabilities and coping capacities of each of the 11 countries in the SEA Region. It will help Member States to move towards a safer future as they take actions to prevent and reduce the risk to life, property, social and economic activities and natural resources from natural hazards.
Communicable disease threats in South-East Asia: a risk profile
Summarizing the rationale for the risk assessment and its findings

The WHO South-East Asia Region suffers from a high burden of infectious diseases, which contribute more to the total disability-adjusted life years (DALYs) lost (42%) than the world as a whole (40%). In addition to human losses, a more serious impact of infectious diseases is the economic burden on communities and nations, which is far more severe and disproportionate among countries of this Region than elsewhere. Further, the Region is home to dynamic systems in which there is a complex interplay of biological, social, ecological and technological drivers. This enables microorganisms to exploit ecological niches, putting the entire Region at high risk for emerging infectious diseases (EIDs). Under the aegis of the Regional Office, the Region has responded to the demands of the International Health Regulations (IHR) (2005) with strategic frameworks, in order to strengthen system capacity to deal with EID threats and prepare for multiple hazards. As a result, surveillance and response capacities have improved and the Region is far better prepared to detect and respond to these threats than ever before.

As part of the systematic risk assessment carried out by the Region, risks affecting EIDs were mapped. The assessment of major communicable disease syndromes and select communicable diseases was done using a combination of methods. This dynamic exercise characterized threats, reviewed exposure and assessed vulnerability to communicable disease threats. Further, priority syndromes and select communicable disease hazards were identified based on a literature review and predefined criteria adapted from standard internationally applied tools. This was followed by adapting the Disease Attribute Intelligence System (DAISY) risk assessment tool and applying it to each of the priority hazards in the 11 Member States of the Region to assess the risk of large public health threats by country. The risk assessment was based on cumulative scores and risk ranks.

The five syndromes and corresponding priority diseases assessed included severe acute respiratory illness represented by Middle East respiratory syndrome (MERS), acute watery diarrhoea represented by cholera, acute haemorrhagic fever represented by Crimean–Congo haemorrhagic fever (CCHF), acute encephalitis syndrome represented by Japanese encephalitis (JE) and acute febrile illness with rash represented by Zika virus disease (ZVD).

Based on inherent characteristics, the biggest threat to the Region was found to be in the form of MERS, followed by CCHF. However, the assessment revealed that the Region is homogeneously vulnerable to all five threats, as was evident from the narrow range of risk scores across diseases and countries. A further risk ranking, however, revealed some differences in risk profile by disease and country. Bhutan, Bangladesh, India, Nepal and Timor-Leste were assessed to be at higher risk for a maximum number of threats in the Region.

Going forward, it will be important to understand the discrepancies in findings and mount focused efforts to build and practise the skill of risk communication within the health system. The current risk assessment and subsequent similar efforts will be steps in the direction of mitigating present and future infectious disease threats and their risks.
**Trends in infectious disease burden of South-East Asia Region**

The WHO SEA Region accounts for a fourth of the world’s population, 30% of the global disease burden and the highest proportion (26%) of global mortality, as compared to other WHO regions. As a percentage of the world’s disease burden, it accounts for 64% of the burden of measles, 36% of tuberculosis, 33% of upper respiratory infections, 52% of dengue and 28% of diarrhoeal disease. Correspondingly, it records some of the highest annual incidence worldwide of diarrhoeal diseases, lower respiratory infections, malaria, measles and dengue.

**“Hotspot” for emerging infectious diseases**

The Region is considered a “hotspot” for emerging infectious diseases, including those with pandemic potential. It has witnessed several outbreaks of new and emerging infections as new microorganisms appear and existing ones alter their characteristics to promote their survival at the expense of human health. Japanese encephalitis, Nipah virus disease, leptospirosis, drug-resistant microbes such as New Delhi metallo-beta-lactamase 1 (NDM-1) and artemisinin-resistant malaria are a few of the emerging and re-emerging infectious diseases that have appeared recently and have now established endemcity.

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**Intensified agriculture, a trigger for the spread of disease**

Agriculture is a dominant source of income, especially in rural parts where total agricultural area has increased by over 8% between 1990 and 2008. Cultivation of paddy, for instance, has seen a 30% increase across the Region. It has a direct consequence in terms of vector-borne diseases such as JE and leptospirosis. It also attracts wild birds and, with them, viral pathogens such as novel influenza viruses.
Inherent vulnerabilities such as poverty (over 40% of the world’s poor live in the SEA Region), gaps in policies and interventions, lack of sustainable financing to scale-up interventions and competing priorities of international aid agencies and donors for the prevention, control and treatment of communicable diseases, put the Region more at risk for EIDs. This is evident in the Region by the fact that the share of total DALYs lost due to communicable diseases is higher than the regional average (approximately 30%), in Bangladesh (48%), Bhutan and India (44% each), Myanmar (46%), Nepal (49%) and Timor-Leste (58%). In contrast, this proportion is lower than the regional average in Sri Lanka (15%) and similar to it in the Democratic People’s Republic of Korea, Indonesia, Maldives and Thailand.

**What drives the trend**

Rapid economic development may have brought many benefits to the SEA Region, but on the flip side, it has resulted in widening health inequalities, rampant environmental degradation, increasing migration and urbanization and an increase in urban population density, food production and economic activity. In places, porous borders have led to illegal and free movement of human, livestock and wildlife trade and along with them, pathogens.

With a total population of 1.86 billion, the Region\(^1\) is considered to be the most populous in the world. A resultant increase in human–human contact brings other ecological forces into play, such as changing land use, agriculture and livestock intensification. All these contribute to increasing the risk of emergence and spread of infectious diseases. Further, in the absence of adequate biosecurity measures in largely backyard settings, the human–animal interface remains poorly guarded, increasing further the risk of emergence and spread of infections such as JE, Nipah virus disease, avian influenza and antimicrobial resistance between countries of the Region and beyond.

**Improving surveillance and response capacities**

Several strategic efforts, including the implementation of IHR (2005) have in recent years contributed to strengthening systemic preparedness and response capacity in the Region. The Region is far better prepared now to detect and respond to EIDs. However, the quality and coverage of implementation needs to be more consistent across countries.

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\(^1\) Over 40% of the world’s poor live in the SEA Region
**The Integrated Disease Surveillance Programme's (IDSP)'s focus on surveillance and response to EIDs:**
Promoted by the SEA Region in the 1990s, the IDSP called for intersectoral coordination for better preparedness and response to EIDs.

**Revival of the IHR (2005) and aligning these to suit global realities:** The threat of EIDs received renewed attention post the outbreak of severe acute respiratory syndrome (SARS) in China and its rapid global spread. WHO responded by adapting IHR to suit these realities while focusing on health systems strengthening.

**Development of strategic frameworks:** The demands of IHR led to finalization of a series of strategic frameworks aimed at strengthening system capacity in the Region to deal with EID threats while preparing for multiple hazards.

**Multisectoral collaboration for border health management:** Recommendations of the 2007 bi-regional meeting on “Cross-border Collaboration on Emerging Infectious Diseases” included strengthening border health collaboration, surveillance and response mechanisms and multisectoral collaboration for border health management at local/intercountry levels.

**Identification of research priorities:** In 2009, the SEA Regional meeting on “Research priorities in communicable diseases” saw experts acknowledging the acute research–policy disconnect. They identified research priorities in HIV, malaria, tuberculosis, vector-borne diseases (VBDs), neglected tropical diseases (NTDs), acute respiratory illnesses (ARIs)/diarrhoeal diseases and EIDs.

**Expanding the scope of the Asia Pacific Strategy for Emerging Diseases (APSED), 2010:** The scope of the Strategy was widened to include surveillance, risk assessment and response; laboratories; zoonoses; infection prevention and control (IPC); risk communication; public health emergency preparedness; regional preparedness, alertness and response and monitoring and evaluation (M&E).

**Strengthening the capacity of public health laboratories:** Members of a strategic group convened by the Regional Office in 2011 recognized the limited capacity of public health laboratories to provide comprehensive services for diagnosis and characterization of emerging pathogens. A decision was then taken to operationalize regional laboratory networks.
**Need for a systematic risk assessment**

Limited tools and methodologies have kept the Region from undertaking a refined assessment of the distribution and profile of risks for disease emergence. There are a number of reasons for this limitation, such as geographic heterogeneity, interaction of different drivers of the evolution of pathogens, crossover and dispersion and dynamic systems. The elements of uncertainty inherent in such assessments are also limiting. However, a few risk assessments in the past have attempted to understand the preparedness of and response in the Region to specific emerging diseases and, in doing so, highlighted several gaps that are summarized below.

**Limited subnational capacities:** Previous experience of global infectious disease threats facilitated preparedness in terms of multilevel and multisectoral collaboration and coordination structures, multidisciplinary rapid response teams at the central level, capacity for public communication and social mobilization and laboratory capacity. However, most of these existed at the national level with serious lacunae in subnational capacity, especially in large countries. Some of these gaps, such as lack of subnational laboratory capacity, can result in delays and potentially grave consequences for disease control.

**Gaps in critical capacities:** Many countries in the Region are unable to adequately respond to emerging threats from new and re-emerging diseases or to surges in demand that might accompany them. Gaps exist in critical capacities, which could relate to systematic risk assessment and subsequent risk communication. Challenges pertain to quality, coverage and timeliness of surveillance systems (especially in animal health) and include early warning systems. At the health facility level, countries still do not have good facility-level IPC programmes. They struggle with health workforce shortages and limited skills and multimodal strategies. Also, inspite of IHR (2005) being rolled out over a decade ago, dealing with the surge of cases is still a challenge, especially since the health-care system’s surge capacity continues to be constrained due to several reasons, such as improperly functioning incident management systems, limited space, supplies and staff at facilities, amongst others.

Regional challenges in the control of EIDs continue to be daunting. They range from compelling factors that drive disease emergence, to making surveillance systems fit for the purpose or to ensuring that regional governance mechanisms work effectively to improve control interventions. An important step in the prevention and control of EIDs is to conduct periodic...
reviews and systematic risk assessment before mapping risks that affect the emergence of infectious diseases in the Region. This risk assessment of major communicable disease syndromes and select communicable diseases was undertaken by the WHO Health Emergencies Programme SEARO as a dynamic exercise that aims to characterize threats, review exposure and assess vulnerability to communicable disease threats.

**Methodology adopted for risk profiling**

The risk assessment helped develop a risk profile of selected infectious disease threats in the SEA Region. Countries were ranked on the basis of the risk of spread of select infectious disease threats with a potential for public health disaster. The risk assessment tool (DAISY) for emerging human infectious diseases methodology was adapted for risk assessment of select communicable diseases in the SEA Region. It was used to establish a baseline, which will be further updated when new data come in.

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2 This risk assessment was done in the month of June 2017 based on evidence that existed for the period 1st July 2012 to 30th June 2017.
A three-step process was used to conduct the risk assessment

1. Identifying priority syndromes and select communicable disease hazards based on a literature review and predefined criteria adapted from standard internationally applied tools.

2. Adapting the DAISY risk assessment tool to each priority hazard in each of the 11 countries of the Region to assess the risk of large public health impacts by country and assessing risks based on cumulative scores and risk ranks using principal component analysis (PCA).

3. Presenting data in the form of graphs and choropleth maps to give a visual understanding of the risk to each country and Region as a whole.

**Step 1. Selecting communicable disease syndromes and diseases**

Major communicable disease syndromes that are widely under surveillance globally and in the SEA Region were shortlisted. Within each syndrome, common aetiological factors were identified following a literature review. Any disease with a known or unknown reservoir and mode of transmission was considered for inclusion in the list. One or more diseases with a known serious national and international public health impact were selected under each syndrome according to criteria adapted from the WHO-recommended surveillance standards and priority diseases enlisted in IHR (2005).

**Priority communicable disease syndromes and criteria for selecting diseases**

The study team identified five priority syndromes that are commonly taken up under communicable disease surveillance globally. These include acute watery diarrhoea, fever with rash, acute encephalitis syndrome, acute haemorrhagic fever and severe acute respiratory infection (SARI). Each syndrome includes specific diseases transmitted by different routes with a bearing on the nature and specificity of public health action. Within each syndromic category, a selection was made of one or more diseases based on a five-point criteria covering existence, impact, epidemic potential, specific programmatic focus and potential for public health action.

