Antimicrobial resistance has been recognized as one of the most important problems being faced in the area of communicable diseases. To assist countries in developing national plans, a regional strategy for prevention and containment of antimicrobial resistance has been developed by WHO. This report briefly describes the strategy as well as the implementation steps debated by participants at the regional meeting held at Chiang Mai, Thailand from 8 to 11 June 2010.
Prevention and Containment
of Antimicrobial Resistance

Report of a Regional Meeting
Chiang Mai, Thailand, 8 June – 11 June 2010
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Background

Resistance to antimicrobials is a natural and inevitable biological phenomenon that can be amplified or accelerated by a variety of factors and practices that facilitate “selective pressure”. The microbes which adapt and survive carry genes for resistance, which can be passed on to the next generation of microbes and also, in some bacteria, across different species. The selection pressure is utmost when antimicrobials are used irrationally in health and veterinary sectors. The emergence and spread of antimicrobial resistance are complex problems fuelled by the knowledge, expectations and interactions of prescribers and the patients, and regulatory environment. Patient concordance with recommended treatment is another major problem. Easy access of antimicrobials in developing countries and myths amongst communities about their use exert an equally important influence on the emergence of resistance.

No systematic studies have been done in the Region to understand the status of resistance, trends and consumption of antimicrobial agents. While multi-drug resistance in *Mycobacterium tuberculosis* in the Region is still at an acceptable low level of less than 3%, this figure is, however, very high with regard to several other bacteria. Outbreaks of resistant salmonellae causing typhoid fever and shigellosis causing bacillary dysenterie have been reported from the Region. Resistance to *Vibrio cholerae*, *Neisseria gonorrhoeae*, and *Streptococcus pneumoniae* has been increasing. More than 50% of isolates of *Staphylococcus aureus* in hospital settings are now methicillin-resistant. Multiresistant klebsiellae and *Acinetobacter* species have given new dimensions to the problem of hospital-associated infections. More than 400 million people live in areas which are at risk of resistant malaria. With rapid means of travel, international movement of resistant bacteria occurs frequently. In Canada and the USA several outbreaks of resistant strains have been reported with resistant strains originating from the SEA Region.
Box1: Consequences of resistance

Longer treatment
- Longer duration of illness
- Higher mortality
- Treatment with expensive drugs
- Increased burden on the health system
- Negates technological advances in the medical sector
  - Complex surgeries
  - Transplantations and other interventions
- Patient acts as a reservoir of resistant organisms for the community and health-care workers
- Huge impact on the economy

Apart from MDR-TB and XDR-TB, global concerns are being expressed about the emergence of resistance in HIV as well as malaria parasites, thus hampering the achievements of the Millennium Development Goals. The prevention and containment of resistance has a common approach and requires integrated and well coordinated national efforts.

Several issues hamper the prevention and containment of antimicrobial resistance and the efficacy of these drugs to maintain their “wonder” status. Some of these are: neglected problem with a profound impact on health and economy; inadequate visibility at decision-making level, lack of education amongst prescribers and users, weak collaboration between stakeholders; poor or no systematic surveillance of resistance and consumption of antimicrobial agents’, ineffective regulatory mechanism; lack of economic potential for pharmaceuticals to invest in development of new drugs; and abysmal infection control practices.

Resistance is a biological, behavioural, technical, economic, regulatory and educational problem that requires a comprehensive response. It is a major public health issue. To combat this cross-cutting problem, WHO has developed a simple and easy-to-implement strategy.
To discuss these issues and implementation of the Regional Strategy a regional meeting was organized at Chiang Mai, Thailand from 8-11 June 2010. The meeting was attended by 20 participants from Member States of the Region. Experts from Bangladesh, India and Thailand facilitated the meeting which was chaired by Dr Pathom Sawanpanyalert, Director, National Institute of Health, Department of Medical Sciences, Ministry of Public Health, Thailand, and co-chaired by Prof Abul M Faiz, former Director-General of Health Services, Bangladesh. The agenda and the list of participants are contained at Annex 1 and Annex 2 respectively.
Objectives

The following were the objectives of the meeting:

(1) To review the status of antimicrobial resistance in the Region.

(2) To share with stakeholders the Regional Strategy on Antimicrobial Resistance.

(3) To discuss the mechanism for step-by-step implementation of the strategy at country level and for keeping track of the progress made.

(4) To identify country-specific follow-up actions.
In his message, the WHO Regional Director for South-East Asia, Dr Samlee Plianbangchang, noted that during the past seven decades, antimicrobial agents have saved millions of lives, substantially reduced the burden of diseases that were previously widespread and improved the quality of life as well as helped increase life expectancy. Accordingly, these drugs were called “wonder drugs”. In the recent past, emergence and spread of resistance in several microorganisms has rendered the management of many infectious diseases difficult. Resistance poses a growing threat to the treatment and control of endemic, epidemic-prone as well as pandemic diseases, including H1N1 and HIV. The development of resistance to drugs commonly used to treat malaria, TB and HIV is of particular concern and an impediment in achieving the Millennium Development Goals by 2015.

