Meeting Report

Second Meeting on Laboratory Strengthening for Emerging Infectious Diseases in the Asia Pacific Region

4 - 6 June 2013
Manila, Philippines

World Health Organization
Western Pacific Region

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REPORT

SECOND MEETING ON LABORATORY STRENGTHENING FOR EMERGING INFECTIOUS DISEASES IN THE ASIA PACIFIC REGION

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NOTE

The views expressed in the report are those of the participants in the Second Meeting on Laboratory Strengthening for Emerging Infectious Diseases in the Asia Pacific Region and do not necessarily reflect the policies of the Organization.

This report has been prepared by the World Health Organization Regional Office for the Western Pacific for governments of Member States and for those who participated in the Second Meeting on Laboratory Strengthening for Emerging Infectious Diseases in the Asia Pacific Region, held in Manila, Philippines, 4 – 6 June 2013.

SUMMARY

It is an unusual time for emerging infectious diseases (EIDs) with the world experiencing and managing two novel virus infections, namely avian influenza A(H7N9) and MERS CoV. As the epidemiology of both agents is still evolving with many questions to be answered, there is a need to manage such situations in a time of uncertainty and to be prepared for different scenarios. These events emphasize the value of the Asia Pacific Strategy for Emerging Diseases (APSED 2010) and the International Health Regulations (IHR 2005).

APSED (2010) is used to guide countries in the Asia Pacific region to prepare for and respond to EIDs in line with IHR (2005) core capacity requirements. APSED (2010) recognizes the critical importance of laboratories in reaching this goal. This bi-regional Second Meeting on Laboratory Strengthening for EIDs in the Asia Pacific Region focused on progress made with and future directions of the APSED (2010) public health laboratory work plan.

First, several Member States presented their progress made with the implementation of their work plans for surveillance of and response to EIDs. All reported progress in this area. Despite in-country public health laboratory networks being at different stages of development, all had incorporated sub-national level laboratories for the strengthening of laboratory services and response plan for EIDs. Progress was also reported in other areas, including biosafety and laboratory quality management.

Participants deliberated about the detection of pathogens causing SARI. This was a very timely discussion given the important contribution of laboratories to the detection of avian influenza A(H7N9) and MERS-CoV. It was agreed that syndromic surveillance should be integrated with the public health laboratory function. A syndromic approach could be cost effective in expanding the scope of pathogens detection, especially when using new technologies that can test for multiple pathogens at the same time.

Quality of testing was an important issue that was addressed during the meeting. WHO has been supporting the external quality assessment (EQA) of influenza for many years. This not only assesses competency of testing in laboratories, it also strengthens collaboration and networking between laboratories. Lessons learnt from influenza EQA were used to implement an EQA for dengue which was well received by participants.

Overall, progress has been made and challenges have been identified in strengthening and sustaining national and regional laboratory capacities. We will continue to face EID threats and there remains a central role for laboratories in their detection and characterization allowing efficient response.

ABBREVIATIONS AND ACRONYMS

APSED	Asia Pacific Strategy for Emerging Diseases
ASEAN	Association of South-East Asian Nations
CCHF	Crimean Congo Hemorrhagic Fever
CDC	Centers for Disease Control and Prevention
CoV	Coronavirus
EIDs	Emerging Infectious Diseases
EQA	External quality assessment
EWAR	Early Warning, Alert and Response
FAO	Food and Agriculture Office of the United Nations
H1N1pdm09	Pandemic influenza H1N1 2009
IHR	International Health Regulations
ISARIC	International Severe Acute Respiratory and Emerging Infection Consortium
GLP	Good Laboratory Practice
KONSAR	Korean Nationwide Surveillance of Antimicrobial Resistance
LQMS	Laboratory Quality Management System
LQM	Laboratory Quality Management
LQSI	Laboratory Quality Stepwise Implementation
MERS	Middle East Respiratory Syndrome
MOH	Ministry of Health
NCLE	National Centre for Laboratory and Epidemiology, Lao People's Democratic Republic
OIE	World Organization of Animal Health
PCR	Polymerase Chain Reaction
PHLN	Public Health Laboratory Network
PUE	Pneumonia of Unknown Etiology
QA	Quality Assurance
QSE	Quality System Essentials
SARI	Severe Acute Respiratory Infection
SARS	Severe Acute Respiratory Syndrome
SLMTA	Strengthening Laboratory Management Towards Accreditation
WHO	World Health Organization
USAID	United States Agency for International Development

CONTENTS

Key words: Communicable diseases, Emerging infectious diseases, epidemiology, prevention and control, Laboratories, Laboratory organization and administration, Laboratory standards, Public health

1. INTRODUCTION

Past experiences with outbreaks of Hendra virus, Nipah virus, SARS, avian influenza A(H5N1) and H1N1pdm09 stress the importance of EIDs in the Asia Pacific Region. It is hard to predict when the next outbreak will occur as emphasized by the recent outbreak of avian influenza A(H7N9) in China. The outbreak of MERS CoV in other regions also highlights the importance of public health preparedness.

The WHO Asia Pacific Strategy for Emerging Diseases (APSED) 2010 functions as a guide for Member States to achieve IHR core capacities, including those related to laboratories. APSED (2010) has a dedicated focus area for laboratories, aimed at strengthening public health laboratories and their networks to improve laboratory capacity for routine surveillance activities and prepare laboratories for rapid response to outbreaks. For public health laboratory systems to function efficiently, appropriate infrastructure needs to be in place at the peripheral, sub-national (regional), national and international levels with a specimen referral system linking all levels and allowing transport to increasingly advanced laboratories.

The First Meeting on Laboratory Strengthening for Emerging Infectious Diseases in the Asia Pacific Region was held in Kuala Lumpur, Malaysia, from 19 to 21 October 2011. The purpose of this second meeting is to review, discuss and develop concrete next steps for the further implementation of the APSED laboratory work plan.

1.1 Objectives:

(1) To facilitate the implementation of a national public health laboratory work plan for the surveillance of and rapid response to EIDs;

(2) To agree on priority activities that will enhance the surveillance of and response to EIDs through coordinated efforts by public health laboratories and their epidemiology counterparts, e.g. building capacity at the subnational level, external quality assessment (EQA) and strengthening diagnosis of antimicrobial resistance;

(3) To facilitate coordination among ASEAN Member States and harmonize laboratory activities of ASEAN and WHO; and

(4) To agree on recommendations and follow-up actions.

1.2 Opening remarks

Dr Li Ailan, Director, Division of Health Security and Emergencies, WHO Regional Office for the Western Pacific

Dr Li welcomed all to the meeting and gave the opening remarks on behalf of Dr Shin Young-Soo, WHO Regional Director for the Western Pacific. She stated that the

purpose of this meeting was to bring together WHO Member States in the Western Pacific and South-East Asia to address public health laboratory capacity for EIDs. She stressed the importance of preparedness for emerging pathogens, because as history has shown, outbreaks will continue to occur and it is impossible to predict which pathogen will cause the next outbreak. Lessons learned from severe acute respiratory syndrome (SARS), influenza A(H1N1)pdm09 and avian influenza A(H7N9) emphasized the importance of the surveillance of and response to EIDs in these Regions. To improve early detection of and response to disease outbreaks in Asia and the Pacific, Member States should have access to public health laboratory services that are safe, rapid and accurate, in line with IHR (2005).