**Diseases identified for the risk assessment**

Five diseases were selected under five different syndromes, namely MERS, cholera, CCHF, JE and Zika virus disease (ZVD).
### Table 3.1: Priority diseases and rationale for their selection

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Priority disease and rationale for its selection for the risk assessment</th>
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<tbody>
<tr>
<td>Acute respiratory illness</td>
<td>MERS has, since its emergence in 2012, been reported in 27 countries (human cases too) in the Middle East and beyond, including SEA Region. It has significant socioeconomic impact, given the massive movement of pilgrims to Middle East and tourists to the Region and potential for the virus to travel along these routes; the case fatality rate is close to 35%. Most cases are found in the Middle East but potential for nosocomial spread is high and a cause of concern since the Region is plagued by weak surveillance and IPC programmes. Regular reviews have been carried out by WHO for reporting under IHR (2005). Each case needs careful observation, given the uncertainty around the reservoir host, period of communicability, modes of transmission, human–human transmission and case fatality.</td>
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<tr>
<td>Acute watery diarrhoea</td>
<td>Cholera is a leading cause of acute watery diarrhoea in the Region. It continues to cause large outbreaks with an estimated &gt;800 000 cases and 25 000 deaths. It has an important relationship with access to improved water and sanitation and the achievement of SDGs. It is reportable under IHR (2005).</td>
</tr>
<tr>
<td>Acute haemorrhagic fever</td>
<td>CCHF is an emerging disease in the Region with serious clinical manifestations and has a high case fatality rate. Health-care workers are particularly vulnerable due to its nosocomial spread. It is a significant threat for the Region, which has a high human and animal density, poorly guarded human–animal interface, widespread distribution of the vector and weak animal health and vector surveillance systems. It is reportable under IHR (2005) and is regarded as an important zoonosis that needs strengthening, One Health coordination and response.</td>
</tr>
<tr>
<td>Acute encephalitis</td>
<td>Japanese encephalitis is a leading cause of acute encephalitis. Nearly three billion people in 24 countries of the SEA and Western Pacific Regions are at risk. It has high morbidity and mortality and long-term clinical complications. In addition to seasonal increase in number of cases, it causes large outbreaks every 2–15 years, overwhelming health-care systems technically, operationally and socioeconomically. It is the focus of a dedicated disease control programmatic response (especially vaccination campaigns) in affected countries. The rural distribution and higher incidence in those &lt;15 years of age adds to a huge socioeconomic impact that calls for dedicated public health action.</td>
</tr>
<tr>
<td>Acute febrile illness with rash</td>
<td>Zika virus disease is a re-emerging disease that has serious clinical complications in vulnerable groups. The wide geographical range of the mosquito vector of the virus, vastly susceptible human populations and emerging complications of infection call for a global response. It is viewed as a major public health threat in the Region because it is difficult to distinguish from other similar illnesses, has weak disease surveillance (including vector surveillance) and public health laboratory support.</td>
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</table>
Step 2. Identifying a standard tool and assessing risks based on cumulative scores and risk ranks

For each of the five diseases, risk in the SEA Region was systematically assessed using the adapted version of the DAISY tool. It assessed risk across 25 attributes spanning five focus areas, including threat, regional vulnerability, monitoring of agents and social and economic impact. The risk to any disease is an interplay between risk-based management capabilities and socioeconomic impact.

Each attribute was scored over five scenarios of increasing risk levels. Raw scores of 1 to 5 were used to assess risk and the cumulative scores of all 25 attributes constituted the risk score for a priority hazard (disease) by country.

Special considerations in the risk assessment

Special attention was given to the DAISY risk assessment tool to adapt it to the regional context.

- Risk attribute 19 assesses “closest affected region” which is critical when determining local country vulnerability to a specific threat, especially when the disease is not present in that country. This is identified as the nearest country accessible within four hours by air instead of considering the WHO Region.

- Risk attribute 13 and 16 assess “disease containment capabilities” which are in the closest affected region and are locally estimated in a multihazard vulnerability and programmatic context, where the same health system is expected to respond to diverse infectious disease threats, more so in resource-constrained settings. Disease containment capability was estimated based on self-assessment for selected IHR core capacities in each country and applied commonly to all diseases in that country.

- Risk attributes 11, 12, 14 and 15 assess “human disease surveillance and surveillance of vector or reservoir or source control”. This was completed for the country being assessed and the

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1 The original DAISY methodology requires calculation of weighted scores followed by total risk scores by adding up the weighted scores. This involves calculation of weights based on expert opinion on increasing level of risk scenario using randomly mixed descriptors under each attribute. This weighting may differ between countries and for different diseases in different countries, making it complicated with the added risk of losing reliability. A single set of weights for all diseases in a country/region will not add much information, given diversity of countries and diseases. Hence, in the interest of efficiency and quality of scoring, it was decided to exclude expert-driven weighting of raw scores. Instead, key drivers of disease risk were identified following literature review to identify weights for attributes 20 and 21 and weighted scores calculated for these two attributes of exposure risk (Annexure 2). Cumulative weighted scores of all 25 attributes then constituted the risk score for that particular hazard by country.
Communicable disease threats in South-East Asia: a risk profile

Key indices or drivers of disease transmission were identified from the literature review, suitably transformed into weights and these weights were then applied to risk attributes pertaining to exposure risk to arrive at the weighted risk.

Overcoming limitations of the DAISY tool

The DAISY tool and the quality and source of data to support risk scoring had its share of limitations in the risk assessment, which were duly addressed.

Assessment confined to five diseases: The vulnerability assessment was limited to five diseases, which may be insufficient to assess overall regional vulnerability. It may lack specificity from the perspective of public health intervention, given the different modes of transmission of different threats when following a syndromic approach. This was overcome by identifying priority threats based on available peer-reviewed evidence following objective criteria to assess vulnerability in different systemic core capacities, rather than looking at disease-specific interventions.

Limited peer-reviewed evidence on application of core risk assessment methodology: In spite of having limited peer-reviewed evidence to support its reliability, validity and application, the DAISY tool was found to be an objective vulnerability assessment tool developed by the Environmental Science and Research Limited, New Zealand. It addressed all components of a systematic risk assessment, with practical examples of application in the programmatic context for different diseases, countries and regions.

Reliance on indirect inferences: Although some indirect inferences were made from available evidence and expert opinion, which did not directly validate findings, multiple sources of information actually helped triangulate the evidence. They limited the need for non-documentary evidence by referring to expert opinion in <25% scoring opportunities. Experts contributed with their knowledge of infectious diseases, especially relating to the epidemiology of diseases in the Region.
Possibility of an overestimation of capacities: Disease-containment capability at the regional and local levels is a critical determinant of vulnerability. This was determined based on IHR self-assessment. A likely overestimation cannot be entirely ruled out. On the other hand, specificity was brought in by disease- and country-specific assessments of human surveillance, vector/reservoir/source surveillance, laboratory capacity and vaccination.

Certain assumptions made: The study assumed that large countries were homogeneous when being assessed for any attribute, while there could be wide subnational variations in seeking attention from epidemiological and political standpoints. This was seen more in the light of the assessment being an initial exercise aimed largely for advocacy and looking at preparedness to communicable disease threats in the Region.

Most inferences drawn for the Region and not country-specific: Recommendations may lack specificity at the country level but since this was mostly an advocacy effort, highlighting regional vulnerabilities with a corresponding call for action, it is suggested to follow it up with a country-level assessment later. At that point, it can serve as a standardized tool providing a more nuanced and comparable inference drawn by country.

Step 3. Identifying and listing data sources and experts
Risk profiling is a complex exercise that requires extensive data support on different attributes and expert consultations. For each of the diseases taken up for the 11 countries, scoring was done in the DAISY tool based on reliable evidence mined from multiple sources. A scoping review methodology, which is well suited for addressing the broader, more complex and exploratory set of research questions pertaining to a risk assessment, comprised conceptual mapping of the subject under research, followed by mapping of sources, which included peer-reviewed literature, grey literature, policy documents and consultations with experts. The database was organized in a spreadsheet in Microsoft Excel and separate sheets were created for individual diseases. Within each sheet, columns were arranged according to risk attributes (for scores) and rows were arranged by country. The scoring and evidence was reviewed by attribute, disease and country by experts.

The risk for priority diseases was studied descriptively by comparing and contrasting risk scores by disease, country and attributes. PCA was adopted to simplify ranking of the risk for the country using a reduced number of factors and carried out for all five diseases in each of the 11 countries. Briefly, data on risk attributes that measured multiple aspects of risk status and explained the maximum variation in the risk data for each disease were utilized to extract their underlying
constructs. After creating standard indices, scores were categorized in five groups (lowest to highest quantile, i.e. risk rank categories 1–5 of low risk, moderately low risk, moderate risk, moderately high risk and high risk, respectively) by using the quintile formula.

**Results based on application of the risk assessment tool**

Risk assessment was completed by adapting the DAISY tool followed by PCA to arrive at a risk ranking of countries for individual diseases. This section describes the trends in the scores of 25 risk attributes for each of the five diseases, followed by a description of the cumulative risk scores by disease and country. Finally, the risk ranking of countries by diseases is detailed.

**Attribute score characteristics**

**Inherent characteristics of the threat:** Risk based on identification of the disease was the same for all five diseases, as all required laboratory diagnosis for confirmation. Risk due to reservoir was highest for cholera due to water/environmental reservoirs, while three diseases (JE, MERS and CCHF) had a zoonotic reservoir. Mode of transmission contributed maximum risk in case of MERS (air/respiratory droplet) followed by cholera (water). Three diseases (JE, CCHF and ZVD) were transmitted by vectors (mosquito and tick) and the risk was highest when the mean incubation period was <1 week in three of the five diseases (cholera, CCHF, MERS) followed by ZVD and JE with a mean incubation period of <2 weeks. Except for JE, which has no human-to-human transmission due to transient viraemia, all other diseases had a period of communicability at least eight days (risk score 3–5). In case of CCHF and MERS, the period of communicability was not known conclusively, putting them at higher risk due to this factor (Figure 3.1).

Except for JE, which affects children 5–19 years of age, all age groups were susceptible to the remaining four diseases and therefore had similar risk due to susceptibility. With the exception of cholera, the risk due to effectiveness of treatment was high and similar in four diseases (ZVD, CCHF, MERS, JE), as the treatment was found to be minimally effective or ineffective (only supportive care). Risk based on case fatality was highest in CCHF, MERS and JE, with all three showing a high case fatality of >25%. Cholera and ZVD are mild diseases. Method of control contributed the highest risk in case of CCHF, MERS and cholera, which were found to require more aggressive methods of control such as temporary to prolonged isolation, contact tracing and surveillance of contacts.
Regional vulnerability: Across all diseases, the closest affected regions were those that were less than a four-hour flying distance. Apart from there being local transmission of the disease, there was the possibility of the infection being carried across borders. In case of MERS there was an exception, as the Middle East is the closest affected region, which is more than four hours flying distance for all countries (except in case of India which has a flying distance of less than four hours).

Risk due to closest affected region was similar in four diseases other than MERS. Except for MERS, which was found to have lower risk (with country-level variations), the risk was high (risk score 3–5) due to both human and vector/reservoir/source surveillance status in the closest affected region for all other diseases, as surveillance was found to be mostly minimal or absent. Some ability to implement disease control measures was found for all diseases in the Region, with the ability to implement adequate control measures in case of MERS.

Local vulnerability: At country levels, risk due to the level of both human and vector/reservoir/source surveillance was found to be low in case of ZVD and MERS, with there being passive plus sample-based active or risk factor surveillance. For others (cholera, JE and CCHF), it was high due to

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Note: References to the alphabets above the circles provided on the left.
minimal or no surveillance. Some ability to implement disease control measures was found for all diseases at the local level. Laboratory capacity to provide timely diagnosis to guide public health response as a risk was highest for CCHF and MERS, taking 15–28 days for laboratory confirmation, which was possible within two weeks for other diseases. A population-level immunization programme existed for JE but for all other diseases, vaccination was not found to be available and prophylactic measures were typically pressed into action during epidemics, thus resulting in high risk due to methods of control.