Dr Samlee emphasized that the consequences of resistance were severe. Infections caused by resistant microbes failed to respond to treatment, resulting in prolonged illness and greater risk of death. Treatment failures also lead to longer periods of infectivity, which increased the number of infected people moving in the community and thus exposed the general population to the risk of contracting a resistant strain of infection. It was also a threat to patient safety due to the rapidly growing pandemic of antimicrobial resistance.

Antimicrobial resistance has been an unrecognized and neglected issue which is not only cross-cutting but also has far-reaching implications as an emerging public health problem with a serious risk to international health security. Newer drugs are being discovered at a slow pace. Efforts need to be made to slow down or delay the resistance, thus preserving the available antimicrobials.
To address these issues, Dr Samlee said, WHO-SEARO has developed a Regional Strategy on Antimicrobial Resistance. The strategy is simple and practical, can be adapted by Member States and is acceptable to multiple stakeholders. He strongly felt that the strategy will act as a powerful tool to prevent negation of the progress made in the field of communicable diseases. The Regional Strategy aims to comprehensively address interventions involving the introduction of legislation and policies governing the use of antimicrobial agents, establish laboratory-based networks for the surveillance of resistance, and assure rational use of these drugs at all levels of health-care settings. It also advocates ownership and active participation by several stakeholders.

Dr Pathom Sawanpanyalert read out the message from the Director-General, Department of Medical Sciences, Ministry of Public Health, Thailand. He welcomed the participants and thanked WHO for holding this meeting in Thailand. He highlighted the importance being accorded by the Government of Thailand to the burgeoning problem of antimicrobial resistance.
Proceedings of the meeting

The meeting included the presentation of country reports to review the current status of prevention and containment of antimicrobial resistance in the Region as well as discussions on underlying fundamental issues that promote emergence and spread of resistance. The recently developed Regional Strategy on Prevention and Containment of Antimicrobial Resistance (Annex 3) was used as the working document to deliberate the national activities in this area.

4.1 Current status in SEA Region

Systematic studies to understand the status of antimicrobial resistance and its trends, and consumption of antimicrobial agents have been undertaken in the SEA Region. However, the data available from published reports from Member States of the Region provide an insight into the magnitude of the problem of resistance. The information available for selected diseases/organisms is briefly described below:

**Tuberculosis**

Resistance to first-line anti-TB drugs has become a concern for national TB control programmes. The population weighted mean of MDR-TB\(^1\) in the Region is 2.08% (1.9%-3.6%) among new cases and 18.8% (13.3%-24.3%) among previously treated cases. It is estimated that around 150 000 cases of MDR-TB reside in this Region with more than 80% of these being in Bangladesh, India, Indonesia, Myanmar and Thailand.

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\(^1\) MDR-TB = Resistance in mycobacteria to isoniazid and rifampicin.
The level of multidrug-resistant TB however remains low (below 3%) reflecting the good quality of TB programmes. The need for preserving the efficacy of first-line antituberculous drugs has been widely felt since drugs used in the management of MDR-TB cases are not only expensive but also toxic.

Extensively drug-resistant TB (XDR-TB)\(^2\) has been detected in mycobacteria isolated in Bangladesh, India, Indonesia and Thailand giving another serious dimension to managing resistance in TB.

**HIV and sexually-transmitted infections**

Emerging diseases continue to challenge public health as never before. An estimated 3.5 million people are currently living with HIV/AIDS; the Region’s HIV/AIDS burden is next only to sub-Saharan Africa. The generic antiretroviral (ART) drugs produced by the pharmaceutical industry in the Region are contributing greatly to improve the survival rate of patients worldwide and in rendering HIV as a chronic but manageable condition. Although the response to ART drugs is excellent when they are delivered at health facilities, the emergence of resistance in HIV can destroy the hopes of survival for millions of people living with HIV.

There has been a substantial change in the antimicrobial susceptibility of *Neisseria gonorrhoeae*. Thirty years ago, gonorrhoea used to respond effectively to penicillin. Now, the resistance to penicillin and fluoroquinolones is widespread across the Region\(^3\).

**Malaria**

Resistant malaria has become a major issue for a population of 400 million living in areas that expose them to a high risk of contracting it. Artemisinin-based combination therapies (ACT) have recently been introduced in virtually all countries in which malaria is endemic, thereby making such drugs the most essential class of antimalarial agents. However, recent data indicate that artemisinin resistance has emerged along the border between Cambodia and Thailand. Surveillance data from the Thai Ministry of Public Health indicate that clinical failures of artemisinin-based therapies exist in the Thai–Cambodian border.

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\(^2\) XDR-TB = MDR-TB + resistance to fluoroquinolones and at least one of the three injectable second-line drugs (capreomycin, kanamycin and amikacin).

border, whereas efficacy with artesunate–mefloquine along the western borders of Thailand remains high⁴.

A “global disaster” could happen if malaria parasites worldwide developed resistance against the new artemisinin-based combination therapies (ACTs) that have become the gold standard. Large parts of the world would have no drugs to fall back on, and malaria cases and deaths could soar, erasing the hope that the world might be close to a huge reduction in the disease. Yet, resistance against ACTs is precisely what now seems to be developing in western Cambodia, along the Thai border⁵.