Dr Li outlined that since 2005, WHO has been working closely with its Member States to improve their laboratory capacities for surveillance and response under APSED. An example of this joint effort is the strong regional network of influenza laboratories. However, there is a need to increase the range of pathogens that can be detected in Asia and the Pacific. Additionally, laboratory capacities must exist close to the front-line to detect known pathogens early, and a system must be in place to refer specimens of unknown aetiologies to increasingly advanced national or international laboratories.

Dr Li mentioned that WHO has been working closely with ASEAN. Acknowledging that laboratory capacity is not only important to human diseases but also for animal health, she expressed appreciation of the collaborations with the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE) to develop strategies to address zoonotic threats. She also acknowledged the support and contributions of other partners in strengthening public health laboratory capacities, including the European Commission, Government of Japan, United States Agency for International Development and United States Centers for Disease Control and Prevention.

Dr Li was confident that the deliberation from all representatives of Member States, temporary advisers and partners would result in a fruitful meeting. The recommendations from the meeting will help WHO move forward in assisting Member States to implement activities to strengthen public health laboratory capacities for EIDs under APSED (2010).

2. PROCEEDINGS

2.1 Plenary One: Setting the scene

2.1.1 Asia Pacific Strategy for Emerging Diseases (2010)

Dr Chin Kei Lee, Team Leader, Emerging Disease Surveillance and Response, WHO Regional Office for the Western Pacific

The Asia Pacific region is a hotspot for EIDs, which highlights the importance of IHR (2005). To achieve IHR (2005) core capacity requirements, APSED (2010)

provides a common framework for countries and areas to strengthen national and local capacities required for managing all EIDs and public health emergencies. APSED (2010) is an updated version of the original 2005 strategy and has an expanded scope; however, both iterations of APSED recognize the importance of laboratories in the surveillance of and response to EIDs and include a dedicated focus area for laboratories, detailed in the next presentation.

2.1.2 Public health laboratory capacity building for emerging infectious diseases under the Asia Pacific Strategy for Emerging Diseases 2010

Dr Frank Konings, Technical Officer, Emerging Disease Surveillance and Response, WHO Regional Office for the Western Pacific

Past experiences with outbreaks of Hendra virus, Nipah virus, SARS, avian influenza A(H5N1) and influenza A(H1N1)pdm09 stress the importance of EIDs in Asia and the Pacific. It is hard to predict when the next outbreak will occur as emphasized by the recent outbreak of avian influenza A(H7N9) in China. The outbreak of Middle East respiratory syndrome coronavirus (MERS-CoV) in other regions also highlights the importance of public health preparedness, especially with air travel allowing the rapid spread of pathogens across the globe.

APSED (2010) has a dedicated focus area for laboratories, aimed at strengthening public health laboratories and their networks to improve laboratory capacity for routine surveillance activities and to prepare laboratories for rapid response to outbreaks. For public health laboratory systems to function efficiently, appropriate infrastructure needs to be in place at the peripheral, subnational (i.e. regional), national and international levels with a specimen referral system linking all levels and allowing transport to increasingly advanced laboratories.

Sometimes by sending specimens to a pathogen-specific laboratory, novel pathogens may go undetected, as negative results do not trigger forwarding of specimens to a laboratory for different pathogens. However, a syndromic approach to laboratory testing has advantages in the detection of novel pathogens. For example, specimens from patients with acute watery diarrhoea may be tested for cholera in a bacteriology laboratory while the causative agent may actually be a virus. A syndromic approach to laboratory testing, e.g. severe acute respiratory infections, will support the detection of novel viruses such as avian influenza A(H7N9) and MERS-CoV.

For a public health laboratory to function properly, a laboratory quality management system (LQMS) needs to be in place. Part of the LQMS is the laboratory participating in EQA programmes. Besides improving diagnostic accuracy, such programmes have the added value of stimulating networking between laboratories at all levels. WPRO and relevant laboratories have established a regional EQA programme for dengue, which will serve as the foundation of a broader EQA for multiple EIDs.

This meeting builds on recommendations of previous laboratory meetings and work plans, as well as activities of partners, including ASEAN, FAO and OIE. Specifically, the meeting will address the progress made with national work plans,

laboratory quality management, the approach to testing and the contributions of the public health laboratory system to the surveillance of and response to EIDs.

2.1.3 Public health laboratory networks and their role in surveillance of and response to emerging infectious diseases

David Smith, Network Director and Clinical Virologist, PathWest Queen Elizabeth II Medical Centre, and Clinical Professor, School of Pathology and Laboratory Medicine, University of Western Australia

Laboratory networks are widespread around the world and take several forms: groupings of multipurpose laboratories, specific-pathogen networks such as the WHO Global Influenza Surveillance Network and specific-purpose networks (e.g. antimicrobial-resistant groups or bioterrorist agents). In 1997, Australia formed the Public Health Laboratory Network (PHLN), a multipurpose network that brings together public health, clinical diagnostic, animal health, environmental health and research laboratories. PHLN is now the peak body providing advice to the government on a wide range of laboratory-related issues and provides a mechanism for nationally coordinated responses to EIDs. It has demonstrated the value of collaborative networks in strengthening laboratory capacity.

The formation of networks either within or across countries extends the expertise available to individual member laboratories, allows collaborative rather than competitive development of capacity, improves the efficiency of responses to new threats and facilitates the development of and participation in quality assurance activities. The outcomes include a better response capacity and capability, improved quality of testing for current and new threats, and the ability to demonstrate quality through quality assurance activities and accreditation. Networks also facilitate interactions across the human, animal and environmental health sectors; provide opportunities for strategic applied research in emerging diseases; and facilitate interactions with other laboratory networks internationally. All of this increases the credibility of member laboratories and provides opportunities to actively participate in national and international planning.

Laboratory networks are able to provide substantial benefits in the range, efficiency, quality and credibility of services.

2.1.4 The role of the laboratory in the detection of outbreaks of emerging and re-emerging infectious diseases

Dr DT Mourya, Director, National Institute of Virology, India

During the last decade, many EIDs affected Asia and the Pacific, including the Nipah virus in 1999; Chandipura virus and SARS in 2003; avian influenza A(H5N1) in 2004; Chikungunya virus in 2006; influenza A(H1N1)pdm09 in 2009; Crimean–Congo haemorrhagic fever in 2010; hand, foot and mouth disease and MERS-CoV in 2012; and avian influenza A(H7N9) in 2013. Many of these pathogens continue to cause human infection today.

Kyasanur forest disease was considered to be endemic in five districts of Karnataka State, India, and recently, cases have been reported in neighbouring states. No surveillance for this viral disease is in place in other areas. Hence, the National Institute of Virology has established molecular and serological diagnostic tests for the detection of this disease.

Other emerging and re-emerging pathogens, such as Hantaan River virus and MERS-CoV, pose health threats to Asia and the Pacific. In addition, vectorborne pathogens (e.g. Japanese encephalitis virus, West Nile virus, dengue and malaria) as well as drug-resistant organisms (e.g. multidrug-resistant tuberculosis and drug-resistant influenza) are also of concern in Asia and the Pacific. The National Institute of Virology has been involved in preparedness and response to emerging and re-emerging pathogens.