**Epidemic dynamics:** The risk based on epidemic dynamics was highest for MERS and JE, while the other three diseases occurred sporadically, globally. The risk for MERS and JE was similar and could be because there were multiple reports of outbreaks in different regions (>4-hour flying distance). Comparatively, the risk was lower for CCHF because no cases were reported at the country and regional levels in majority of the countries. Regionally, except for JE, all other diseases were either sporadic in occurrence or had not been reported in the past two years. Barring JE (in India and Myanmar), local outbreaks in Member States were mostly absent for all other diseases in the previous two years.

In case of all three diseases, the risk at the global level was highest followed by regional level and was lowest at local level. Risk at local level was lowest maybe because cases were not reported in most countries. Furthermore, the risk gets amplified from the local to regional level and at the global level. This amplification occurs because first, even if no cases are reported at the country or local level, cases from countries that are within the four-hour flying radius will be included in the calculation of risk at the regional level. Second, while at the local level, occurrence of sporadic cases gets a score of 1, at the regional level, occurrence of sporadic cases gets a score of 2.

**Risk communication:** Risk based on risk communication was highest for ZVD and JE, followed by cholera, MERS and CCHF. This was due to a travel alert by the Centers for Disease Prevention and Control (CDC) of ZVD transmission in Maldives and ZVD-related travel advice in Bangladesh, India, Indonesia, Myanmar, Thailand and Timor-Leste. Similar alerts were recommended for MERS and JE in the Region. Comparatively for cholera, there was only one CDC travel advice notification in Thailand and no travel alerts or advice against CCHF reported in any SEA Region country. At the local level, only ZVD and JE attracted global media coverage and related local travel advice. Public perception of disease risks and public reactions were both appropriate and pragmatic. This indicated a fair amount of trust in the health system and its capacity to deal with all diseases in the past two years.
Individual disease attributes: In case of ZVD, the highest adverse risk score of 5 was attained in susceptibility (all age groups), followed by a high adverse risk score of 4 in effectiveness of treatment, vaccination or prophylactic measures instituted at the local level. At the regional level, the closest affected region being within four hours flying distance was an important risk contributor to overall risk (score 4). Susceptibility contributed the highest adverse risk score of 5 in case of cholera. These included closest affected region (disease being widely endemic in practically every country of the Region), water or environmental reservoir, short mean incubation period, long period of communicability, need for aggressive methods of control, minimal human and source surveillance at regional and local levels, prophylactic measures targeted only during epidemic activity in the absence of an effective vaccine – all contributed to an adverse risk score of 4.

CCHF scored a high adverse risk score of 5, due to the long period of communicability, susceptibility across all age groups, non-effectiveness of treatment, high case fatality and minimal-to-nil human surveillance at both regional and local levels. A short mean incubation period, need for aggressive methods of control, proximity to the affected region, limited local laboratory capability and absence of an effective vaccine and prophylaxis being pressed into action during epidemics contributed to a high adverse risk score of 4 to the risk profile.

In the case of MERS, long period of communicability, susceptibility across all age groups, lack of effective treatment, high case fatality rate, need for aggressive methods of control and multiple global outbreaks contributed to a high adverse risk score of 5 to the risk profile. As in CCHF, a short mean incubation period, limited local laboratory capability and absence of an effective vaccine and prophylaxis used only during epidemics contributed a high adverse risk score of 4 to the risk profile. In addition, the airborne/respiratory droplet mode of transmission added to the risk by contributing to a risk score of 4.

Absence of effective treatment, high case fatality rate, proximity to an affected region and multiregional epidemic activity were responsible for the high adverse risk score (score 5) in the case of JE. Minimal-to-nil human and vector surveillance at both the regional and local levels also contributed adversely to the JE risk (risk score 4).

Characteristics of cumulative risk scores calculated by disease and country
Risk scores that were assigned by disease and country were based on a range of indicators, such as modes of transmission, incubation period, case fatality, effectiveness of treatment, human and vector surveillance, among others.
**Risk score by disease:** The average risk score by disease in the SEA Region was highest for CCHF (76.8), followed by MERS (76.3), JE (73.0), cholera (72.3) and ZVD (68.9) (Fig. 3.2). The highest risk score of 81.3 was calculated for MERS (range: 71.1–81.3) among all priority diseases and among all countries, followed by CCHF (79.8; range: 73.4–79.8), cholera (78.4; range: 64.6–78.4), JE (77.0; range 77.0–68.0) and ZVD (75; range: 58.3–74.0) (Table 3.2).

Bangladesh scored the highest risk for CCHF (79.8) and Maldives the lowest (73.4). India scored the highest risk score for MERS (81.3) and Thailand the lowest (71.1). For JE, Bhutan scored the highest risk (77) and Thailand the lowest (68). In the case of cholera, India had the highest risk score (78.4) and the Democratic People’s Republic of Korea the lowest (64.6). Maldives scored highest for ZVD (75) and the Democratic People’s Republic of Korea the lowest (58.3).

**Risk score by country:** The average risk score by country across priority threats ranged from 76.2 to 68.8. India had the highest risk score for all diseases (76.2) and the Democratic People’s Republic of Korea the lowest (68.8) (Table 3.2).

**Table 3.2: Risk scores by country and priority threat in SEAR**

<table>
<thead>
<tr>
<th></th>
<th>ZVD</th>
<th>Cholera</th>
<th>CCHF</th>
<th>MERS</th>
<th>JE</th>
<th>Average risk score (by country)</th>
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<tr>
<td>Bangladesh</td>
<td>74.0</td>
<td>73.5</td>
<td>79.8</td>
<td>77.3</td>
<td>76.1</td>
<td>76.1</td>
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<td>79.2</td>
<td>78.0</td>
<td>77.0</td>
<td>75.4</td>
</tr>
<tr>
<td>DPR Korea</td>
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<td>64.6</td>
<td>77.1</td>
<td>73.0</td>
<td>70.9</td>
<td>68.8</td>
</tr>
<tr>
<td>India</td>
<td>70.0</td>
<td>78.4</td>
<td>76.8</td>
<td>81.3</td>
<td>74.7</td>
<td>76.2</td>
</tr>
<tr>
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<td>74.2</td>
<td>74.4</td>
<td>68.6</td>
<td>71.6</td>
</tr>
<tr>
<td>Maldives</td>
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<td>75.0</td>
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<td>72.6</td>
</tr>
<tr>
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<td>71.8</td>
<td>79.7</td>
<td>77.0</td>
<td>72.8</td>
<td>74.3</td>
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<tr>
<td>Nepal</td>
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<td>77.9</td>
<td>79.4</td>
<td>77.0</td>
<td>72.3</td>
<td>75.0</td>
</tr>
<tr>
<td>Sri Lanka</td>
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<td>75.2</td>
<td>76.0</td>
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<td>73.2</td>
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<tr>
<td>Thailand</td>
<td>67.0</td>
<td>70.5</td>
<td>75.6</td>
<td>71.1</td>
<td>68.0</td>
<td>70.4</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>69.3</td>
<td>73.4</td>
<td>75.1</td>
<td>79.0</td>
<td>75.8</td>
<td>74.5</td>
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<tr>
<td>Average risk score (by disease)</td>
<td>68.9</td>
<td>72.3</td>
<td>76.8</td>
<td>76.3</td>
<td>73.0</td>
<td></td>
</tr>
</tbody>
</table>
Figure 3.2: Risk score by disease, WHO South-East Asia Region

Figure 3.3: Risk score by country, WHO South-East Asia Region
**Risk assessment of select infectious disease threats**

The risk assessment was conducted against the backdrop of a range of underlying drivers of disease transmission in the SEA Region at three levels. First, the risk assessment analysed the interplay of individual risk attributes across different diseases. Second, this led to the development of a risk profile of selected infectious disease threats in the Region and, finally, based on risk scores and risk index, countries were ranked in terms of their risk to these infectious disease threats.

**Infectious disease threats: profile of risk attributes**

**Inherent characteristics of threats:** The five priority diseases identified as the biggest communicable disease threats to the Region included MERS, ZVD, CCHF, JE and cholera. Based on its inherent characteristics, MERS was found to have the greatest threat (threat score 38) to the Region, followed by CCHF (threat score 35) and ZVD, which was the least (threat score 25). In addition to other inherent characteristics that aid in their transmission (short incubation periods, long period of communicability, susceptibility across all ages), limited understanding about mode of transmission in case of MERS, lack of effective treatment along with high case fatality (>30%) in case of both MERS and CCHF, made them particularly threatening diseases for the SEA Region.

While cholera is endemic to the Region, JE has re-emerged in different parts, including spreading to urban and semi-urban areas and in places without pigs, thus indicating a potent bird–mosquito–human cycle. On the other hand, MERS, ZVD and CCHF have recently emerged in the Region, either by way of spillover from animal reservoirs (as in case of CCHF) or by introduction from emergent foci outside the Region.

The SEA Region’s agro-climate supports vector ecology that is likely worsened by rapid urbanization, urbanization of rural areas and changes in land-use patterns. This in turn allows vectors to breed in both rural and urban areas, while reducing the gap between rural and urban distribution of vectors. An increased incidence of malaria at higher altitudes in India, expansion of JE from Terai regions to Kathmandu valley and spillover of dengue to Bhutan from Sikkim are examples of the expanding threat of VBDs. From a systemic response perspective, limited vector surveillance capacity, both in terms of quality and coverage, poses the risk of rapid introduction and spread of VBDs in the Region. On the other hand, several attempts have been made to improve intersectoral coordination between the human, animal and environmental sectors, mainly in the aftermath of the avian influenza outbreaks. However, the gains are yet to percolate to subnational levels. Despite significant advances in core capacities to deal with known and unknown infectious disease threats due to IHR
implementation in countries, the SEA Region continues to lag behind in most core areas, especially at subnational level, thus greatly increasing the vulnerability of the Region. Surveillance capacity, laboratory capacity and human resources continue to be challenges, more so in the veterinary field. The wildlife and environment sectors have not been mainstreamed from the perspective of preparedness and response to EIDs. Most importantly, One Health collaboration at the systems level, which could provide a template for response to EIDs of animal origin, is still grossly inadequate. With majority of livestock production taking place in informal backyards using intensive farming practices, the threat of EIDs from animal sources remains the greatest for the Region - 70% of EIDs reported from the Region are of animal origin, with Nipah virus disease, avian influenza, Chandipura virus disease, CCHF being representative of some of these.

Majority of priority threats for the Region were characterized by shorter incubation periods, relatively longer periods of communicability (Point of Control or PoC; with PoC of MERS and ZVD yet to be established but likely to be on the longer side) and susceptibility across age groups. Each of these attributes contributes to easy spread of infection in human populations. Human and vector/reservoir/source surveillance showed wide variation from limited surveillance on one end to comprehensive active/risk factor surveillance on the other. While VBDs tend to spread less rapidly, high vector densities in most countries of the Region and waterborne/foodborne transmission of cholera result in easier transmission of these diseases. Typical watery diarrhoea may aid to some extent in a presumptive diagnosis. However, all other select threats need laboratory support, with most cases calling for advanced diagnostics before a specific clinical and public health response can be mounted, including in the case of JE, wherein changing epidemiology in endemic areas has led to questions being asked about the ability of recommended tests to detect infection and suggestion of diverse aetiological factors to explain the widespread incidence of acute encephalitis. Once these diseases spread, high case fatality rates, absence of pathognomic clinical features, lack of specific and effective treatment and prolonged need for isolation of infected cases results in the need for surge capacity, laboratory support, sound IPC and a skilled health workforce.

Regional vulnerability: This is determined by the proximity of the nearest affected region (and therefore the rapidity with which the spillover can happen across geographical areas), level of surveillance (human, vector, reservoir, source, as the case may be) and disease containment capability of the closest affected region. Across four select diseases, the closest affected region or disease activity was found to be at least less than four hours of flying distance and, in many cases, transmitted in the neighbouring country or locally transmitted. In the case of MERS, only India among all the SEA Region countries was within four hours of flying time from the affected
country (in the Middle East). While air travel time may not be the best indicator of vulnerability in this age of rapid and frequent air travel, a rather homogeneous occurrence of disease activity within and bordering the Region (countries of Western Pacific and Eastern Mediterranean) indicated similarities in the inherent vulnerabilities across countries, including disease and vector ecology. Surveillance for MERS was found to be better in the Region across countries and could be attributed to massive investments made in surveillance for zoonotic and pandemic influenza preparedness and response.