**Kala-azar**

Kala-azar is a public health problem in Bangladesh, India and Nepal and is being targeted for elimination using miltefosine. Pentavalent antimonials have been successfully used for treatment of kalaazar since the last six decades. Since the 1970s, however, their conventional dosages have failed to achieve the desired results with 60% unresponsiveness being reported with the WHO regimen in Bihar (India). Pentamidine initially used as a second-line drug, acquired resistance (25%) even with prolonged dosage. The newer oral drug, miltefosine is a potent antileishmanial drug with a longer half-life, a property likely to delay resistance⁶. The evolution of resistance to this drug will cause havoc to the regional efforts to combat this disease.

**Diarrhoeal diseases**

Cholera germs have acquired resistance to a number of antimicrobials. The resistance spectrum varies in different locales. In areas around New Delhi (India) extensive resistance to furazolidone, cotrimoxazole and nalidixic acid has been noted,⁷ while tetracycline has remained effective. On the other hand, in Bangladesh, tetracycline resistance has also been found to be frequent.

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Respiratory infections

*Streptococcus pneumoniae* is the most common causative agent of pneumonias in children and adults in Asia\(^8\). Till the 1980s, almost all isolates of this organism used to be susceptible to penicillin. In 2006, in a hospital in Thailand, almost 69% isolates of this bacterium were found to be penicillin-resistant\(^9\).

Typhoid and paratyphoid fever

Typhoid and paratyphoid fever continue to be important causes of illness and death, particularly among children and adolescents in the SEA Region where this disease is associated with poor sanitation and unsafe food and water. Published reports indicate that multidrug-resistant *Salmonella typhi* are prevalent widely in India and Indonesia. Shortly after the emergence of multidrug-resistant *Salmonella typhi* in this Region, case fatality rates approaching 10% (close to 12.8% recorded in pre-antibiotic era) were reported\(^10\).

Wound sepsis due to *Staphylococcus aureus*

More than 50% isolates of *Staphylococcus aureus* in hospital settings are now methicillin-resistant. In a study undertaken in a 1000-bedded hospital in Thailand, 48% patients with bacteraemia due to resistant *Staphylococcus aureus* died. Methicillin-resistant *Staph. aureus* (MRSA) is a major problem in hospital-associated infections in almost all countries in the SEA Region\(^11\).

Nosocomial infections

Multiresistant klebsiellae, pseudomonas and *Acinetobacter* species have given new dimensions to the problem of hospital-associated infections. *Acinetobacter baumannii* has become an important pathogen in intensive care units. It

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produces a wide range of beta lactamases and has a formidable spectrum of intrinsic resistance mechanisms that can mean that some strains are resistant to almost all known antimicrobial agents. In a study done in Thailand, mortality in admitted patients due to imipenem-resistant \textit{Acinetobacter baumannii} was 52\% as compared to 19\% in those who were infected with the sensitive variant\textsuperscript{12}.

### 4.2 Country reports

**Bangladesh**

Antimicrobial resistance (AMR) is considered a national priority though there is no national alliance or regulations governing the use of antimicrobials and no national coordination mechanism on AMR. The Director-General of Drugs Administration is the proposed focal point for AMR in Bangladesh. Antimicrobials are also used extensively in the veterinary sector. There is no national surveillance and network of laboratories on AMR at present but it is being planned. Many medical colleges and NGOs have published several scientific papers in different technical journals highlighting the problem of AMR in Bangladesh.

Many infectious diseases do not respond to conventional antimicrobial agents. While standard treatment guidelines are available at various levels of health care delivery and medical professionals are oriented on the rational use of antimicrobials, community awareness programmes are weak.

Most of the antimicrobials are available over the counter all over the country and usually prescribed even by unqualified or unauthorized personnel.

For surveillance of antimicrobial resistance, national authorities are planning to establish a national network of laboratories to be coordinated by a National Reference Laboratory.

**Bhutan**

Bhutan has a very comprehensive essential drugs list that includes drugs that are used to treat all major ailments. A Bhutan National Formulary (BNF) is available to guide the prescribers on the rational use of drugs. However, antibiotics policy

\textsuperscript{12} Jamulitrat S et al. Attributable mortality of imipenem-resistant nosocomial \textit{Acinetobacter baumannii} blood stream infection. J Medical Association of Thailand 2009; 92:413.
and guidelines were developed in 2007 to rationalize the use of antibiotics in the country. These guidelines are followed at the national level as well as other levels of health care.

A National Drugs Committee is functional in Bhutan and Antibiotics Advisory Committee operates in JDWNR Hospital Thimphu. Antibiotics are not easily available over the counter in Bhutan without prescription of the physician.

Physicians and pharmacists are imparted training on the rational use of antimicrobials. The drug inspectors have also been trained to monitor the quality of the drugs, registration of drugs and examining the license.

Major issues being include lack of public awareness, inadequate surveillance, weak coordination between stakeholders and the absence of a national focal point. These issues are, however, being addressed by national authorities.