The laboratory's role in preparedness and response during outbreaks is to provide services (e.g. identification of aetiology, phenotypic and genotypic characterization, training, reagents and technical support), conduct surveillance (e.g. evolution and genetic adaptors), support epidemiological investigations (e.g. identify risk factors and host pathogen interactions) and support public health interventions and applied research (e.g. diagnostic tests, antivirals, host reservoirs, development of vaccines and pathogenesis). The National Institute of Virology coordinates inter-institutional activities such as reference services to other laboratories through the Global Outbreak Alert and Response Network.

2.1.5 Discussion

Participants agreed that APSED (2010) was important for strengthening public health laboratory capacity for the surveillance of and response to EIDs in Asia and the Pacific, as it provides a clear vision and direction to support Member States to strengthen their laboratory capacities and achieve compliance with IHR (2005).

It was agreed that national public health laboratory networks should be a part of the overall public health system and should include laboratories in all sectors including private, animal and food laboratories. Once established, the public health laboratory system should be tested for its intended functions.

Although much research has been done to improve laboratory diagnosis, little is accessible to public health laboratories. From past and current meetings and events in Asia and the Pacific, it has been shown that laboratories play an important role in public health emergency preparedness and response. Currently, different Member States may be at different stages of strengthening their laboratory networks. It is important to identify constraints and gaps in the different countries and areas.

2.2 Plenary Two: Progress made with implementation of country work plans for public health laboratory networks for the surveillance of and response to emerging infectious diseases

2.2.1 Public health laboratory networks for surveillance of and response to emerging infectious diseases

Dr Frank Konings, Technical Officer, Emerging Disease Surveillance and Response, WHO Regional Office for the Western Pacific

The laboratory focus area of APSED (2010) has four key components: (1) accurate laboratory diagnosis, (2) laboratory support for surveillance and response, (3) coordination and laboratory networking and (4) biosafety. WHO has provided technical guidance and support to its Member States through the implementation of the APSED (2010) work plan. Activities related to strengthening public health laboratory networks can be divided into three stages: (1) defining the role of public health diagnostic laboratories in surveillance and response, (2) ensuring safe and accurate diagnosis and (3) identifying novel pathogens.

APSED (2010) has contributed to strengthening laboratory capacity in key areas, starting with the establishment of national steering committees and technical working groups to develop laboratory policy and work plans. During the second stage, a national public health laboratory system is to be established, composed of laboratories at the national and subnational levels with their own roles and related capacities. Once established, the third stage is to test the public health laboratory system to ensure proper functioning.

It is acknowledged that individual countries are at different stages of establishing public health laboratory network capacities. It is important, as countries move to complete activities in the second stage, that they continue to assess activities to ensure that the emergency preparedness plan for laboratory services is performing the functions as intended. Therefore, testing the function of laboratory network is important, and WHO intends to support and assist countries to perform assessment exercises. Discussion at this meeting will be useful for preparing the testing of the functionality of national public health laboratory networks as part of the health system.

2.2.2 The Lao People's Democratic Republic

Dr Phengta Vongphrachanh, Director, National Center for Laboratory and Epidemiology (NCLE), Lao People's Democratic Republic

The Lao National Policy for Health Laboratories and the National Strategic Plan, endorsed by the Minister of Health, strengthen laboratory capacity and include three types of laboratories (i.e. curative sector, public health sector and international partners).

NCLE, the national reference laboratory, participates in international networks, including for influenza, measles and rubella, and the Global Foodborne Infections Network. It coordinates national sentinel surveillance networks for influenza-like illness, non-malarial febrile illness and diarrhoea, and offers cross-laboratory epidemiology

training to strengthen collaborations between laboratory staff and epidemiologists. NCLE collaborates formally with the National Animal Health Laboratory and Ministry of Agriculture and Forestry under the One Health plan.

The Lao People's Democratic Republic is in the process of developing national laboratory network guidelines and identifying priorities for testing and establishing referral laboratories. Currently, diagnostic services at the central level, subnational level and provincial level (there are provincial hospital laboratories in 12 provinces) include several testing platforms such as sequencing, real-time polymerase chain reaction (PCR), serology tests, culture methods and susceptibility testing.

Strengthening laboratory capacity and collaborations has improved surveillance of and response to EIDs (e.g. Chikungunya virus). Despite challenges, including lack of reagents and inadequate human resources, the Lao People's Democratic Republic will continue to support epidemiological surveillance and response; improve laboratory data management in terms of timeliness, accuracy and completeness; and provide continuous education to peripheral laboratory technicians and clinicians. Under the National Health Policy, a steering committee will be formalized to oversee multisectoral laboratory activities, and a laboratory working group will be restarted to strengthen collaboration with animal health, tuberculosis, food and drug, and other laboratory networks on infectious diseases.

2.2.3 Viet Nam

Dr Dang Duc Ahn, Deputy Director, National Institute of Hygiene and Epidemiology, Hanoi, Viet Nam

Viet Nam has four national/regional institutes in the National Preventive Medicine System that conduct scientific research in epidemiology, medical microbiology, immunology and molecular biology; conduct studies of and develop new vaccines and biological products for humans; direct some national health programmes; and provide advice to the Ministry of Health on technical issues, policies, strategies, national guidelines and planning for prevention and control of infectious epidemics nationwide.

Depending on the services provided, laboratories in Viet Nam are classified as communicable disease, HIV, food or tuberculosis laboratories. Communicable disease laboratories include more than 700 districts, 63 provincial, 3 regional and 1 national laboratories (i.e. the National Institute of Hygiene and Epidemiology). District laboratories only have bacteriology, microscopic and rapid tests; therefore, many specimens are collected, stored and shipped to provincial laboratories. Provincial laboratories support district laboratories and cover bacteriology, virology and immunology tests, but may need to refer specimens to the national laboratory. National and regional laboratories are the most advanced and provide molecular biology using different platforms. They set standards and provide training and EQA to subnational levels. Referral to WHO Collaborating Centres and international laboratories are through these laboratories.

The Public Health Laboratory Network is providing laboratory testing for surveillance. The methods used include RT-PCR and isolation of viruses from severe acute respiratory infection specimens.

2.2.4 The Philippines

Ms Lydia T. Sombrero, Supervising Science Research Specialist, Microbiology Department, Research Institute for Tropical Medicine, Manila, Philippines

The Research Institute for Tropical Medicine, the research arm of the Department of Health, was designated as the national reference laboratory for most infectious diseases with the mandate to conduct research, training, surveillance and response to emerging and re-emerging infectious diseases. Recognizing these roles, WHO funded a project to establish a functional laboratory network system for disease surveillance for emerging and re-emerging infections and outbreak investigations in the Philippines, including capacity building in accordance with the National Laboratory Plan.

The final outputs of the project included an outbreak manual, which contains basic biosafety and biosecurity, specimen collection transport and storage instructions following International Air Transport Association guidelines and the specimen referral system in the country to enhance the information link between different government agencies for disease surveillance and outbreak investigation.