**Local vulnerability:** Given the homogeneous regional vulnerability, it is not surprising that the local vulnerability of Member States in the Region presents a uniform picture across diseases. Human surveillance for priority threats is minimal or at best limited to passive internal surveillance; as is also the case with vector/source/reservoir surveillance. Serology based diagnosis has allowed easier deployment of specific diagnostic capacity for select diseases, wherever applicable. However, laboratory capacity to handle dangerous pathogens such as MERS and CCHF continues to be limited in most Member States. This is reflective of the overall limited laboratory capacity, both at advanced and subnational levels and further continues to be a challenge for most countries.

Against the backdrop of inherent vulnerabilities related to disease ecology in the Region, this shifts the burden on health systems to prepare for and respond to these threats, be it surveillance, laboratory capacity, coordination or surge capacity to deal with evolving situations that are yet to be conclusively established to adequately exist in the Region. Since local disease containment capacity was based on IHR self-assessment, across diseases it was estimated that Member States have some ability to implement disease control measures. The Joint External Evaluation (JEE) is an independent expert-driven assessment of in-country IHR core capacities as part of the new Monitoring and evaluation framework of the IHR. This is expected to provide a better understanding of IHR core capacities and also guide focused interventions.

While progress has been made as a result of implementation of the IHR at the country level, a more nuanced appreciation is needed to identify gaps that need strengthening across IHR core capacities. This is particularly relevant for large and populous countries such as Bangladesh, India and Indonesia that demonstrate wide variation in subnational health system capacity and corresponding health outcomes.

**Epidemic dynamics in the SEA Region:** Epidemic dynamics as a measure of disease transmission activity and exposure was limited at the local level across all diseases except JE in outbreaks in India.
and Myanmar. Emerging diseases such as MERS and ZVD have been more active globally, but at the regional and local levels, are yet to be reported widely. Lessons from other global disease foci should be integrated into preparedness and response plans, especially because the Region is known to be lagging behind for long periods after the emergence of diseases outside and even following their introduction in the Region. For example, several years after the emergence of zoonotic influenza (H5N1) and after repeated calls for action by global agencies, pandemic influenza plans of SEA Region countries had several limitations and gaps. Similarly, recently conducted systematic risk assessment showed critical gaps in Ebola preparedness in the Region. Interestingly, despite the significant estimated regional burden of cholera, reported epidemic activity at regional and local levels has been extremely limited. Underreporting of cholera has been identified as an important surveillance gap that could seriously limit public health efforts to combat diarrhoeal diseases and attain developmental goals.

**Risk communication:** Media reaction, public risk perception and public reaction are all impacted by the nature of risk communication. Risk at the societal level is a direct function of the above three. While media represents the voice and perception of communities, especially in case of poor and marginalized sections in developing countries, “common sense” notions about scientific phenomena are picked up by mass media and represented in multiple ways. In the past, this has ranged from “othering” the threat, whereby segments of the population with habits such as poor hygiene, eating strange foods and other cultural/ethnic practices are blamed for being a source of disease (for example Ebola in West Africa, SARS outbreak) and for its spread. It also becomes an issue of national pride (NDM-1 in India), conveying perceived threats to commercial interests (NDM-1, variant Creutzfeldt–Jakob disease [vCJD] in the United Kingdom and conspiracy (NDM-1, vCJD in UK, Ebola in West Africa) and an upward blaming of privileged and elites (H1N1), including the health system and those managing and administering them.

These representations can cause a breakdown of trust between the community and authorities as a result of inappropriate reaction from the community and other stakeholders, which could in turn seriously jeopardize public health response, its efficiency and effectiveness. At the same time, the resultant overwhelming of the health system (2009 pandemic influenza) can dissuade the community from seeking health-care and lead to spread of infection in the community (Ebola in West Africa) and eventually a self-inflicted risk to the threat. While national authorities and international agencies have been calibrated and consistent in their messaging, media reaction and public response (as captured in and represented by the media) has been surprisingly
appropriate in case of both endemic and emerging diseases, except for JE in India, which has constantly been in the public eye and on the radar of local political circles every season. However, past evidence on serious gaps in risk assessment and risk communication strategy in the Region point more towards a case of information asymmetry and misperception among media and community stakeholders and their inability to perceive threats that are not immediate.

**Infectious disease threats: risk profile of individual diseases**

The assessment provided insights on the introduction and spread of selected diseases and the ecological and systemic preparedness that exists in each of the countries to contain these.

**CCHF (acute haemorrhagic fever)**

Dengue and CCHF were reported among major causes of acute haemorrhagic fever in the Region. The Region has also been assessed to be at risk for the introduction and spread of yellow fever and, in recent times, Ebola, which is yet to be reported. Dengue fever (and its complications) continues to be a dominant cause of acute haemorrhagic fever and is reported in 10 of 11 countries, with eight countries (or parts of the individual country) being hyperendemic. Annually, 2.9 million cases and 5,906 deaths occur in the Region, with 372 (210–520) DALYs per million inhabitants being lost every year. While large outbreaks of dengue have overwhelmed the health systems in different countries of the Region, expansion of the disease to newer areas (spillover of dengue to Bhutan from India) and rural areas has positioned dengue high on the priority list of infectious disease threats for the Region. Yellow fever is yet to be reported from the Region but given the suitability of the Region due to the presence of a potent vector (Aedes aegypti) in a vastly susceptible population, the risk of disease emergence and spread is real.

However, in the recent past, CCHF has been recognized as an emerging communicable disease threat in the Region (threat score 76.8; Table 3.2). Human cases of CCHF have been reported in two countries – India and Bangladesh (and in nearby Pakistan and Afghanistan) and so has the vector (different species of the Hyalomma tick) in Bangladesh, Bhutan, Democratic People’s Republic of Korea, India, Myanmar, Nepal and Thailand. In addition, nosocomial outbreaks of CCHF have been reported on several occasions. Porous borders between many countries and poor animal quarantine allow illegal and free movement of livestock between countries that could be potentially infested with infected ticks.
There is a significant overlap in the presentation, clinical scenario and laboratory abnormalities between dengue and CCHF. Most Member States are endemic for dengue and hence differential diagnoses are difficult until late into the illness. This is especially true in countries such as Democratic People’s Republic of Korea, Indonesia, Myanmar and Timor-Leste, where CCHF has never been reported. On the other hand, Ebola has not been reported from the Region, except in rare cases of clinically recovered patients positive for viral RNA in semen. As most physicians have little or no experience with these viruses, uncertainty often arises when viral haemorrhagic fever is a diagnostic possibility. For example, nosocomial transmission of CCHF infection was reported in India and other parts of the world with good ability for disease containment. In Germany, nosocomial transmission of CCHF occurred from a soldier returned from Afghanistan to health-care workers at the hospital.

Health systems in most countries of the Region score high on disease containment capabilities as compared to African countries. This reduces the probability of disease transmission and outbreaks. Yet, with underlying risks such as poor infection control in health-care settings, limited critical care facilities, lack of trained human resources, weak health systems in general, highest human and livestock densities (along with a poorly guarded human–animal interface) and the presence of culturally rich populations with various forms of social networking in rural communities, similar to rural African communities, CCHF is likely to be a diagnostic dilemma. In other words, it is likely to suffer from underdiagnosis and be a public health threat as well. It has been reported in recent times only from Bangladesh and India. It would also be difficult to predict how countries with poor disease containment systems in place will respond to CCHF infection.

**MERS (severe acute respiratory illness)**

Like other regions of the world, seasonal influenza viruses continue to circulate widely in the SEA Region resulting in significant absolute morbidity and mortality, even in the face of availability of an effective intervention in the form of seasonal influenza vaccines. However, the emergence and spillover of zoonotic influenza viruses and coronaviruses in recent decades have caught the attention of the global health community as public health threats. After an outbreak of A(H5N1) virus in 1997 in poultry in Hong Kong SAR, China, since 2003, this avian virus and other zoonotic influenza viruses have spread from Asia to Europe and Africa. In 2013, human infections with the influenza A (H7N9) virus were reported in China. Influenza A (H7N2) viruses were detected in poultry populations worldwide, although human infection was found to be rare. Influenza A (H9N2) viruses are enzootic in poultry populations in parts of Africa, Asia and the Middle East, post their emergence in 1998.
Influenza A(H1) variant (v) viruses such as influenza A(H1N1)v circulate in swine populations in many regions of the world. Similarly, influenza A(H3N2) viruses are enzootic in swine populations in most regions of the world. Most human cases resulted following exposure to avian influenza viruses through contact with infected poultry or contaminated environments, including live poultry markets or close contact with pigs. Mortality in humans following infection with avian influenza viruses has been high (>50%) compared to those from swine influenza viruses. As viruses continue to be detected in animals and the environment, further human cases can be expected.

The overall public health risk from currently known influenza viruses at the human–animal interface has not changed and the likelihood of sustained human-to-human transmission of these viruses remains low. Yet, highly pathogenic avian influenza (HPAI) has resulted in a high socioeconomic impact in the Region, prompting national and international agencies to place it high on the priority list. This is best exemplified in IHR (2005) wherein HPAI (H5N1) has been identified as a priority disease for reporting.

While severe respiratory diseases due to zoonotic influenza viruses continue to be a cause for concern in the Region and have evinced a heightened response, the recent emergence of MERS has forced the public health community to take a relook at priority threats. Unlike the SARS epidemic, which rapidly died off after the intermediate amplifying hosts were identified and segregated from humans by closure of wild animal markets in southern China, the MERS epidemic persisted for more than two years with no signs of abatement. Although the most agreed upon source of infection is the dromedary camel and hence the largest concentration (>80%) of clinical cases has been in Middle Eastern countries, the SEA Region is specifically vulnerable to the introduction and spread of the virus. Large movement of human populations to the Middle East for Haj pilgrimage and Umrah and back; and tourism between the Middle East and SEA Region can aid in easy spread of infection. Little is known about the virus and its inherent characteristics, such as period of communicability, modes of transmission and reservoir host. These uncertainties, along with local systemic vulnerabilities related to surveillance and response, put most countries of the Region at grave risk. Human–human transmission has been reported to be limited with nosocomial clusters reported commonly, especially outside the Middle East. In light of weak IPC practices in most countries of the Region, these attributes of the disease are a serious concern.
Accordingly, risk assessment for MERS showed a moderate to high risk from the virus for majority of countries in the Region. Bangladesh and India were found to be in the highest risk category; significant Muslim populations in both countries adding to their risk. Inspite of massive movement of tourist populations from MERS-affected countries in the Middle East to these countries, Indonesia and Thailand were found to be at low risk for MERS. This could be attributed to good human surveillance, laboratory capacity and disease containment capacity (possibly a reflection of extensive experience of dealing with zoonotic influenza viruses in the past).

**Japanese encephalitis (acute encephalitis syndrome)**

JE and hand, foot and mouth disease (HFMD) caused by enterovirus 71, are two important causes of viral encephalitis that have been reported widely in Asia since they were first detected. On the one hand, JE has spread throughout large parts of Asia since they were first detected. On the other, EV71 has affected larger parts of Asia Pacific. While spread of JE is better understood and attributed to the expanding mosquito–animal cycle and agricultural practices, the spread of EV71 is less well understood.

The occurrence of large outbreaks in the past across Asia – large HFMD outbreaks in Taiwan (1.5 million cases) and Malaysia (Sarawak, 2628 cases) in the late 1990s; large outbreaks in China (490 000 cases) in 2008 and 2011 and Viet Nam (110 000 cases) and an outbreak in Cambodia in 2012 – demonstrate the emergence and spread of serious EV71-related disease in the Region and the possibility that a large proportion of EV71 is underdiagnosed, cannot be ruled out. The disease poses a threat to most countries in the Region as they have health infrastructure that is easily overburdened by outbreaks. Moreover, the economic and social burden of long-term neurological sequelae of the disease, even in mild cases, may be higher than that seen during the acute illness. Therefore, it is important to monitor and study the disease and pathogen to evaluate future risk to the Region.