India

Antimicrobial resistance in important disease pathogens has become a matter of great public health concern globally including India. The factors responsible for this are widespread use and availability of practically all the antimicrobials across the counter meant for human as well as animal consumption. Though there are definite policies/guidelines for appropriate use of antimicrobials at national level in specific national health programmes being run in the country, the same are not available for other pathogens of public health importance like enteric fever, diarrhoeal disease, respiratory infections etc. However, during the recent H1N1 pandemic, national guidelines were framed and implemented regarding restricted sale/use of oseltamivir in the country. Similarly, there is no national data base on antimicrobial resistance in different pathogens except for those where there is a specific national health programme.

Though a large number of laboratories in the country (both in the private and public sector) are carrying out drug susceptibility testing of micro organisms, the data is either not analysed on a regular basis or not being disseminated for use of clinicians/public health experts/programme managers. There are also issues of quality control and data sharing with these laboratories. There are a few examples of successful networking of laboratories carrying out antimicrobial sensitivity testing of gonococcus in the country with the Regional STD laboratory
at S.J. Hospital, New Delhi being the referral laboratory. There is networking of such laboratories also in the Revised National TB Control Programme of the country generating some useful data on drug resistance in TB and recently a laboratory network has also been established for antimicrobial testing of HIV under National AIDS Control Organization.

Meta analyses of the drug susceptibility results of various laboratories across the country reveal an increasing trend of development of resistance to commonly used antimicrobials in pathogens like salmonellae, shigellae, *V.cholerae*, *Staph aureus*, gonococcus, meningococcus, klebsiellae, *Mycobacterium tuberculosis*, HIV, malarial parasite and others.

Though there is no national database on surveillance of use of antimicrobials in the community, there are a few studies in the country in this regard. Studies carried out in Delhi and Vellore, with support from WHO during 2003-2005 suggested a very high use of fluoroquinolones in the community as compared to other antimicrobials.

At present there are a large number of challenges that need to be addressed for effective containment of this problem. Available data suggest increasing drug resistance trends in the country. There is no national programme for the purpose, there is inadequacy of quality assured laboratories, insufficient data analysis and dissemination, absence of national guidelines on antimicrobial usage, no control on sale of these drugs for public consumption etc.

In the last decade or so a large number of new initiatives have been launched by various agencies to contain this problem. These include IndiaClen (Indian Clinical Epidemiology Network) which has generated some quality data on AMR in pathogens like pneumococcus, *H.influenzae* across the country; IIMAR (Indian Initiative for Management of Antibiotic Resistance) launched in March 2008, with WHO support, by a consortium of NGOs to promote prudent use of antimicrobials, INSAR (Indian Network for Surveillance of Antimicrobial Resistance) a network of 20 laboratories in the private as well as public sector across the country to generate quality data on AMR, organization by the ICMR of an expert group meeting in December 2009 and an Indo-Swedish workshop held at New Delhi on 2 February 2010 to discuss a joint strategy for containment of AMR, recommendations of which are under consideration by the Ministry of Health & Family Welfare.
Antimicrobial resistance is considered as a national priority as the resistance of antimicrobials is increasing over the years. There is no national policy or a guideline on AMR. There are no national programmes or alliances on use of antimicrobials with any country or nation. Since there are no animals in the country, there is no veterinary sector and hence antibiotics are not used in these areas. There is no national focal point, no national surveillance mechanism and no network of labs on AMR. Data collection has not been done nationwide. However, data is available with the Indira Gandhi Memorial Hospital (IGMH) Lab information system.

The data that is available on AMR is taken from IGMH Lab information system from 2007 to 2009. Three organisms that are commonly isolated are selected along with the antibiotics tested for them. The three organisms are: *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella species*. When the data are analyzed, it is seen that all the three organisms are showing more than 70% resistance to ampicillin and amoxacillin. Amikacin shows less than 3% resistance to *E.coli* and *Klebsiella*. Also, it is seen that the resistance of *Klebsiella* to all antibiotics is much more compared to that of *E.coli*. Based on the data, it is seen that the resistance has been increasing over the years to the antibiotics that we are using. This can be very useful information for the clinicians regarding AMR.

There is some training for doctors and pharmacists about the rational use of drugs, but for nurses and dental professionals training is not being conducted regarding AMR.

The mechanism for monitoring of rational use of drugs is under development and it is hoped to be completed in the near future.

Most of the antimicrobials are not available over the counter and it can be taken only by a prescription from a qualified professional. There are no NGOs working on rational use of drugs. Community awareness programmes are coordinated through the media but no research has been done to analyze the impact of these programmes.

Major issues with regard to prevention and containment of AMR are absence of a national guideline on AMR, availability/accessibility of data/information nationally and also lack of resources to carry out sustainable assessments like not having enough microbiologists and also no funds for research.
A plan of action is being proposed to the government on AMR advising on consideration for policy formulation, formation of guidelines and also action plans.

Myanmar

Myanmar needs to formulate a national policy on use of antimicrobials and national regulations related to the use of antimicrobials.

A national policy on use of antimicrobials and a national co-ordination mechanism on AMR do not exist but are being developed.

Although restrictions on the use of specific antimicrobials in therapeutic purposes (veterinary sector) is present, it needs to be implemented. It is the same for non-therapeutic purposes.