The National Center for Health Facilities Development spearheaded the establishment of the national framework of the National Health Laboratory Network, which was approved through Administrative Order No. 2012 -0021, to provide a direction for strengthening the capacities of health laboratories of all government and private hospitals at all levels for quality and accessible health services. Strategies were set, the targets have been achieved and the activities are ongoing. In addition, support for biosafety and biosecurity from the Biosecurity Engagement Program has been received from the Government of the United States, Canada-Asia Regional Emerging Infectious Disease (CAREID) project, Canadian International Development Agency, European Union and the Philippine National Police.

2.2.5 Thailand

Dr Aree Thattiyahong, Deputy Director, National Institute of Health, Ministry of Public Health, Thailand

The Thai National Institute of Health, Department of Medical Sciences, Ministry of Public Health, serves as the national reference laboratory. Besides the National Institute of Health, there are 14 regional medical science centres located across the country serving as subregional public health laboratories.

The EID laboratory network was initially established for influenza and subsequently expanded to include several infectious pathogens. Members of the network include the public health laboratories and hospital laboratories of government, private and university hospitals. At present, laboratory surveillance and response programmes on

EIDs include avian influenza A(H5N1), pandemic influenza, multidrug-resistant tuberculosis, extensively drug-resistant tuberculosis, HIV/AIDS, *Streptococcus suis,* leptospirosis, dengue, Chikungunya virus, Japanese encephalitis virus and vaccine-preventable diseases such as measles and diphtheria.

In 2013, in response to the emergence of new influenza subtypes such as avian influenza A(H7N9) in China and MERS-CoV in Saudi Arabia, the National Influenza Center at the National Institute of Health has already prepared the diagnostic tests for the detection of both diseases and is providing training courses and supplies, as well as proficiency testing samples for the network members.

2.2.6 Mongolia

Ms Dulamjav Jamsransuren, Head, Laboratory Department, National Center for Zoonotic Diseases, Ministry of Health, Mongolia

The National Health Laboratory Strategy (2010–2015) was developed to guide the development of health laboratory services in Mongolia, including the public health laboratory network strategic plan and procedures. The national strategy focuses on: (1) national reference laboratories, (2) the public health laboratory network and (3) national standards for laboratory service. The public health laboratory network includes clinical diagnostic, veterinary and environmental laboratories. The Public Health Unit of the Provincial Health Department, established in 2012, has epidemiology, statistician, public health and environmental health specialists. The Ministry of Health is planning to establish a public health centre to integrate the laboratories of provincial hospitals, National Center for Zoonotic Diseases and public health units to enhance surveillance.

There are six national reference laboratories that provide reference laboratory services. The national surveillance systems includes: (1) an integrated laboratory sentinel influenza surveillance network, consisting of the web-based real-time online reporting of influenza-like illness; (2) sentinel severe acute respiratory illness surveillance; (3) the early warning, alert and response system, which records weekly surveillance and laboratory data; (4) the zoonoses surveillance network, which coordinates human- and veterinary laboratory-based surveillance; and (5) WHONET for antimicrobial susceptibility testing.

Laboratory services, including those at the subnational level, have been strengthened and expanded in scope and technology platforms. A specimen referral system for zoonotic diseases and nonzoonotic diseases has specimen flows to national reference laboratories from subnational laboratories, field investigations and the surveillance systems. This increased laboratory capacity has strengthened surveillance and response activities.

Further planned improvements include: (1) adding primary- and secondary-level laboratories in the early warning, alert and response system; (2) implementing national standards on biosafety, biosecurity and quality management; and (3) coordination and WHO Collaborating Centre support for zoonoses.

2.2.7 Discussion

All countries reported progress in the implementation of their national work plans for public health laboratory networks for the surveillance of and response to EIDs. All have identified or are in the process of identifying a national laboratory focal point and steering committee. It is acknowledged that the national public health laboratory networks in Asia and the Pacific are at different stages of development, but all showed attempts to incorporate subnational-level laboratories. All reported activities related to biosafety and laboratory quality management under APSED (2010). These activities include setting national standards and policies, conducting training workshops, and developing and implementing guidelines to meet national standards and policies.

Although it is best that national public health networks have all levels of laboratories publically funded, a sustainable system may include private laboratories and nongovernmental organizations (e.g. international laboratories and academic and research laboratories). Private laboratories may be conducting most of the patient diagnoses and could be valuable to public health or surveillance.

A reference laboratory service system may involve more than one designated laboratory in a country depending on available resources, reporting structure and existing working relationships. Specimen transport in geographical and climatic diverse conditions could be challenging, but there is progress and strategies to overcome these challenges.

2.3 Plenary Three: Strengthening public health laboratory quality and referral systems for emerging infectious diseases

2.3.1 Background on the laboratory quality management system and development of the laboratory quality stepwise implementation tool

Dr Christopher Oxenford, Technical Officer, Health Laboratory Strengthening, WHO, Lyon

The laboratory is an area of the health system that is most amenable to standardization, and it is well recognized that a consistent, quality outcome requires a systematic approach.

The Clinical and Laboratory Standards Institute in the United States has developed 12 quality system essentials as a means of describing the components of an LQMS. These quality system essentials include topics such as organization, purchasing and inventory, facilities and safety, and are consistent with international standards ISO 15189 for medical testing laboratories. Despite these international standards of providing a framework for what should be in place in a laboratory, they do not contain enough detail nor guidance for implementation.

Therefore, WHO and partners have developed a number of resources for countries and laboratories to use to enhance their laboratory quality systems. These include a training toolkit for laboratory quality based on the 12 quality system essentials. This is

available on the WHO website, in CD and book form in English, with French and Russian language versions in development.

WHO is also developing a stepwise laboratory quality stepwise implementation (LQSI) tool that provides direct practical support for laboratories wishing to implement a quality management system in a stepwise manner with the ultimate goal of achieving accreditation against an international standard. The tool is now in its final stages of preparation and will be available in English on the WHO website in the coming months, with a French version to follow.

These tools are fully compatible with regional strategies such as APSED (2010).

2.3.2 A laboratory quality management system in Cambodia and roll-out of laboratory quality stepwise implementation

Dr Sau Sokunna, Deputy Director, Bureau of Medical Laboratory Services, Ministry of Health, Cambodia

Cambodia has two programmes to assist laboratories to implement LQMS, namely Strengthening Laboratory Management Towards Accreditation (SLMTA) and LQSI.

SLMTA is a mentor programme that helps laboratory staff members understand quality management and the requirements to meet national standards of quality management. Under SLMTA, three training workshops and onsite visits were conducted targeting 20 people from seven laboratories. Based on the pre-training and post-training assessment of the 12 quality system essentials, the laboratories improved in most elements. The assessment also identified some challenges of SLMTA; however, these can be resolved by increased funding to expand the training programme to emphasize the importance of quality management and more likely commit to its implementation. The translation of training materials and training of local trainers will also eliminate the language barrier during workshops.