On the other hand, JE continues to be the main cause of viral encephalitis in many countries of Asia, with an estimated 68 000 clinical cases every year. Without early diagnosis and management, mortality rates may be 15–30% and up to half of the survivors may have permanent, residual neuropsychiatric sequelae. Because JE transmission is primarily restricted to rural areas, where the majority of the population of the Region lives, it is of special importance to the Region. It affects children, mainly those under 15 years of age. If left untreated, it can have long-lasting debilitating health, social and economic effects. Over the last few years, widespread JE
vaccination campaigns have been launched to contain its spread and burden. However, given the weak routine immunization services in the Region, the constant threat of animal and wild bird sources and related risks of changing agricultural practices, it continues to be a threat. In the present assessment, the risk of JE was found to be highest in Bhutan and India. In case of India, it could be attributed to widespread local transmission and local systemic vulnerabilities in terms of inadequate human and vector surveillance, as well as disease containment capabilities in response to even seasonal surges in cases of acute encephalitis syndrome. Another marker of systemic response is JE vaccination, the reported coverage of which has often been repeatedly questioned in JE-endemic areas in India.

The perception among different stakeholders, including media, regarding adequacy of the public health response to JE in northern India is also an example of the less-than-adequate standards of risk communication, generating mistrust among communities. Bhutan, on the other hand, is surrounded by affected countries India and China, which enhances its vulnerability, in addition to the inherent system capacity for surveillance and disease containment. Moreover, previous experience of spillover of dengue into Bhutan is a clear indicator of its ecological risk to VBDs. Countries such as Indonesia and Thailand were at a lower risk to the threat of JE and this could mainly be attributed to efficient and effective human vaccination coverage and control of JE infection in swine populations through vaccination and regulation of piggeries.

Cholera (acute watery diarrhoea)
The SEA Region is endemic for a large number of food-borne and waterborne diarrhoeal diseases such as cholera, salmonellosis, campylobacteriosis, viral and parasitic diarrhoeas that cause small and large outbreaks as well as sporadic cases. However, cholera continues to be a leading cause of adult watery diarrhoea in developing countries and SEA Region in particular. It remains an important public health issue in more than a third of the countries across the world. An estimated 2.9 million cases are reported annually in 69 cholera-endemic countries with over 95 000 deaths recorded between 2008 and 2012. Bangladesh and India are estimated to have about 800 000 cases (24 000 deaths) of cholera annually, accounting for the highest burden of disease in the Region. Small and large outbreaks are reported and linked to poor hygiene and sanitation, including during mass gatherings and post emergencies/disasters. With the highest population density and greatest rapid uncontrolled urbanization, risk for waterborne diseases and cholera in particular, is likely to increase in the Region.
The assessment found India and Timor-Leste at high risk for the threat of cholera. In both countries, nearly 60% of the population lacks access to improved sanitation facilities. Other countries that were close behind in terms of risk included Bhutan and Nepal. This could be attributed to their similarities in ecoepidemiology, systemic vulnerabilities as well as disease transmission in a nearby country. The Democratic People’s Republic of Korea, Myanmar, Sri Lanka and Thailand were at lower risk for cholera, as the majority of the population (80% and above) has access to improved sanitation facilities. Cholera assumes greater importance since the Region is prone to natural and human-induced disasters, with limited experience of handling large outbreaks following such disasters.

**Zika virus disease (acute febrile illness with rash)**

In the SEA Region, the syndrome of acute febrile illness with rash has been dominated by measles, chicken pox, rubella and dengue, among others. In recent years, measles has gained high priority globally and in the Region as countries implement their measles elimination plans. However, post-disaster measles outbreaks in a largely disaster-prone Region continues to be a risk, due to disruptions in immunization services. Chicken pox and rubella have benefited from the availability of effective vaccines and have seldom presented as large outbreaks of public health concern.

On the other hand, ZVD, which is endemic in parts of Africa and is becoming established in the Americas and Caribbean, is a growing concern for the Region.

The Region is particularly suitable for endemic transmission of ZVD. Serological studies in the past have shown a wide geographical footprint for ZVD in SEA, ranging from Pakistan to the Philippines. Evidence clearly establishes the long presence and circulation through much of this area, although true levels of circulation are yet to be established. The circulation of the virus has not been associated with a significant disease outbreak, which indicates that the sporadic transmission is most likely a result of a spillover sylvatic cycle and that the SEA strain produces lower levels of viraemia, thus precluding urban transmission. Given the strong possibility of a potent sylvatic cycle, widespread presence of the vector in urban areas, non-human primate reservoirs across SEA, increased virulence of recent strains and immunological enhancement, these factors can come together to cause large-scale outbreaks in SEA. Moreover, a disease that is difficult to distinguish from similar illnesses, coupled with weak disease surveillance systems and public health laboratory support, ZVD poses a serious threat to health security in the Region.

In recent times, Bangladesh, India, Indonesia and Thailand, have reported local transmission of ZVD, with acute cases diagnosed by molecular techniques during 2012–2016. Travellers returning...
from Maldives were found positive for Zika virus infection in 2015 and 2016. Several reports from Thailand showed endemicity and widespread transmission across the country. Myanmar’s national risk assessment concluded that ZVD is likely to be endemic, given the proximity and close connection with Thailand. Additionally, Thailand and Viet Nam reported ZVD-associated microcephaly in five neonates since January 2016. These findings are a cause for concern and emphasize the public health urgency of planning for the needs of children/families affected by the congenital Zika syndrome (CZS). There is need to support implementation of primary (vaccine, prevention of mosquito bite and population control; prevention of sexual transmission and pregnancy; prevention while travelling; transfusion transmission), secondary (protection from mosquito exposure during illness) and tertiary (management of neonates with CZS) prevention measures. To date, most countries are unprepared for detecting CZS and therefore adequately mitigating its impact.

Accordingly, in the risk assessment, countries that face difficulties in mounting an effective response to other VBDs such as dengue, chikungunya and JE, mainly because of inadequacies in human and vector surveillance and disease containment capabilities, were assessed to be more vulnerable to Zika virus. These included Bangladesh and Myanmar. While Maldives has been able to eliminate malaria, a VBD, recent outbreaks of dengue caused by the same vector highlights the continuing risk of VBDs in the country. Thailand, a good practice model for dengue control and Sri Lanka, which recently eliminated malaria, was found to be at low risk for ZVD compared to other countries in the Region.

Infectious disease threats: country risk profiles

At country level, the risk for different threats varied as a result of an interplay between local vulnerabilities and ecoepidemiological suitability of the respective countries, thus creating a unique risk profile for each of the countries taken up in the risk assessment.

All-disease risk was assessed as rather homogenous across SEAR, as indicated by a narrow range of cumulative risk scores across diseases and countries. Thereafter, PCA was carried out for each disease separately to derive standardized indices and risk ranks. The principal components contributing to risk ranking in each disease comprised different combinations of a subset of 25 DAISY risk attributes, indicating the unique risk characteristics of each disease and their relevance for the Region. Following this, country risk profiles for each disease were created using these risk ZVD poses a serious threat to the Region, especially because it is difficult to distinguish from other similar illnesses, coupled with weak disease surveillance systems and public health laboratory support.
ranks. Risk ranking, however, showed some variations with Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal and Sri Lanka assessed as having higher risk to most threats in the Region (risk rank 3 and above in three or more diseases). Similarly, for all five selected infectious disease threats, most countries were found to be at higher risk (risk rank of 3 and above), which was in line with a homogeneously at-risk Region (6 out of 11 countries had a risk rank of 3 and above for all diseases).

While the ecoepidemiology of different diseases was found to be similar across the Region, local systemic capacity was also similar across countries. Disease containment capacity was determined based on IHR country self-assessment reports with the same score applied to all diseases. These assessments have often been suggested to be an overestimation of in-country core capacities, especially in case of large countries. Differences could still be observed in the capacity for human surveillance and vector/reservoir/source surveillance and was the best in Thailand, which stood out as a country with the lowest all-disease risk. The risk assessment of nine Member States showed a similar homogeneity but vital difference in core capacities, with special reference to EIDs. Sri Lanka and Thailand were found to be the most prepared, followed by Indonesia. Countries which needed to build their capacities further included Nepal and Timor-Leste. Meanwhile, the differences were vital in identifying gaps and areas of strengthening in the Region and in individual countries.

**Bangladesh**
Bangladesh was found to be at high risk for MERS, ZVD and CCHF. The higher risk of Bangladesh to MERS is due to weak surveillance systems in both the human and animal sectors, in addition to transmission of the disease close to the Region. The higher risk to MERS is also in line with other drivers that are relevant in the context of Bangladesh, such as large annual population movement to MERS-affected countries in the Middle East during the Haj pilgrimage. Repeated outbreaks of avian influenza in poultry as well as human cases of avian influenza also point towards weaknesses in the system for dealing with respiratory illnesses of zoonotic origin.

ZVD is a high risk for Bangladesh as retrospectively confirmed cases have been reported from the country. The ecology and terrain of Bangladesh is conducive to the breeding of *Aedes aegypti*, the same vector as that of dengue, recent outbreaks of which in Bangladesh have resulted in significant number of deaths. The risk assessment indicated less-than-adequate human and vector surveillance systems in place, making the risk of ZVD a public health threat in the country.
Map 3.1
Risk profile of Crimean–Congo haemorrhagic fever in the South-East Asia Region

Risk of Crimean–Congo haemorrhagic fever

Widespread presence of CCHF transmitting vector (Hyalomma tick) in SEAR elevates the risk and need for surveillance in the Region.

Hyalomma tick has been found in eight out of 11 SEAR countries.

Three countries in the Region have reported CCHF in humans and/or animals in the past. Bangladesh and Thailand are at high risk of spread of CCHF.

Nosocomial outbreaks in SEAR in the past highlight the need for improving infection control in health settings, limited critical care facilities & training of human resource.
Map 3.2
Risk profile of Cholera in the South-East Asia Region

SEAR accounts for the second highest global burden of cholera cases at 29%; India and Bangladesh have estimated 800,000 cases (24,000 deaths) of cholera annually accounting for the highest burden of disease in the SEAR. India and Timor-Leste are at a high risk of cholera spread with only 40% population having access to improved sanitation.

Six out of the 11 SEAR countries have less population with access to improved sanitation as opposed to the global average of 67.5%. Cholera assumes even greater importance in the Region as the Region is not only prone to natural and manmade disasters but also has limited experience of handling large outbreaks following these disasters.
JE is endemic in 24 countries in SEAR and Western Pacific Region (10/11 countries in SEAR), exposing three billion people to risk of infection. JE has re-emerged in different parts of the Region, including spreading to urban, semi urban areas and areas without pigs. JE has long-lasting debilitating health, social and economic effects. Increasing paddy cultivation and pig rearing are important drivers of JE transmission in SEAR; six/11 SEAR countries have higher rice production than 26.1% of regional and 22.0% of global average; pork production increased by 26.4% between 2004-2013 in SEAR compared to 22.3% change at global level. India and Bhutan are at high risk of JE spread. Four out of 10 countries in SEAR have 50% of land area that is favourable for Culex tritaeniorhyncus presence. Widespread local transmission, local systemic vulnerabilities (inadequate human and vector surveillance), disease containment capabilities contribute to elevated risk.
Map 3.4
Risk profile of Middle East respiratory syndrome in the South-East Asia Region

Risk of Middle East respiratory syndrome

Large population movement to and from SEAR to MERS affected countries annually places the Region at high risk for introduction and spread of virus.

Nearly 0.4 million undertake Haj pilgrimage from SEAR annually; 95% of these pilgrims are from Indonesia, Bangladesh and India; comprise 25% of all Haj pilgrims globally.

Average 4.2 million passengers from just four Middle East countries (Saudi Arabia, Jordan, Qatar and the United Arab Emirates) travel to SEAR annually, between June and November. Unlike the SARS epidemic, which rapidly died off after closure of wild animal markets, MERS epidemic has persisted for more than two years with no signs of abatement.