A national network of laboratories on AMR needs to be developed for initiating quality national surveillance.

There is a strong need to formulate standard treatment guidelines at the national level. CME is required for physicians, nurses, dental professionals and pharmacists. Community awareness programmes also need to improve.

Major issues with regard to prevention and containment of AMR and future national plans are the following:

- Establish national alliance against AMR.
- Establish national policy on AMR.
- Promote public awareness on rational use of drugs.
- Improve national surveillance system on AMR.
- Improve infection control programme in health care practice.

Nepal

Public sector health institutions in Nepal are categorized in three levels: primary level constitutes the health post and sub-health post, where paramedical staff are available, the secondary level constitutes primary healthcare centre and district hospitals. There are zonal, sub-regional, regional, central and specialized hospitals at the tertiary level. In the non-governmental sector, there are
teaching, I/NGO, community and private sector hospitals. Antibacterial drugs are prescribed both by physicians and paramedical personnel. The National Drug Policy, 1995 addresses the issues regarding rational use of antimicrobials in human and animals. However, implementation status is far from satisfactory.

The Drug Act has categorised antibiotics as a prescriptive drug, which cannot be sold without prescription, though there may be a gap between the legal provision and practice. Standard treatment protocol is available for some national programmes like tuberculosis, leprosy, HIV/AIDS and also for health posts and sub-health posts to treat common infections. For the surveillance of AMR, 11 laboratories are participating, coordinated by the National Public Health Laboratory. Data dissemination is done every year although there is no formal publication. Various journals and bulletins published by academic institutions and professional organizations include results of AMR surveillance. The organisms regularly monitored are: Neisseria gonorrhoeae, Salmonella typhi, Shigella, Vibrio cholerae, Streptococcus pneumoniae, Haemophilus influenzae and E. coli.

Training on the rational use of drugs is normally conducted by NGOs, though recently the Ministry of Health has also started such training. The government has initiated the process for developing treatment protocols for various levels of health institutions.

Antibiotics used for curative purposes are not allowed to be used in feed supplement or as growth promoters.

Though policy guidelines and a legal framework is in place, there are lapses in practice due to inadequate monitoring and supervision. This results in over-the-counter sale of antibiotics, which may enhance the development of resistance. The laboratory findings suggest that the above-mentioned micro organisms have developed resistance of various degrees towards many antibacterials in use.

**Sri Lanka**

Monitoring of AMR is considered a national priority. Though presently there is no national programme, there is an on-going activity by the Sri Lanka College of Microbiologists that commenced in 2009 and involves seven surveillance centres to monitor AMR in gram negative organisms. It is proposed to expand this programme to three additional laboratories in 2010. AMR surveillance for gram positive organisms shall also commence in a few centres in August 2010.
Data related to AMR in different settings are published in the Bulletin of the Sri Lanka College of Microbiologists and released annually.

The Ministry of Health has constituted a Task Force on Microbiology that has recognized the need for an antimicrobial policy and it will be formulated on data generated by the aforesaid surveillance programme. There is no national policy for use of antimicrobials.

There are no direct regulations on antimicrobial use, but indirect controls are exerted at the time of drug registration and in selecting prescribers. Legal restrictions on nontherapeutic use of antimicrobials in veterinary practice exist but the status of implementation remains unknown.

Standard treatment guidelines are available nationally and in major hospitals but compliance is inadequate which is compounded by frequent shortages of antimicrobials.

Monitoring of drugs at the community level is done through authorized officials belonging to the National Regulatory Authority.

Professional bodies are working on rational use of antimicrobials and some of them are the Sri Lanka College of Microbiologists and the Sri Lanka Medical Association. There have been training programmes on rational use of drugs to different categories of healthcare providers but coverage remains inadequate.

Availability of antimicrobials over the counter and their prescription by unauthorized personnel takes place in spite of laws against such practices.

**Thailand**

Antimicrobial resistance (AMR) is considered a national priority although not so prominently. This reflects that there is no national policy with only a draft policy for more than 10 years without adoption or action. There are two major national programmes regarding AMR, one on human health (Ministry of Public Health) and another covering animal health (Ministry of Agriculture and Cooperatives).

National antimicrobial resistance surveillance in Thailand was set up by the National Institute of Health, Department of Medical Sciences, Ministry of Public Health in 1997. It started with 28 hospitals as members and increased to 60 hospitals in 2005. Data from routine laboratory isolation of bacterial pathogens
was collected, analyzed, and the information of resistance was disseminated annually through websites (http://narst.dmsc.moph.go.th), brochures and reports to all hospitals and relevant institutions.

There are standard treatment guidelines for a few selected diseases both at the national level and at major hospitals but the updating system is not very clear. Implementation is unlikely to be followed in all settings. Training imparted on rational use of drugs both in the undergraduate curriculum and as continuing education are provided to all health professionals (physicians, nurses, dentists, and pharmacists). There are at least three official programmes that always have sessions on promoting the rational use of antibiotics. These are: the National Congress in Infection Control; secondly, the short training in infection control; and thirdly, the Annual Academic Meeting of the Infectious Disease Association of Thailand. All these activities are held annually aimed at physicians, pharmacists, nurses, and laboratory personnel.