LQSI is a tool that translates the ISO 15189 requirements into step-by-step activities. The LQSI activities were coordinated by the Ministry of Health and WHO. Currently, an online site provides many user-modifiable support materials such as document templates and standard operating procedures to assist laboratories. Initially, five laboratories were included, targeting all staff members, including nontechnical, who have access to each laboratory. In-service mentorship, supported by different organizations, provides daily encouragement and guidance to implement the quality management system. As SLMTA and LQSI are complementary, they will be integrated in the future.

2.3.3 Key role of specimen referral in public health laboratory systems

Dr Lai King Ng, Consultant, Emerging Disease Surveillance and Response, WHO Regional Office for the Western Pacific

It is recognized by the scientific community that no single laboratory has all of the capacity to respond to all health hazards. Therefore, interlaboratory collaboration for rapid identification and reporting of EIDs should be part of any prevention and control plan. The decision for an individual laboratory to refer specimens will depend on its capacity and relationship with other national and international laboratories or laboratory networks.

The turnaround time for laboratory tests depends on the effectiveness of sample collection, the referral system and the complexity of the test. Simulation exercises can test the functionality of such referral plans and should include sample referral systems and surge capacity required for rapid response to emergencies of different scales. Nonlaboratory partners could also be included, especially for collection, transport of specimens and communication of results. The preparedness and response plan should have written standard operating procedures, and all relevant members within the rapid response system should understand the plan, the procedures, each member's roles and responsibilities, and the mechanism and rules on risk communication. The referral system should also include sample tracking and the defined chain of custody to avoid confusion of recording and reporting results.

For novel pathogens, the sample referral system should have algorithms to define unknown specimens. As laboratory capacity increases within the national laboratory network, more tests will be used to detect known pathogens. Although it is uncommon to have mixed infections (bacterial and viral) in one specimen or one pathogen causing more than one syndrome, these pose challenges in a national system that lacks horizontal collaboration between pathogen-specific vertical networks or with other sectors.

2.4 Summary: Day 1

Dr Frank Konings, Technical Officer, Emerging Disease Surveillance and Response, WHO Regional Office for the Western Pacific

"Setting the Scene" included: (1) a summary of the APSED (2010) strategy, (2) public health laboratory networks and their role in the surveillance and response for EIDs, and (3) the role of the laboratory in outbreak detection of EIDs. From the presentations, it was agreed that Asia and the Pacific is a hotspot for EIDs and that the public health laboratory system for EIDs (APSED 2010 Focus Area 2) requires further strengthening. Building upon conclusions and recommendations from the previous regional laboratory meetings, including building laboratory capacity at the subnational level and a syndromic approach for identifying novel pathogens, is recommended.

A series of five presentations from Lao People's Democratic Republic, Viet Nam, Philippines, Thailand and Mongolia showed that these Member States have made progress in developing a public health laboratory system that functions at national and

subnational levels—a core part of the surveillance of and response to EIDs, contributing to achieving core capacities under IHR (2005).

Dr Li Ailan, on behalf of the Regional Director, addressed the participants and gave her vision of the role of WHO in assisting Member States in building capacity to meet the challenges of EIDs, antimicrobial resistance and other cross-cutting issues.

After lunch, presentations included the description of the WHO's LQMS and LQSI toolkits. Cambodia presented its application of the LQMS and LQSI toolkits and its implementing experiences. Laboratory quality and specimen referral are key elements of a well-functioning public health laboratory system for surveillance and response to EIDs. It is important that these referral systems function well in both sending and receiving referral specimens.

2.5 Plenary Four: Detection of pathogens causing severe acute respiratory infections

2.5.1 Situation updates on avian influenza A(H7N9) in China: contributions of laboratory to surveillance and response

Prof Feng Zijian, Chinese Center for Disease Control and Prevention, China

Influenza A(H7N9) was first reported in China in 2013. The initial specimen was forwarded from Shanghai to the Chinese CDC through the pneumonia of unknown aetiology surveillance system on 24 March 2013, and reported through IHR on 31 March 2013. Over the next 2 months, a further 132 cases, including 37 deaths, were reported from other areas including Anhui, Beijing, Fujian, Henan, Hunan, Jiangsu, Jiangxi, Shandong, Taiwan and Zhejiang. Since then, sporadic cases continue to be reported.

The laboratory contribution to the initial outbreak response included the development of the RT-PCR method at the Chinese CDC, allowing for the detection of the influenza A(H7N9) virus 1 day after receipt of the specimen. On 28 March 2013, the virus was isolated, with the genome sequenced the following day. The Chinese CDC then distributed the laboratory protocol and diagnostic kit in April to all provinces in China. However, the initial case of influenza A(H7N9) from each province was confirmed by the National Influenza Centre at the Chinese CDC. After this, prefectural CDC laboratories tested specimens using RT-PCR for avian influenza A(H7N9), with provincial CDC laboratories re-testing for confirmation. Other laboratory research undertaken included genetic characterization of the virus, drug-resistance testing, vaccine development, animal model experiments and source tracking.

During the outbreak, the Chinese CDC expanded their surveillance of influenza-like illness by adding H7 PCR testing. The pneumonia of unknown aetiology surveillance system was simplified by performing testing locally to reduce response time. In the outbreak response, close contacts were followed up and recorded through a newly implemented suspected avian influenza A(H7N9) reporting system. The case definition of pneumonia of unknown aetiology, suspected case and confirmed case were defined.

China shared information and specimens with WHO, WHO Collaborating Centres and other countries. As of 29 April, 20 shipments of virus were sent to 15 recipients.

Future steps include conducting a serology study, monitoring virus mutations, reviewing case definitions including the surveillance definition, improving laboratory testing and increasing clinical laboratory capacity.

2.5.2 Building diagnostic capacity for the Middle East respiratory syndrome coronavirus

Dr Christopher Oxenford, Technical Officer, Health Laboratory Strengthening, WHO, Lyon

In September 2012, a novel coronavirus detected in a patient in the United Kingdom was almost identical to one isolated from a patient in Saudi Arabia. Since then, this virus has been detected in cases originating from a number of countries in the Middle East and was subsequently named MERS-CoV.

At present, the preferred assay for the detection of MERS-CoV in clinical specimens is PCR. A number of assays have been developed that are both highly sensitive and specific. WHO currently recommends testing for at least two targets, with both testing positive before the case is considered laboratory-confirmed. Alternatively, a single positive PCR result combined with sequencing an appropriate PCR product confirming identity with known MERS-CoV sequences would also constitute a laboratory-confirmed case.

WHO has developed case definitions and testing algorithms to assist Member States identify which cases to test and which assays to use. WHO can also assist those Member States without the capability to perform testing for MERS-CoV to develop such capability or to identify international laboratories that can provide this service.

2.5.3 Severe acute respiratory illness diagnostic testing algorithm and multipathogen detection

Dr Rogier van Doorn, Clinical Researcher, Centre for Tropical Medicine, Oxford University Clinical Research Unit, Viet Nam

Clinical research has become an intrinsically slow process because of complicated regulatory requirements. As the peak of a pandemic or epidemic usually lasts only 6–8 weeks, this is a major barrier to initiating clinical research in outbreak settings, as demonstrated during the 2009 pandemic of influenza A(H1N1)pdm09. The International Severe Acute Respiratory and Emerging Infection Consortium (ISARIC) was initiated to change the approach to research in outbreak situations by ensuring that clinical researchers have the open access protocols and data-sharing processes required to facilitate a rapid response to emerging diseases that may turn into epidemics or pandemics. Pre-outbreak preparation for clinical research is being assembled across Asia and the Pacific, resulting in a linked network of ready-to-go research sites with pre-approved study protocols in place for the next outbreak. ISARIC aims to address the social, operational and ethical issues related to this paradigm change.