India and Bangladesh are at high risk of MERS transmission and spread.

Limited understanding of inherent viral characteristics, along with local systemic vulnerabilities put most countries of the Region at grave risk.
Till date, at least 60 countries and territories have reported continuing mosquito-borne transmission of Zika. 10 of 11 SEAR countries have been found highly suitable for Zika virus transmission; Thailand, India, Maldives and Indonesia have reported cases recently. Majority of SEAR countries are at risk for spread and transmission for ZVD; Bangladesh and Myanmar are at highest risk. Inadequacies of human as well as vector surveillance and disease containment capabilities, contribute to risk of ZVD in SEAR.
Bangladesh was also found to be at high risk for CCHF in places where the CCHF-transmitting Hyalomma tick vector was found. Similarly, confirmed human cases have been reported in the past, both of which, along with the ecoepidemiology, increase the probability of occurrence of CCHF. The assessment revealed limited human and vector surveillance for CCHF. The country also continues to struggle to provide sanitation facilities, with 39% of its population lacking access to improved sanitation. Although clinical case management of cholera has markedly improved with years of experience, repeated outbreaks and a high burden of disease indicate the challenging ecoepidemiology, making cholera a risk for Bangladesh.

**Bhutan**

Bhutan was found to be at high risk for JE and cholera. Its unique geographical location, sharing borders with India in the south and China in the north, add to its vulnerability, as confirmed cases of JE are regularly reported in both countries. Accordingly, in the risk ranking, Bhutan was found to be at high risk of JE. While recent evidence suggests that Bhutan is ecologically less favourable for Culex tritaeniorhyncus, the main vector for JE transmission in the Region, spillover of dengue from India into Bhutan in recent years points towards the changing epidemiology of VBDs. Such phenomena highlights the need for constant vigil through improved surveillance and general system preparedness as was evident in poor human and vector surveillance along with weak laboratory capacity. This calls for investigation into the potential role of other Culex species and their suitability for the transmission of JE in agroclimatic regions such as Bhutan. This country was also found to be at risk for cholera. Although there has been no big cholera outbreak in the recent past, with limited capacity for human surveillance, laboratory diagnosis and surveillance for cholera – this disease is still a significant threat. Furthermore, despite improvement in recent years, there continues to be limited access to improved sanitation facilities, posing a risk for cholera transmission.

**Democratic People’s Republic of Korea**

The Democratic People’s Republic of Korea was found to be at moderate risk for JE by virtue of being part of the JE endemic belt in South-East Asia. For other select infectious disease threats, the country was at low risk. Across most diseases, the country was characterized by less-than-adequate laboratory capacity. However, the presence of favourable capacity for human, vector and environmental surveillance reduced the overall risk, as did the

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**ROOTS FOR RESILIENCE**

*Health Emergency Risk Profile* of the South-East Asia Region
geographical location of the country vis-a-vis rest of the Region, and distance to the closest affected regions. Notably, in case of the Democratic People’s Republic of Korea, the assessment was based on limited evidence. As more evidence becomes available, more refined risk estimates are likely to emerge.

**India**

The assessment found India to be at highest risk for JE, MERS and cholera. Some of the major contributing factors that heightened the risk of JE included confirmed cases of JE, inadequate human and vector surveillance and media reaction including people’s own reaction to JE. This also led to people developing fear and anxiety about JE. Other ecoepidemiological factors that contribute to the country’s risk profile of JE include suitable vector ecology and agricultural and system capacity attributes. A large number of unregulated pig farms spread mostly in the north and north-eastern parts of the country emerge as a risk factor. India is one of the world’s leading rice producers in the world and the colocation of paddy fields with piggeries and pig holdings is yet another risk driver. Similarly, presence of the vector has been established from a long time (nearly 20% of India’s area is ecologically favourable for Culex *tritaenorrhyncus*; other members of the Culex *vishnui* group also potently transmit JE in India). The coexistence of all three drivers, namely pigs, paddy and vector, results in JE continuing to be a major public health threat in the country. Additionally, India shares borders with six JE-affected countries on all sides (Bangladesh, Bhutan, China, Nepal, Pakistan and Sri Lanka).

India, along with Bangladesh, is estimated to contribute the most to the burden of cholera in the Region. Not surprisingly, India was found to be at high risk of cholera. While recent years have seen an improvement in outbreak reporting of diarrhoeal diseases in the country, cholera continues to be underreported in the formal system. This points to the need for improving human surveillance along with systematization of environmental surveillance. At the programmatic level, subnational laboratory capacity for surveillance and diagnosis of cholera remains a challenge, adding further to the risk, despite centres of excellence for cholera at the national level. Finally, with only 40% of the population having access to improved sanitation, the country will continue to be at risk for cholera.

India was also found to be at high risk for MERS, as it is geographically close to the Middle East countries such as the United Arab Emirates (UAE) and Oman. These countries are affected by MERS and have reported multicluste outbreaks in the recent past. In addition, annually, over
100,000 people from India go to Saudi Arabia for their religious pilgrimage. With limited surveillance capacity for MERS in India, the country is at high risk of MERS. India is also at risk of ZVD. While India was assessed as having better human and vector surveillance, as well as laboratory capacity for dealing with ZVD, the widespread presence of the common vector *Aedes aegypti* mosquitoes in the country and the recent incidence of confirmed ZVD cases in the western and southern parts of the country, places the country at risk for future spread of the disease. The country thus needs to be vigilant to these risk factors.

**Indonesia**
Indonesia is at high risk for ZVD. The country has recorded recent cases of Zika virus infection. While the capacity for both human and vector surveillance is moderate, it has a highly suitable ecology for Zika virus transmission. Indonesia was also found to be at moderate risk for CCHF. While there are no confirmed human cases reported in the past 10 years and the vector is not found in the country, the geographical location of Indonesia in the Region places it at high risk of the disease. Neighbouring countries in the region, such as Myanmar where the tick is present and Bangladesh where confirmed human cases have been reported in the recent past, puts Indonesia at risk for CCHF. Both neighbours do not have adequate human and vector surveillance. Laboratory capacity for CCHF is limited in all three countries.

**Maldives**
Maldives is at moderate risk for ZVD. In the present risk assessment, Maldives was found to have reported confirmed cases of ZVD in the recent past. Recent evidence suggests that Maldives is highly environmentally suitable (having a suitable area of more than 10,000 sq. km) for Zika virus transmission. At the same time, recent outbreaks of dengue in the country, with over 1,800 confirmed cases, suggests a conducive environment for multiplication of *Aedes aegypti* mosquitoes, supported by the mid-year South-west monsoon.

**Myanmar**
Myanmar was found to be at high risk for ZVD, MERS and CCHF. Myanmar is surrounded by Bangladesh, Laos and Thailand at its borders. All three countries have reported confirmed cases of ZVD. This is an important attribute that contributes to the high risk status of Myanmar for ZVD. Risks increase with the overall less than adequate human and vector/source surveillance capacity of Myanmar for zoonotic infectious diseases specifically for ZVD, MERS and CCHF.
High risk of CCHF in Myanmar is in line with recent evidence showing parts of the country where humans are predicted to be at potential risk for CCHF. It also highlights that evidence is lacking from these areas and that surveillance should be a priority.

**Nepal**
Nepal was found to be at moderately high risk for JE and cholera. The expanding distribution of JE from the usual Terai regions of Nepal to Kathmandu valley point towards the increasing risk of JE and VBDs in general, as climate change and other environmental changes make more and more landscapes conducive to the spread of VBDs. Nepal has responded to this emerging threat by instituting vaccination campaigns and mobilizing efforts to maintain coverage. Environmental management constitutes the management of piggeries. However, being part of the JE belt and with the highly endemic regions of India and China as immediate neighbours, Nepal is likely to be at ongoing risk, calling for constant vigil. The moderately high risk of cholera was attributed mainly to less-than-adequate human and environmental surveillance for source contamination and laboratory capacity. Although large outbreaks have not been reported from the country in recent times, cholera remains a public health threat for the country. This is largely because barely half the population has access to improved sanitation. Several environmental changes that have taken place due to factors such as rapid urbanization have added to the threat. Nepal's vulnerability to natural disasters, as was demonstrated by the 2015 earthquake, also brings into focus the urgency to establish mechanisms that ensure constant vigil over diseases such as cholera, which have the potential to complicate post-disaster risks.

**Sri Lanka**
Sri Lanka was found to be at moderate risk for both JE and MERS. Its geographical proximity to the southern states of India, which are endemic for JE, places it at risk for JE. Moreover, recent evidence suggests that more than 85% of the land in the country provides a favourable ecology for the JE-transmitting vector, *Culex tritaeniorhyncus*. Sri Lanka is also at moderate risk of MERS due to its relatively close geographical location and population movement with Middle East countries.

**Thailand**
Thailand was assessed at high risk of CCHF and Zika. The former can be explained by the presence of CCHF causing tick in Thailand. The country is also a near neighbour to Bangladesh where several cases of CCHF have been reported in the past. Similarly, recent evidence also suggests that parts that border Viet Nam are at high probability for occurrence of cases of
CCHF. The present risk assessment could also find inadequate human and vector surveillance that places Thailand at risk to CCHF. Thailand has often been considered as a best practices model for dengue control and management. For example, Thailand reports one of the lowest case fatality rates due to dengue compared with other countries in the Region, even in the face of high burden of incident case. However, it is also a reflection of a favourable ecology for dengue and ZVD transmitting vector *Aedes aegypti*. Also, according to recent evidence Thailand is assessed as a country that is highly environmentally suitable for ZVD transmission. Not surprisingly, the country has recently reported cases of ZVD. From ecoepidemiology perspective, Thailand is thus at high risk for ZVD.

**Timor-Leste**

Timor-Leste was assessed to be at high risk of JE, MERS and cholera, mainly due to system-wide weaknesses related to surveillance, laboratory capacity and disease containment in general. The country was found to be at high risk in spite of the lack of reported cases and geographical remoteness of the country relative to the rest of the Region. Some of the risks to these different threats was also contributed by its proximity to Indonesia. Additionally, nearly 60% of the total population of Timor-Leste lacks access to improved sanitation facilities and 70% of the area provides a favourable ecology for the JE-transmitting vector, *Culex tritaenorrhyncus*.

**Insights that emerged from the assessment**

The risk assessment for select infectious disease threats revealed that the Region is homogeneously vulnerable to all the threats, as was evident from the narrow range of risk scores across diseases and countries. A further risk ranking, however, reveals some differences in risk profile by disease and country. Bhutan, Bangladesh, India, Nepal, Sri Lanka and Timor-Leste were assessed to be at higher risk to the largest number of threats. CCHF, JE and MERS were the biggest threats. Vector-borne and zoonotic diseases are a greater risk to the Region compared with diseases transmitted by other modes.

Risk is driven both by the inherent characteristics of the threats (some of which may change as more knowledge becomes available and effective interventions are identified) and systemic weaknesses, especially at local levels. Although the IHR self-assessment estimated a higher disease containment capability, disease-specific and country-specific vulnerability assessed by regional experts clearly provides a more nuanced understanding of the local situation, as
exemplified by largely minimal or nil surveillance in both the human and vector/source/reservoir sectors, including zoonoses. Similarly, laboratory capability across different diseases was found to be wanting in the Region.

Among the inherent characteristics of the diseases, a short incubation period, long period of communicability, lack of availability of effective treatment, susceptibility across all ages and absence of an effective vaccine for almost all the diseases contributed the maximum to the risk for these select diseases. These threats can produce serious manifestations and be transmitted rapidly, thus potentially overwhelming the public health systems in an already constrained scenario in countries of the SEA Region. Regional vulnerabilities also influence local vulnerabilities, even when local transmission of a disease is absent. For example, several countries of the Region have not reported MERS and CCHF. However, they continue to be at high risk for these. In case of VBDs especially, this is supported by presence of the vector and therefore suitability of the ecology. In others, it is the proximity to the closest affected region and additional information on frequent movement of populations across borders and geographical areas. Risk communication and related risk perception as well as public reaction was found to be appropriate. However, for a region, such as South-East Asia, which is known for its weaknesses in risk communication, this calls for more in-depth analysis and understanding.