There is no national regulation related to the use of antimicrobials. Only some scattered activities in different organizations such as requirement for DUE (drug use evaluation) for some schedule IV and V of Essential Drug List (EDL). Mechanism for monitoring of rational use of drugs is not set as routinely but is covered by occasional observation or by research and by indirect approach such as Pay for Performance Programme.

Antimicrobials are unfortunately available over the counter, allowed by law to be dispensed without prescription from pharmacies by pharmacists and illegally distributed via grocery by unqualified professionals. There are some academic programmes on rational use of drugs specifically with antimicrobials. The first is the ‘Antibiotic Smart Use’ programme coordinated by the Thai FDA and IHPP. The second is DMD (Drug System Monitor and Development Programme) by Chulalongkorn University that works broadly on the drug system and supports the movement for AMR policy as one direction. Monitoring of drug use at the community level is observed but not systematically. Awareness of the community regarding AMR is low as observed by the high tendency of using antimicrobials in the community and poor understanding on antimicrobial use.

Ten major issues for prevention and containment of AMR and future national plans are as follows:

1. National Policy on AMR.
2. National Monitor System on antibiotic use pattern and rationality at all levels of health facilities and the community.
(3) Alert or signal system on AMR to stakeholders.

(4) Linkage from monitoring data to policy implementation.

(5) Regulatory strengthening of antibiotics registration.

(6) Antimicrobial in vet and farm/fishery.

(7) Pharmacy and therapeutic committee (PTC) strengthening on rational use of drugs (RUD) especially antimicrobials

(8) Consumer knowledge and awareness on antimicrobial use and resistance.

(9) Curriculum and continuing education in RUD of antimicrobial use and resistance.

(10) Collaboration among countries in the Region for further AMR prevention and containment.

**Timor-Leste**

This important issue has not been discussed in any formal forum in Timor-Leste since there are many other priorities. This workshop on prevention and containment of AMR has highlighted the real problem being faced now globally including Timor-Leste. Limited data are available from the national laboratory.

Available test results show high level (62%) of the isolates being resistant against cloxacillin among isolates of *Staphylococcus aureus* from patients in the national hospital Guido Valadares in Dili. At the same time, 13% resistance is recorded against amoxicillin plus clavulanic acid. The data as interpreted is likely to reflect that the difference between cloxacillin and amoxiclav resistance reflect *Staph aureus* carrying betalactamases, while the remaining proportion may be true mec gene dependent, so called MRSA resistance, e.g. resistance against all betalactam antibiotics. If this is the case, the available test data suggest that some 13 % of the *Staphylococcal* infections would need treatment with vancomycin. This issue needs to be addressed with the help of molecular biology, to assess the true mec gene positive *Staph aureus* rate. The rate of quinolone resistance in clinical isolates of *Staph aureus* is also considered to be surprisingly high. Likewise the Gentamicin resistance rate of 22% presents a cause for concern, which needs to be considered further also in the recommendations provided for treatment of pneumonia, in cases where *Staph spp* infection is suspected.
Major issues for prevention and containment of AMR and future Timor-Leste national plans include:

(1) Strategy plan for prevention and containment of AMR.

(2) A national drug policy drafted.

(3) A new Pharmacy Law with stronger prescribing rules drafted.

(4) Standard Treatment Guideline for PHC and hospital care has been developed, to be launched and implemented as a tool for guiding patient treatment throughout Timor-Leste.

(5) Inspection of private pharmacies, including prescription handling and drug OTC sale practices.

(6) Establish regulation and legislation for antibiotic use.

4.3 National network of antimicrobial monitoring in Thailand

Thailand has been undertaking surveillance of antimicrobial resistance of *Streptococcus pneumoniae* and *Haemophilus influenzae* since 1993. The National Antimicrobial Resistance Surveillance of Thailand (NARST) was launched in 1998 and currently has more than 60 hospitals as members. NARST has the following objectives:

- To monitor the magnitude and trend of antimicrobial resistance among bacteria isolated from humans;
- To disseminate the information regularly; and
- To standardize lab techniques and strengthen/support quality assessment in clinical microbiology laboratory.

Thailand also established an Invasive Bacterial Infection Surveillance (Thai-IBIS) in 2005.

The information generated by all networks in Thailand have supported appropriate choices of antibiotics and updating lists of essential drugs as well as updating of national guidelines for treatment of infectious diseases.
The data generated by NARST in recent past has shown growing resistance to the newly introduced drug imipenem. In less than eight years of its introduction, more than 50% isolates of Acinetobacter baumanii have become resistant to this antimicrobial (Figure 1).

**Figure 1: Rate of imipenem resistance**

![Graph showing resistance rates of various bacteria over years](image)

*Acinetobacter baumanii* has, in the recent past become a major organism of concern especially in hospital settings and for critically ill patients. NARST demonstrated that in intensive care units in Thailand hospitals more than 80% of all isolates of this organism were resistant to imipenem (Figure 2) implying that patients getting infected with this organism in ICUs will have little chance of recovering.
The direct relationship between importing of imipenem group of drugs and overall emergence of resistance has also been shown conclusively by NARST (Figure 3).