Diagnostic approaches to severe acute respiratory illness depend very much on the situation, which can vary from the rapid identification of a pathogen in an individual patient in a hospital setting, to identification of a range of pathogen classes for surveillance purposes or to determine an unknown pathogen causing an outbreak of transmissible severe acute respiratory illness. Each situation comes with different requirements for speed, sensitivity, specificity, predictive values and ranges of known and unknown pathogens. The available diagnostic approaches (both for indirect testing for antibodies and direct testing for pathogens) is rapidly expanding through technical developments and decreasing per-assay costs. Pathogen-specific (single or multiplexed) testing methods, more generic pathogen (family)-based approaches and entirely diagnostic deep sequencing techniques have all been developed to a level where they can be implemented in reference or hospital laboratories. Testing algorithms are required for the optimal use of these modalities in each setting and will depend on the setting, required outcome and time-frame.

2.5.4 Discussion

The participant from China elaborated on the influenza testing algorithm during the avian influenza A(H7N9) outbreak. After provincial laboratories increased their laboratory capacity as a result of the outbreak, the pneumonia of unknown aetiology surveillance system was simplified to allow for more rapid specimen referral. The routine influenza testing algorithm in China, similar to other countries, was to test for influenza A first, then continue to screen for unknown viruses, e.g. pandemic H1, H3 and H5 and then H7. However, after the emergence of avian influenza A(H7N9), China updated this protocol to ensure early detection of all H7 cases by conducting H7 testing first after a positive influenza A, followed by testing for H5. If influenza A were positive and H7 and H5 negative, then seasonal influenza was tested for. All cases detected by provincial laboratories were confirmed by the Chinese CDC.

It was also reported that a serosurvey of asymptomic cases is currently being conducted in China. Sera were collected from close contacts, including family and hospital and health care contacts, and also from community members in some districts that were highly affected. The study is not complete yet because the testing method is being improved.

Over the last 10 years, there has been a general enhancement to the entire laboratory system in China in preparedness to respond to EIDs, and China now has a WHO Collaborating Centre for influenza-like illness. Without these improvements, the impact of avian influenza A(H7N9) would have been much bigger. This experience has shown that building local capacity for EIDs should start with a known pathogen first, as the faster known pathogens can be screened, the faster unknown pathogens can be detected.

More information was then provided about the testing for MERS-CoV. As described, WHO recommends using two targets for PCR testing of MERS-CoV, and if both are positive, then it is as confirmed case and there is no need to do other tests for confirmation. However, if the technician is not confident about the results or it is the early stage of an outbreak, the laboratory can send specimens to another laboratory to confirm the results. WHO country offices can assist Member States in finding another

laboratory for this testing. If only one target test is positive, then it is recommended to sequence an appropriate section of the PCR products. As there is no rapid test for MERS-CoV, the PCR method is currently the only diagnostic tool.

Countries may have different laboratory capacities, and there is no single technology that suits all laboratory systems for detecting novel pathogens. There are PCRs that can conduct multiplex for respiratory syndromes. Networking and rapid referral between laboratories could be important ways to allow for the rapid detection of unknown viruses in resource-poor settings.

2.6 Plenary Five: External quality assessment: ensuring accurate diagnosis of emerging infectious diseases

2.6.1 Coordination and impact of the global external quality assessment programme for influenza

Dr Janice Lo, Medical Microbiologist, Public Health Laboratory Centre, Department of Health, Hong Kong (China)

The EQA programme for the detection of influenza A by PCR was initiated in 2007, coordinated by the WHO Global Influenza Programme, and implemented by the H5 Reference Laboratory and National Influenza Centre in Hong Kong (China). The background for undertaking this programme was: (1) the continually evolving pandemic and avian influenza situation as a global issue; (2) recognition that efficient, reliable detection of novel influenza infections in humans is extremely important for global pandemic influenza outbreak response; and (3) the utility of PCR as the first-choice laboratory test for detection of potential pandemic infections, due to biosafety requirements on virus culture and many National Influenza Centres not possessing containment facilities.

Various changes have occurred since the establishment of the programme. There were two dispatches per year until 2012, when it was scaled down to one dispatch annually. The initial dispatch comprised 10 RNA samples, including influenza A H1, H3 and H5 viruses, where 64 laboratories returned results and 77% reported all correct H5 results. Additional viruses have been introduced in subsequent panels, including influenza A(H1)pdm09, influenza A H9 and influenza B (Victoria and Yamagata lineage) viruses. The virus inactivation methods have also evolved from RNA extracts initially to gamma ray-inactivated viruses since 2011, and beta-propiolactone-inactivated viruses in 2013. In the latest completed Panel 11 in 2012, 163 laboratories returned results and 88% reported all correct H5 results. Good Laboratory Practice surveys were undertaken in 2010 and 2012, and improvements were tangibly seen in various aspects of laboratory practices.

The continued evolution of the EQA programme is expected to address the exploration of alternative virus inactivation methods to reduce fragmentation of RNA due to the inactivation process, and the inclusion of new virus strains and evaluation of proficiency in antiviral susceptibility testing.

2.6.2 Establishment of an external quality assessment programme for dengue

Associate Professor Lee Ching Ng, Director, Environmental Health Institute, National Environment Agency, Singapore

The objectives of the dengue EQA programme is to assess regional laboratories in the molecular and serological detection of dengue, identify gaps in dengue detection, build core capacity of arbovirus laboratories and stimulate networking and collaboration among regional arbovirus laboratories. The EQA programme is expected to contribute to enhanced regional disease surveillance and outbreak response towards dengue and EIDs.

As the coordinating laboratory, the Environment Health Institute is supporting WPRO in (1) establishing an EQA programme for the detection of dengue by serological and molecular methods, which include preparing and distributing the EQA programme specimens, analysing returned results and preparing a performance report of participating laboratories; (2) promoting Good Laboratory Practices, including analysis of survey results; (3) monitoring the EQA programme through collecting, analysing and responding to comments; and (4) drafting a manuscript for publication. Other partners involved in establishing the EQA programme for dengue include the Technical Committee Members for Dengue EQA Programme and Tan Tock Seng Hospital, Singapore.

The developed scheme was based on guidance from the global EQA programme for influenza, ISO 17043, the EQA programme of the Royal College of Pathologists of Australia and the European Network for Diagnostics of "Imported" Viral Diseases and Good Laboratory Practices survey. WHO will use this EQA programme to guide development of future EQA programmes for other EIDs.

The panel distributed includes a molecular/nonstructural protein 1 antigen test module that consisted of heat-inactivated virus and a serological module that consisted of sera from dengue convalescence volunteers. The biosafety of the samples were verified through cell culture and testing for HIV, hepatitis B, hepatitis C and dengue virus. A total of 19 participants from the Western Pacific Region have been registered, and the final report of the EQA programme is expected to be completed by end of September 2013.