Previous experience of preparedness and response as well as successful handling of public health threats likely reduces the risk. MERS as a respiratory disease acquired from close contact has benefited from previous experience in the Region with Zoonotic influenza and pandemic influenza. This could be viewed as a return on investments in the Region. Similarly, countries such as Thailand that have greater experience and had mounted effective responses to emerging respiratory pathogens were found to be at lower risk. Benefits of previous experience also seemed to have accrued in the form of lower risk in countries such as Thailand (dengue experience) and Sri Lanka (malaria elimination) in handling VBDs.

The risk assessment helped identify several less modifiable and more modifiable drivers and risk factors that operate in the Region and are relevant for intervention in the programmatic context. Global and regional vulnerabilities are less modifiable and need greater regional and global coordination and local vulnerabilities. Urbanization, population expansion, livestock density and migration maybe less modifiable and so are the inherent characteristics of the threats. However, suitable investments can be made to modify factors such as disease surveillance
and containment capability and inherent characteristics such as vaccine availability. The risk assessment clearly brought out that the spread of drivers in determining risk in the Region to a threat needs both systems strengthening as well as research to improve delivery, as well as specific interventions such as vaccines.

**Recommendations for better management of infectious disease threats**

The current risk assessment indicates that the SEA Region is at risk for select infectious disease threats, with some variations by disease and country. The variations are driven by the inherent characteristics of the threats as well as regional and local vulnerabilities, particularly surveillance and disease containment capacities. The following recommendations are suggested to address the risk of infectious disease threats in the Region:

**Institutionalizing and building regional and subregional mechanisms:** Regional vulnerabilities have an accentuating influence on local vulnerabilities. In the SEA Region, countries with a higher local vulnerability are also geo-politico-epidemiologically so situated that it places them at higher risk. While national responses need to be strengthened with specific attention to individual disease-based capacities, regional and subregional mechanisms and responses need to be put in place.

**Ramping up implementation of international and other intergovernmental frameworks:** In recent years, a number of frameworks have been introduced, such as IHR, Global Outbreak Alert and Response Network (GOARN) and Emergency Centre for Transboundary Animal Diseases (ECTAD), World Animal Health Information System (WAHIS), Emergency Prevention System (EMPRES), among others. These mechanisms aim to provide the framework for systems strengthening in preparedness and response to known and unknown threats in diverse settings. There is need for national governments and regional organizations to ramp up implementation of these frameworks while assuring quality of implementation with regular monitoring and evaluation.

**Making timely and relevant policy shifts to address disease risk drivers:** Several drivers of disease risk are particularly relevant in the context of the SEA Region. While many of them, such as urbanization, population movement, land-use patterns and changing agricultural practices may not be modifiable in the immediate future due to socio-politico-cultural reasons, timely and appropriate policy shifts and related strategic planning is needed to eventually address these drivers.
Mounting regular capacity-building initiatives that strengthen intersectorality across levels: VBDs and zoonoses have dominated the select infectious disease threats in the Region. This is in line with the composition of the underlying drivers that operate in the Region. Further, they call for regional and national intersectoral coalitions and focused capacity-building of these two complex sets of diseases, both technically and operationally.

**Strengthening surveillance and response capacities:** Human, vector and source surveillance are weak across countries and threats, although IHR self-assessments contradict this. While it is recommended that these surveillance and response capacities should be strengthened as a priority, more nuanced assessments, including subregional and subnational assessments are needed to begin with and continued on a regular basis to guide such efforts for optimum results.

**Undertaking laboratory strengthening and networking to better manage disease threats:** Public health laboratory capacity and networking have continued to be challenges for the Region. While both national and international efforts have strengthened national capacity, especially in the wake of SARS, avian influenza and pandemic influenza, subnational capacity continues to be extremely weak. Thus, laboratory strengthening and networking to deal with known and unknown threats in the shortest possible time are essential for supporting public health action and effective risk mitigation.

**Strengthening risk communication as a mandatory effort:** Inspite of the present risk assessment not showing gaps, the Region has demonstrated limited capacity with several examples of poorly managed risk communication in the past as well as lack of institutionalized efforts. It is therefore important to not only understand discrepancies in the findings but also to mount focused efforts to build and practice risk communication in the health system.

**Stepping up investments in public health research:** Investments are needed both in basic and public health research, as several inherent characteristics of the threats remain poorly understood. At the same time, public health preparedness and response are severely constrained. Research priorities that emerged from this assessment include infection control practices, vaccine development, understanding the disease epidemiology, surveillance and risk communication.

**Mapping success stories and learning from the Region:** There are several examples of effective disease risk mitigation in the Region. Dengue prevention and control in Thailand and clinical
management of cholera in Bangladesh are cases in point. Few other examples that the Region can learn from include Bhutan and Maldives and their elimination of measles. They became the first in the Region to be verified for having interrupted endemic measles virus transmission, ahead of the 2020 Regional target. Then there was Timor-Leste whose success in controlling malaria went back to 2006 when over 223,000 cases were recorded with more than 68 deaths. With WHO technical assistance and strong political commitment, the National Malaria Control Programme (NMCP) launched a vigorous antimalarial effort across the country and by 2013, malaria cases declined dramatically to 1,040. Thailand also effectively managed to contain the spread of MERS in 2016. These and other examples should be systematically mapped and analysed in depth for their strengths and weaknesses and lessons drawn for replication in other countries in the Region.

What next?

The ultimate goal of the risk assessment exercise is to inform the Region’s policy and programme leadership on threats and vulnerabilities. Also, to see how and in which domains efforts can be channelized to achieve better outcomes, in the face of infectious disease threats.

The findings are a pointer towards regional as well national vulnerability and risks. In terms of next steps, the Recommendations section lays down a roadmap. These findings will be disseminated to different audiences in the form of peer-reviewed publications and advocacy documents, such as policy briefs. The Regional Office could offer technical assistance in conducting similar but more nuanced national and subnational in-depth risk assessments that foster a better understanding for focused action.
Summing up: moving from knowledge to action
Figure 4.1: Towards greater resilience: next steps for countries and the Region

**Actions at subnational level**
- Proceed with risk analyses at subnational level as guided at the national level in countries
- Analyse risks by bringing together information on all hazards, vulnerabilities and health capacities
- Discuss IHR, SEA Region Benchmark capacities, UHC Index and INFORM Index reporting
- Develop a plan of action against priority risks
- Address vulnerability factors and capacity gaps in health
- Map work with other partners
- Monitor and evaluate as well as document work in order to feed into national actions

**Actions at national level**
- Support subnational risk analyses – technical and operational needs
- Compile all subnational risk analyses
- Prioritize actions as per risk and capacity and support these actions accordingly
- Monitor and evaluate actions and provide support for any corrective action as needed
- Report findings in global platforms as well as to regional and global frameworks and instruments
- Support national efforts to assess risks, address vulnerabilities and build capacities as per regional and global frameworks and instruments
- Conduct further analyses of risks at regional and global levels and develop joint plans accordingly
- Facilitate exchange of experiences and best practices

**Actions at regional and global levels**
- Facilitate mobilization of resources
The two risk assessments relating to multihazard vulnerability and capacity risk analysis and the vulnerability profile for communicable disease threats for the Region that have been discussed in the preceding pages of this book have been very well timed. They confirm some of the concerns that are already known, while flagging new threats that must be addressed soonest, given the inherent geophysical characteristics vis-à-vis socio-political-climatic changes that are brewing over the horizon.

The findings of the assessments have made it eminently clear that the Region is homogenously at risk for certain biological hazards. At the same time, it shares a range of risks to natural hazards with common vulnerabilities and capacities. The difference lies in the type of risks and the magnitude with which they would wreak havoc to life, property and future generations, based on their geographical and geological parameters. However, the determinants of risk are clearly shaped by the extent and level of their vulnerability and capacity. And it is precisely this that the book has tried to capture in the hope that preparedness efforts can be strengthened and countries in the Region can be prepared for the worst in the time of a disaster or outbreak.

The five syndromes and corresponding priority diseases that were assessed for all the 11 countries of the Region included severe acute respiratory illness represented by the Middle East respiratory syndrome (MERS), acute watery diarrhoea represented by cholera, acute haemorrhagic fever represented by CCHF, acute encephalitis syndrome represented by JE and acute febrile illness with rash represented by the Zika virus disease. Based on inherent characteristics, MERS was found to be the greatest threat to the Region followed by CCHF. However, the risk assessment pointed towards the Region being homogenously vulnerable to all five threats, as was evident from the narrow range of risk scores across diseases and countries. A further risk ranking revealed some differences in risk profile by disease and country. Bhutan, Bangladesh, India, Nepal, Sri Lanka and Timor-Leste were assessed at higher risk to most threats in the Region.

The natural disaster section provided a comprehensive overview of hazards and risks in the Region, specifically for earthquakes, tsunamis, floods, famines and cyclones, analysing these against the capacities that are currently available. The impact of these disasters varies depending on regional and local vulnerabilities, particularly related to the level of infrastructure, government policies and human resource capabilities of the countries in question.

In terms of the biological hazards, risk was found to be driven both by inherent characteristics of the threats (some of which may change as more knowledge becomes available and effective interventions are identified) and systemic weaknesses, especially at local levels.
Map 4.1
Health emergency risk profile of the South-East Asia Region
Risk for natural hazards

Inform Index
- Low risk
- Moderately low risk
- Moderate risk
- Moderately high risk
- High risk

Capacity for health security

Indicators

Risk rank for CCHF
- Low risk
- Moderately low risk
- Moderate risk
- Moderately high risk
- High risk

Risk rank for Cholera
- Low risk
- Moderately low risk
- Moderate risk
- Moderately high risk
- High risk

Risk rank for JE
- Low risk
- Moderately low risk
- Moderate risk
- Moderately high risk
- High risk

Risk rank for MERS
- Low risk
- Moderately low risk
- Moderate risk
- Moderately high risk
- High risk

Risk rank for ZVD
- Low risk
- Moderately low risk
- Moderate risk
- Moderately high risk
- High risk

Four countries (Bangladesh, India, Myanmar & Timor-Leste) were found to be at moderately high or high risk for three or more select infectious disease threats.

Source: INFORM Index 2016
Critical changes can be made to the capacities and vulnerabilities through efforts for risk reduction and preparedness. For any of these natural or biological hazards, better prevention, detection and response can be expected if any of the IHR core capacities are in place.

Disease containment capability as assessed by regional experts provided a more detailed understanding of the local situation than IHR self-assessment. This was exemplified by absent or minimal human and vector/source/reservoir surveillance, including for zoonoses. Similarly, laboratory capability was found to be wanting in the Region across different diseases.

A definitive outcome of the risk assessment has been the identification of several less modifiable and more modifiable drivers and risk factors that operate in the Region and are relevant for intervention in the programmatic context. These findings should now serve as inputs in creating timely and appropriate policy shifts, along with related strategic planning to eventually address these drivers.

Critical changes can be made to the capacities and vulnerabilities through efforts for risk reduction and preparedness. For any of these natural or biological hazards, better prevention, detection and response can be expected if any of the IHR Core Capacities are in place.

The regional health profile in terms of the UHC Index also shows an epidemiological shift to noncommunicable diseases. Moreover, despite progress towards better maternal and child health, gaps in communicable disease control need to be addressed.

Above all, what we know is that all risks, vulnerabilities and capacities can be measured better with new methodologies and existing indices (such as INFORM and UHC) as well as existing metrics like the SEA Region Benchmarks and IHR monitoring and evaluation tools. Needless to say, each of these can be tweaked in the context of the country and situation, in order to be more robust and effective.

**Embracing the next phase**

These are by no means simple findings with clear-cut answers. What this book presents is an array of insights and possibilities for health programme managers, policy- and decision-makers, emergency and disaster professionals, government authorities and community leaders.

The fundamental step will now have to be towards making a shift that allows us to look at an “all-hazards” approach that is relevant to multiple players and stakeholders. This comprehensive view will help in addressing all possible health issues, needs and actions that must be in place well before any outbreak or disaster. The “all-hazards” approach must therefore, at all times, provide the strongest basis for a functional institutional response to critical events.
Specifically, for actors in the health sector, improving UHC indicators will lead to an enhancement of capacities and reduction of risks at the same time. After all, health is a means to, as well as an end for development goals. A well planned health intervention is hence, a wise investment in capacity development and resilience.