Figure 3: Rate of Imipenem resistant Acinetobacter and amount of imported carbapenem
4.4 Partners in antimicrobial resistance activities

Some organizations are engaged in several areas of prevention and containment of antimicrobial resistance. A synergy between these can yield better results. Some of the active organizations with their networks spread over several countries are:

- International Network on Rational Use of Drugs (INRUD)
- ReAct
- INDEPTH
- Alliance for Prudent Use of Antibiotics (APUA)
- Health Action International (Asia Pacific): HAIAP
- GARP

The Member States in SEAR where some of these networks are active include Bangladesh, India, Indonesia, Maldives, Nepal and Thailand.

4.5 Research needs and perspectives for Antimicrobial Resistance

The issue of antimicrobial resistance requires research in following categories:

- Basic research to bridge knowledge gap.
- Clinical/translational research to put new products into the health system.
- Operational/health systems research to convert information/knowledge into action.

Basic research in the following areas will benefit global efforts against antimicrobial resistance:

- Deciphering microbial genomics.
- How do the microbes cause disease?
- Ascertain dynamics of spread.
- Mechanism of antimicrobial resistance.
- Impact of agricultural/veterinary use.
• Discovery of new drug targets.
• Develop better diagnostics (viral vs bacterial).
• New vaccines.

Operational research on the following subjects is needed:
• Monitoring methodologies for antimicrobial resistance.
• Collect systematic data on compliance and proper public use.
• Understand impact of resistance on illness and economy.
• Determine factors that influence prescription habits.
• Elucidate behavioural aspects about self-medication and adherence and develop interventions to bring about change towards rational use.

Translational research that may be useful can be on the following priority areas with special focus to define genotypic or phenotypic traits of highly virulent multi-resistant strains of:
• Methicillin-resistant Staphylococcus aureus (MRSA).
• Vancomycin-resistant Enterococcus spp. (VRE).
• Extended-spectrum, metallo- and acquired AmpC beta-lactamase (ESMAC-BL) producing Enterobacteriaceae.
• Multidrug-resistant Pseudomonas aeruginosa.
• Multidrug-resistant Acinetobacter baumannii.
• Community-based surveillance of antimicrobial use and resistance in resource-constrained settings.

4.6 Community-based surveillance

WHO has supported a few community-based surveillance studies to determine the antimicrobial resistance as well as use of antimicrobial agents. The studies expanded across five phases of which three have been completed. The long-term aims of these studies were to carry out a series of activities that would contribute to knowledge on how to stem the rising trend in AMR.
Phase 1: develop a model for community-based surveillance systems in resource-poor settings and collect base-line data.

Phase 2: refine the surveillance systems and investigate the reasons underlying prevailing practices in order to develop effective interventions to improve use and contain AMR.

Phase 3: implement and evaluate the impact of interventions using the established surveillance systems.

The studies developed and pilot tested methodologies for the integrated surveillance of Antimicrobial use and resistance in two resource-constrained countries. The studies were aimed to:

- collect baseline data on Antimicrobial use and resistance in five pilot sites India (Delhi, Mumbai, Vellore); S. Africa (Durban, Brits);
- analyse these data to understand current trends in Antimicrobial use and resistance in each site;
- reflect on methodological issues encountered in order to make recommendations concerning future community-based integrated surveillance of Antimicrobial use and resistance; and
- use the baseline data generated to stimulate the development and future evaluation of interventions.

The studies showed very high AMR rates to cotrimoxazole (50% for both microbes) and amoxycillin (>70% for H.influenzae). Higher resistance was seen in pathogens compared to commensals. It was also observed that inexpensive older antibiotics (cotrimoxazole and tetracycline) were used more in public facilities and expensive newer ones (fluoroquinolines, cephalosporins) were used in private facilities.

Under Phase 2, qualitative investigation was undertaken into the reasons underlying prevailing practices. It revealed provider’s perceptions of large patient demand for antibiotics, existence of severe competition between providers for patients, uncontrolled pharmaceutical promotion, involving financial rewards for increased sales, lack of continuing medical education or supervision and public perception that antibiotics can cure common ailments very quickly - so avoiding loss of working days and wages.

The next common antibiotic class used in the community was fluoroquinolones for coughs and colds.
4.7 Policy and Strategy to Contain AMR in Thailand

In 1996 the first draft of a national policy on antimicrobials was developed in Thailand through its Health Systems Research Institute. Appropriate formulary for antimicrobials for Thailand was also drafted. The draft policy addressed the following issues:

- Standard microbiological labs
- Development of human resources at all levels
- System in hospitals
- Appropriate antimicrobial use in livestocks
- Ethical guideline for drug dispensing and prescribing
- Monitoring system for antimicrobial sensitivity
- Epidemiological surveillance of AMR at various levels

This draft policy was revisited in 2008 and is being revised.

In 1996 the Thai MOPH set up a committee to promote appropriate use of antimicrobials in MOPH hospitals.