2.6.3 Discussion

It has been demonstrated that EQA is a useful tool to promote or engage collaboration between laboratories. Laboratories consider WHO EQA programmes to be of high value and prestigious to participate in. The design and preparation of EQA panels depends on the objectives of the EQA or the performance indicators for assessing the quality management programme or laboratory capacity-strengthening activities.

Sustainability of EQA could be achieved through: (1) finding innovative ways to reduce shipping costs without compromising the integrity of specimens (e.g. use WHO regional or country offices, integration with other programmes or remuneration); (2) integration with other EQA programmes; or (3) using a common-platform approach

for syndromic diagnosis to cover multiple pathogens in one specimen (e.g. the European Union has a panel that includes 26 pathogens).

An additional component of EQA programmes is to help participants improve their performance and to troubleshoot. To assist with this, WHO has training materials for addressing laboratories with deficiencies.

There was participant consensus in publishing aggregated results from the dengue EQA programme. The participating laboratories remain unidentified within the EQA programme but can be listed in the publication. Member States from South-East Asia were also encouraged to join the dengue EQA programme.

It was suggested that WHO should consider expanding the EQA programme to include more pathogens and to develop guidance to Member States to implement their national EQA. It is important to consider the whole laboratory system and syndromic approach for diagnostic services to detect multiple pathogens at the same time. Hence, the focus of EQA could be shifted to technology platform-based rather than individual pathogen tests.

2.7 Group exercise

The primary objective of the group exercise was to engage participants in facilitated discussion to develop recommendations for future activities to further strengthen laboratory capacities to prepare for and respond to EID outbreaks and emerging and novel pathogens of international concern.

The scenario for the group exercise was based on a resource-poor country X with a strong poultry industry. Avian influenza has been a potential threat to country X as both a human and animal disease. This country also has endemic seasonal diarrhoea.

First, the participants discussed and proposed ways to strengthen capacity for early detection of avian influenza. These included: (1) improvements in sample collection and a referral system on syndromic severe acute respiratory illness surveillance; (2) improvements to subnational testing capacity including the use of rapid diagnostic tests in clinical, hospital and private laboratories; (3) sharing of information and collaboration with different sectors; and (4) improvement to alert and early warning systems to include front-line and primary health care providers and the animal sectors.

To leverage existing resources to expand the syndromic surveillance of influenza or severe acute respiratory illness to detect novel coronaviruses (e.g. MERS-CoV) or other zoonotic respiratory illnesses, participants suggested modifying the case definition for influenza or severe acute respiratory illness to include clinical signs and symptoms of MERS-CoV cases and other acute respiratory illness. Surveillance capacity could also be increased vertically to include subnational laboratories, and horizontally to collaborate with other sectors (e.g. clinicians, general practitioners and animal health sectors) to collect, test or refer samples. Training laboratory personnel and providing supply reagents could improve local capacity, while national-level laboratories could implement new technologies to test for MERS-CoV. Laboratory platforms for syndromic testing through the detection of multiple pathogens from a single specimen may be cost-effective and

provide timely results. Event surveillance that monitors adjacent countries' events is beneficial for preparedness and response to MERS-CoV and other emerging zoonoses.

It was also suggested that the organizational structure, coordination and management of public health networks in country X was needed to allow for an all-hazard approach (i.e. address endemic diseases and EIDs simultaneously). The laboratory system should have defined roles and responsibilities, complementary testing capacity at national and subnational levels, algorithms for pathogen testing and good communication between epidemiologists and laboratories.

Finally, the participants shared their thoughts on possible challenges for country X. The use of advanced technologies and rapid tests is recommended; however, this requires buy-in and collaboration from different sectors, which can be a challenge where resources are limited. Functional exercises were also recommended to test the public health laboratory network for EIDs.

2.8 Summary: Day 2

Dr Amarjargal Yadam, Director, Division of Medical Services, Ministry of Health, Mongolia

The presentation from China on the avian influenza A(H7N9) outbreak re-emphasized that Asia and the Pacific needs to be prepared for novel EIDs and that laboratory capacity is required. Based on recent events of avian influenza A(H7N9) and MERS-CoV, a syndromic approach to testing for multiple pathogens from the one specimen for a syndrome, such as severe acute respiratory illness, should be considered.

Global EQA for influenza has strengthened laboratory testing capacity, and now there is also an EQA programme for dengue, which could be used as a pathfinder for other EIDs. The results of the first round of the dengue EQA programme needs to be evaluated with the results published. The next priority pathogens for EQA should be considered, and Member States from South-East Asia included.

The group work introduced a scenario for using a syndromic approach to testing and identifying novel pathogens using existing systems. Severe acute respiratory illness was used, as the example groups were asked to brainstorm about all elements of the system that are required to work together to implement syndromic testing.

2.9 Surveillance system and external quality assessment for bacterial antimicrobial resistance in the Republic of Korea: Korean Nationwide Surveillance of Antimicrobial Resistance (KONSAR) group

Professor Dong Eun Yong, Department of Laboratory Medicine, Yonsei University College of Medicine, Republic of Korea

The Korean Nationwide Surveillance of Antimicrobial Resistance (KONSAR) has been operating at the Severance Hospital since 1997 and reports susceptibility test results as a focal point in the Republic of Korea. Currently, over 80 clinical microbiology laboratories from various universities, general hospitals and commercial companies

participate in KONSAR. The main organisms reported through the system are methicillin-resistant *S. aureus,* vancomycin-resistant enterococci, extended spectrum beta-lactamases, plasmid-mediated AmpC beta-lactamase, and carbapenemase-producing Gram-negative bacilli.

The Korean Association of Quality Assurance for Clinical Laboratories system began in 1976 in the Republic of Korea and is a nonprofit, government-approved association supported by both the medical and technical groups that conduct EQA. Today, over 700 clinical laboratories have participated in the system with quality assurance activities including clinical chemistry and clinical microbiology. The number of clinical microbiology quality assurance activities has been increasing since 1977.

Both a successful surveillance system and EQA rely on participant and expert group commitment and confidentiality, as well as regular updating of the system, rapid collection and analysis, higher-quality data and prompt feedback.

2.10 Closing remarks

Dr Li Ailan, Director, Division of Health Security and Emergencies, WHO Regional Office for the Western Pacific

In her closing remarks, Dr Li summarized the meeting and was pleased with the recommendations endorsed by the meeting participants. The meeting demonstrated that the laboratory is an important core capacity for the surveillance of and response to EIDs. She acknowledged the participants' contributions through presentations, discussions, debate and feedback. She congratulated all for achieving the objectives of the meeting with positive outcomes and deliberation. She encouraged Member States to use their own resources and mechanisms as well as tools from WHO to continue to monitor their progress and to strengthen their laboratory capacity.

The participation and continued collaboration of both WPRO and the Regional Office for South-East Asia Member States is very important for EIDs. She thanked all participants, WHO collaborators and partners for their commitment to move forward with the recommendations from this meeting.