Monitoring and measuring what is being done is the key discipline that needs to be the business of health and emergency managers. Moreover, advocating and working with different sectors in measuring capacities in other areas will help change the levels of mitigation and preparedness. Note that the various drivers of diseases are largely under the purview of sectors other than health. The successful implementation of the IHR (2005) calls for a strong national public health system that is critical for response to a public health emergency of international concern (PHEIC). States Parties should be able to maintain active surveillance of diseases and public health events, rapidly investigate reports, assess public health risk, share information and implement public health control measures. Annual reporting, periodic JEEs and periodic after-action review and/or simulation exercises in parallel with corresponding efforts for strengthening animal health and other sectors should become a seamless part of the ongoing capacity development exercise, followed by an evaluation and monitoring process for IHR (2005) implementation.

Recommendations of both risk assessments pointedly emphasize that continuous measurement of vulnerabilities and capacities can never be understated, as it is the basis of all future concerted and systematic actions. Contributing better data for the INFORM Risk Index, UHC Index, measuring IHR capacities across all the monitoring and evaluation tools and the SEA Region Benchmarks are the several tools that are available for undertaking this exercise. Further, the findings from these capacity assessments must be interpreted across each other, leading to a more accurate picture of the health issues while providing clarity with respect to where the actual gaps lie.

If there is one key action point from this publication, it is to regularly undertake detailed risk analyses at the subnational level to be able to address risks at specific populations and areas. From these risk analyses will emerge a more detailed picture of risks that can then be addressed by different organizations, agencies and experts in the disaster risk reduction space.

As countries, states, provinces and communities assess their needs and look at all possible hazards, be it biological, natural, human generated or technological, they will also have to evaluate how it would impact them and their populations. Following various global frameworks such as Sendai, the IHR and its new recommendations, the coming months will really be about penetrating the subnational level with better preparedness. For knowing and addressing risks at the lowest levels will contribute to strengthening preparedness at the national, regional and global levels paving the way for a Region which is less exposed to risks to the health and lives of its people.
Annex: Special considerations of the DAISY tool

**Contemporariness and ‘ad hoc’ adjustment of risk scores**

When deciding risk score for attributes 10, 20, 21 and 22 occurrence of disease in last five years was considered. Score was assigned according to DAISY tool if disease occurred in last two years. The score was downgraded by 1, if disease occurred in years 3-5. This was done to distinguish between contemporariness and corresponding risk of disease transmission. This is especially relevant for a neighbouring country, which if not affected (defined as below), signifies interruption of transmission or more likely, significant reduction in transmission and therefore reduced risk.

For some countries and diseases no report (formal or informal) or evidence of disease incidence could be traced in the last two years, to establish recent transmission. However, if there was an expert understanding to the contrary, an ‘ad hoc’ adjustment was done. The country was considered to have incident cases of disease in the last two years.

**Attribute 10: closest affected region scoring assumptions**

**Definition of closest affected region and method of classification**

- Air travel was considered as travel time between two countries. There is a high possibility of borders being porous between two bordering countries, but considering the lack of concrete evidence of the same, the former method was considered for closest affected region. This could only be an underestimation of risk.

- Due to non-availability of reliable data on cruise/ferry connectivity, this was not considered as a mode of transportation between countries.

- Inward flights were considered to estimate the travel time.

- Skyscanner, MakeMyTrip and WHO SEARO travel desk were consulted to obtain the shortest possible route for travel between two countries.

- Regions in this context means neighbouring or closest affected country within WHO SEAR or beyond.

- For the attribute No.10, ‘Immediate neighbour’ means the country with which a state is sharing political borders.

**Definition of ‘affected’**

- An ‘affected’ region was defined as a country that was up to four hours of flying distance and that had reported local transmission of cases of a disease (sporadic or cluster) in the last five years, that is between 1st July 2012 to 30th June 2017. Imported cases were not considered as local cases and the country was not considered as affected.

- PubMed Search Strategy:
### Japanese encephalitis

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
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<tbody>
<tr>
<td>#1</td>
<td>“Encephalitis, Japanese”[MeSH] OR “Japanese encephalitis” OR JBE</td>
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<tr>
<td>#3</td>
<td>#1 AND #2</td>
</tr>
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</table>

### Crimean–Congo haemorrhagic fever

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<th>Searches</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3</td>
<td>#1 AND #2</td>
</tr>
</tbody>
</table>

### Middle East respiratory syndrome-coronavirus

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<th>Searches</th>
</tr>
</thead>
<tbody>
<tr>
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<td>“middle east respiratory syndrome coronavirus”[MeSH Terms] OR Middle East Respiratory Syndrome Coronavirus[Text Word]</td>
</tr>
<tr>
<td>#3</td>
<td>#1 AND #2</td>
</tr>
</tbody>
</table>

### Cholera

<table>
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<th>Searches</th>
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<tbody>
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</tr>
<tr>
<td>#3</td>
<td>#1 AND #2</td>
</tr>
</tbody>
</table>
**Zika virus disease**

<table>
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<tr>
<th>#</th>
<th>Searches</th>
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<tbody>
<tr>
<td>#3</td>
<td>#1 AND #2</td>
</tr>
</tbody>
</table>

**Attributes 13 & 16: Calculating disease containment score**

Disease containment was identified as one of the most important attribute under DAISY tool contributing to the risk of a disease. Disease containment for any country is dependent on multiple core capacities. To estimate the level of core capacities being attained, we adapted the validated and widely published WHO-IHR core capacity monitoring framework tool. For disease containment, IHR core capacities identified were 1. National legislation policy and financing, 2. Coordination and NFP communications, 3. Surveillance, 4. Response, 5. Preparedness, 6. Risk communication, 7. Human resource, 8. Laboratory, 9. Point of entry and 10. Zoonotic threat.

**Converting attribute scores of core capacity to disease containment**

Calculating disease containment score under DAISY methodology was a two-step process. First, the percentage attainment of each core competency was calculated and converted to percentage unattained (100-attained). DAISY score for each 10 components was then calculated using the below table, where level of risk increases from 1 to 5:

<table>
<thead>
<tr>
<th>Percentage unachieved</th>
<th>76-100%</th>
<th>51-75%</th>
<th>26-50%</th>
<th>&gt;0-25%</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency score</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
In the second step, average score of all the 10 core competencies was calculated. The average score hence obtained was the final disease containment score. Please refer below table for reference:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Core competencies</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National legislation policy and financing coordination</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>National Focal Point communications</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>Surveillance</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>Response</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>Preparedness</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>Risk communication</td>
<td>F</td>
</tr>
<tr>
<td>7</td>
<td>Human resource</td>
<td>G</td>
</tr>
<tr>
<td>8</td>
<td>Laboratory</td>
<td>H</td>
</tr>
<tr>
<td>9</td>
<td>Point of entry</td>
<td>I</td>
</tr>
<tr>
<td>10</td>
<td>Zoonotic threat</td>
<td>J</td>
</tr>
</tbody>
</table>

Disease containment score for the country = \((A+B+C+D+E+F+G+H+I+J)/10\)

**Attributes 20 & 21: identification of weights and calculation of weighted scores for exposure risk**

Epidemic dynamics (regional) and epidemic dynamics (local) mainly pertain to risk of exposure to disease. Key indices or drivers were identified following literature review. These were suitably transformed into weights and applied to DAISY risk attributes pertaining to attributes 20 & 21, as a measure of exposure risk. Indices/drivers used as weights are as follows:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Suitability driver (and corresponding weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholera</td>
<td>Percentage population with lack of access to improved sanitation(20)</td>
</tr>
<tr>
<td>CCHF</td>
<td>Probability index of occurrence of Crimean–Congo haemorrhagic fever (CCHF) (124)</td>
</tr>
<tr>
<td>Zika</td>
<td>Disease reporting status in countries that are highly environmentally suitable (having a suitable area of more than 10 000 square kilometres)(122)</td>
</tr>
<tr>
<td>MERS</td>
<td>Annual number of Haj pilgrims(92)(93)</td>
</tr>
<tr>
<td>JE</td>
<td>Percentage of area of country with 25% estimated probability of <em>Cx. tritaenioryhnchus</em> presence (48)(126)</td>
</tr>
</tbody>
</table>
Glossary

**Aetiology** refers to the cause, set of causes, or manner of causation of a disease or condition.

**Coping capacity** is the investment in public policy to protect people, property and community resources through adoption and implementation of mitigation, preparedness, emergency response and recovery and reconstruction measures and regulations. It defines capacity of a country to cope with any major disaster.

**INFORM Index for risk management** is a composite indicator developed by the Joint Research Centre for European Commission (JRC) as a tool for understanding risk of humanitarian crisis and disasters.

**International Health Regulations (2005)** are an international legal instrument that is binding on 196 countries across the globe, including all the Member States of WHO that aim to help the international community prevent and respond to acute public health risks that have the potential to cross borders and threaten people worldwide.

**Joint External Evaluation** is a voluntary, collaborative process to assess a country’s capacity under the International Health Regulations (2005) (IHR) to prevent, detect and rapidly respond to public health threats whether occurring naturally or due to deliberate or accidental events.

**Point of entry** is the point where cargo is unloaded and enters a country. The IHR (2005) requires countries across the globe to develop and strengthen core capacities at international PoE such as airports and ground crossings.

**Sendai Framework** is a 15-year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, private sector and other stakeholders.

**Sustainable Development Goals (SDGs)** are a universal call to action to end poverty, protect the planet and ensure all people enjoy peace and prosperity. These 17 goals build on the successes of the Millennium Development Goals, while including new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities.

**The “all” hazards approach** contends that emergency preparedness requires attention not just to specific types of hazards but also to actions that increase preparedness for all risks. In view of these common components, WHO as well as other leaders in crisis management advocate the all-hazards approach as the recommended mechanism for emergency preparedness.

**The Tree of Life** is an archetypal symbol, a central theme in mythology across all cultures. It represents the cycle of destruction and creation; of birth and death; and of care and neglect. The tree of life also symbolizes knowledge, enlightenment and achievement.

**Tracer indicators** aim to provide objective information about whether or not a facility meets the required conditions to support provision of basic or specific services with a consistent level of quality and quantity.
References

**Chapter 1: Context and background for a systematic risk assessment for the Region**


Case studies on safe hospitals in the South-East Asia Region. New Delhi: World Health Organization Regional Office for South-East Asia (http://apps.who.int/iris/bitstream/10665/10665/1/B4283.pdf, accessed June 2017).


**Chapter 2: Threat of natural disasters in South-East Asia: a risk profile**

Association of Southeast Asian Nations (ASEAN) [website] (http://asean.org/, accessed June 2017).


Chapter 3: Communicable disease threats in South-East Asia: a risk profile


Advisory Committee on Health Research. 34th Session of South-East Asia Advisory Committee on Health Research. New Delhi: World Health Organization Regional Office for South-East Asia; 2015 (http://www.searo.who.int/about/administration_structure/cds/34-achr.pdf?ua=1, accessed May 2017).


The book uses the tree of life, which is an archetypal central theme across all cultures, including in the WHO South-East Asia Region. The tree is a symbol of resilience with its well-entrenched and nourished roots. It survives wars, pandemics and catastrophes while continuing to grow, shoot new leaves and bear fruit.

The oak tree used on the cover is known for its sturdiness and resilience. Different tree motifs are used as separators. The pine tree is rooted in high altitudes but survives extremities of climate. Similarly, mangroves can resist floods and bamboo does not break easily even with strong winds. The use of roots elsewhere reiterates the need to strengthen the fundamentals—health systems, health workforce, infrastructure and capacities for health emergency risk management.

This book provides a well-researched, documented and illustrated analysis of risks, threats, vulnerabilities and coping capacities in the event of disasters, epidemics and other calamities in the countries of the WHO South-East Asia Region.

These risks are then analysed through the lens of health status and capacity for emergency management across several hazards. The book aims to draw up action points and recommendations at the subnational level.