3. CONCLUSION AND RECOMMENDATIONS

3.1 Conclusion

Member States continue to make progress with their development of public health laboratory systems, a core part of the surveillance of and response to EIDs and other events of public health significance as well as a core capacity under IHR (2005).

3.2 Recommendations

(1) Member States should continue to strengthen national public health laboratory systems for the surveillance of and response to EIDs through building laboratory capacity and effective linkages with stakeholders.

(2) The development of public health laboratory systems in each Member State should be based on and harness existing capacities and channels of referral, including laboratories that do not have a primary public health role, noting the existing variation across Member States in the organization of laboratories providing public health functions.

(3) Members States should develop an interdisciplinary framework and protocols that ensure integration of syndromic surveillance with public health laboratory functions; protocols should include a local and international specimen referral system. It is also recommended that Member States consider demonstrating the effective functioning of the framework and protocols through exercises.

(4) National steering committees for laboratories should continue to strengthen intersectoral (e.g. animal health and environmental health) and interdisciplinary (e.g. clinical and epidemiology) relationships across disease programmes and government ministries. Technical working groups should continue to implement national work plans that include business continuity plans for strengthening the public health laboratory system for EIDs.

(5) Member States should further develop their capacity for the safe and rapid detection of EIDs; expand testing for severe acute respiratory infections beyond influenza, such as avian influenza A(H7N9) and MERS-CoV; and develop links with reference laboratories as necessary.

(6) Member States should consider the use of new technologies that can detect multiple pathogens to improve rapid investigation, identification and response to an event of potential public health importance.

(7) WHO should evaluate the first round of the dengue EQA programme and determine how other priority pathogens of public health importance can be included.

(8) WHO should continue to collaborate with ASEAN, FAO and OIE to strengthen laboratory capacity and response at the animal–human interface.

PROGRAMME OF ACTIVITIES

Day 1: Tuesday, 4 June 2013

08:00–08:30 Registration

08:30–09:30 Opening session

Welcome and opening remarks
- Dr Li Ailan, Director, Health Security and Emergencies, WHO Regional Office for the Western Pacific (WPRO)

Self-introductions
Overview of objectives and agenda
Nomination of Chairs
Administrative announcements
Group photograph

09:30–10:00 Coffee break

10:00–11:30 Plenary One: Setting the scene

10:00–10:10 Asia Pacific Strategy for Emerging Diseases 2010
- Dr Chin Kei Lee, WHO/WPRO

10:10–10:30 Public health laboratory capacity-building under Asia Pacific Strategy for Emerging Diseases 2010
- Dr Frank Konings, WHO/WPRO

10:30–10:50 Public health laboratory networks and their role in surveillance and response for emerging infectious diseases
- Dr David Smith, PathWest, Queen Elizabeth II, Medical Centre, Australia

10:50–11:10 The role of the laboratory in the detection of outbreaks of emerging infectious diseases
- Dr D.T. Mourya, National Institute of Virology, India

11:10–11:30 Discussion

11:30–12:30 Plenary Two: Progress made with implementation of country work plans for public health laboratory networks for surveillance and response of emerging infectious diseases

11:30–11:40 Public health laboratory networks for emerging infectious diseases surveillance and response
- Dr Frank Konings, WHO/WPRO

11:40–11:55	Lao People's Democratic Republic - *Dr Phengta Vongphrachanh, National Center for Laboratory and Epidemiology, Lao People's Democratic Republic*
11:55–12:10	Viet Nam - *Dr Dang Duc Ahn, National Institute of Hygiene and Epidemiology, Viet Nam*
12:10–12:30	Discussion
12:30–13:30	*Lunch break*
13:30–15:00	Plenary Two: Progress made with implementation of country work plans for public health laboratory networks for surveillance and response of emerging infectious diseases *(continued)*
13:30–13:45	Philippines - *Ms Lydia Sombrero, Research Institute for Tropical Medicine, Philippines*
13:45–14:00	Thailand - *Dr Aree Thattiyahong, Ministry of Public Health, Thailand*
14:00–14:15	Mongolia - *Ms Dulamjav Jamsransuren, National Center for Zoonotic Diseases, Mongolia*
14:15–15:00	Discussion
15:00–15:30	*Coffee break*
15:30–17:00	Plenary Three: Strengthening public health laboratory quality and referral systems for emerging infectious diseases
15:30–15:50	Background on laboratory quality management system and development of the laboratory quality stepwise implementation tool - *Dr Christopher Oxenford, Health Laboratory Strengthening, WHO/Lyon*
15:50–16:10	Laboratory quality management system in Cambodia and roll-out of the laboratory quality stepwise implementation tool - *Dr Sau Sokunna, Bureau of Medical Laboratory Services, Ministry of Health, Cambodia*
16:10–16:30	Key role of specimen referral in public health laboratory systems - *Dr Lai King Ng, WHO/WPRO*
16:30–17:00	Discussion
17:30–18:30	*Welcome reception*

Day 2: Wednesday, 5 June 2013

08:30–08:40 Summary: Day 1

08:40–10:00 Plenary Four: Detection of pathogens causing severe acute respiratory infections

08:40–09:10 Situation updates on avian influenza A(H7N9) in China: contributions of laboratory to surveillance and response
- Prof Feng Zijian, Chinese Center for Disease Control and Prevention, China

09:10–09:25 Building diagnostic capacity for novel coronavirus
- Dr Christopher Oxenford, Health Laboratory Strengthening, WHO/Lyon

09:25–09:40 Severe acute respiratory infection diagnostic testing algorithm and multipathogen detection
- Rogier van Doorn, Centre for Tropical Medicine, Oxford University Clinical Research Unit, Viet Nam

09:40–10:00 Discussion

10:00–10:30 Coffee break

10:30–12:00 Plenary Five: External quality assessment: ensuring accurate diagnosis of emerging infectious diseases

10:30–10:50 Coordination and impact of the global external quality assessment programme for influenza
- Dr Janice Lo, WHO Reference Laboratory for Diagnosis of A/H5 and National Influenza Centre, Hong Kong, China

10:50–11:20 Establishment of an external quality assessment programme for dengue
- Dr Lee Ching Ng, National Environment Agency, Singapore

11:20–12:20 Discussion

12:20–12:30 Introduction to group work
- Dr Raynal Squires, WHO/WPRO

12:30–13:30 Lunch break

13:30–17:00 Group work: Public health laboratory systems for surveillance and response

15:00–15:30 Coffee break

Day 3: Thursday, 6 June 2013

08:30–08:40 Summary: Day 2

08:40–09:50 Feedback from group work and discussion

09:50–10:00 Announcement on the Western Pacific Surveillance and Response (WPSAR) Journal
- *Ms Michelle McPherson, WHO/WPRO*

10:00–10:30 Coffee break

10:30–12:00 Plenary Six: External quality assessment: ensuring accurate diagnosis of drug-resistant organisms

10:30–11:00 External quality assessment for bacterial antimicrobial resistance in the Republic of Korea
- Dr Don-Eun Yong, Yonsei University College of Medicine, Republic of Korea

11:00–12:00 Discussion

12:00–13:00 Lunch break

13:00–15:00 Plenary Seven: Conclusions and recommendations

14:30–15:00 Coffee break

15:00–15:30 Closing session

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