In 1997, the Ministry of Public Health set up the National Antimicrobial Resistance (NART) surveillance. NART was designated as a WHO Collaborating Centre in 2005. Thai FDA initiated “Antibiotics Smart Use - ASU” Project (with supports from WHO) with the objectives to: promote rational use of antibiotics in community hospitals (for common diseases, e.g. diarrhoea, common cold and wound); and discourage self medication

Chulalongkorn University (with support from Thailand’s Health Promotion Fund) established a three-year project in 2008 to strengthen drug surveillance and develop drug system with five strategies:

- Knowledge generation
- Model development for social monitoring and intervention
- Network strengthening
- Public communication
- Policy advocacy
4.8 Administrative aspects of implementation of AMR Strategy

Several administrative areas that require to be activated to effectively implement the AMR strategy have been shown in Figure 4. The support from national authorities is required for key activities in all the objectives of the strategy.

4.9 Role of the veterinary sector in combating drug resistance in micro-organisms

Use of antimicrobials in livestock production significantly contributes to the phenomenon of antimicrobial resistance in important human pathogenic bacteria. Increasing international travel and international trade in animals and animal products may spread resistance world-wide. OIE (World Organization of Animal Health) develops and publishes international health standards for animals and products (trade standards and biological standards). These standards also provide guidance on prevention of antimicrobial resistance.
Chapter 6.10 of OIE standards describes responsible and prudent use of antimicrobial agent in veterinary practices and advocates responsibilities of the regulatory authorities, veterinary pharmaceutical industry and of wholesale and retail distributors.

CHAPTER 6.8 of OIE standards calls for harmonization of national antimicrobial resistance surveillance and monitoring programmes and describes the sampling strategies, sample sources and sample specimens to be collected.

CHAPTER 6.11 of OIE standards describes the methodologies of risk assessment for AMR arising from the use of antimicrobial agents with emphasis on analysis of risks to human health as well as analyses of risks to animal health.

OIE has also developed tools for the performance of veterinary services to assist the level of performance, identify gap and weakness in their ability to comply with OIE standards in preventing and containing AMR.
Recommendations and conclusions

The participants appreciated the WHO Regional Strategy on Prevention and Containment of Antimicrobial Resistance and the initiative taken by the WHO Regional Office for South-East Asia. The following recommendations were also made:

**For Member States in the South-East Asia Region**

Member States should:

1. Establish a national alliance against antimicrobial resistance with all key stakeholders as its members. The implementation of national efforts to prevent and contain antimicrobial resistance should be through a multisectorial national steering committee headed by the senior-most health executive and facilitated through advisory/expert groups.

2. Designate a national focal point for antimicrobial resistance in the Ministry of Health.

3. Institute appropriate surveillance mechanisms in the health and veterinary sectors to generate reliable and actionable epidemiological information including baseline data and trends on antimicrobial resistance, utilization of antimicrobial agents and impact on the economy and health through designated national and regional reference centres.
Discourage non-therapeutic use of antimicrobial agents in veterinary, agriculture and fishery practices as growth-promoting agents.

Develop national standard treatment and infection control guidelines and ensure their application at all levels of health care and veterinary services through training, continuous educational activities and establishment of functional drugs and therapeutic committees and hospital infection control committees in health facilities (with the focus on proven, cost-effective interventions such as isolation, hand washing etc).

Undertake operational research for better understanding of the technical and behavioural aspects of prevention and control of antimicrobial resistance and utilize the outcomes of these research studies/interventions in policy and programme development/improvement in the national context.

Launch educational and awareness programmes for communities and different categories of health care professionals.

Strengthen communicable diseases control programmes to reduce disease burden and accord priority to the discipline of infectious diseases in medical education and health services.

For the World Health Organization

WHO should:

Undertake advocacy with national authorities to establish national alliances against antimicrobial resistance;

Develop and disseminate generic protocols to facilitate generation of comparable epidemiological data on antimicrobial resistance and utilization of antimicrobials;

Facilitate cooperation between various players (government agencies, professionals, academia, NGOs, INGOs etc) to enhance synergy between their actions and to obviate duplication of efforts;

Develop generic IEC material to create awareness amongst communities and obtain their active participation in the fight against AMR;
(5) Through its WHO Collaborating Centre on AMR, collate and share global data and regional experiences on all aspects of antimicrobial resistance; The WHO CC should be supported to act as a Regional Clearing Centre and to coordinate multicentric studies in the Region;

(6) Document and disseminate experiences gained within the Region and lessons learnt in combating AMR;

(7) Support operational research on various aspects of antimicrobial resistance; and

(8) Organize regional meetings on a regular basis for exchange of experiences within the Region.
Annex 1

Agenda

(1)  Inauguration and Introduction
(2)  Review of status of antimicrobial resistance in Member countries
(3)  Essential elements and major activities for the strategy
(4)  Implications of resistance in the context of IHR and global health security
(5)  Importance of programmatic, multi-sectoral approach and coordinated efforts in adapting strategy at national level
(6)  Role of various stakeholders in effective implementation of strategy and efficient coordination
(7)  R&D for development of new antimicrobials and enhancing regional capacity in understanding dynamics of various facets of resistance
(8)  Identification of follow-up action points
(9)  Closing session
Annex 2

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The strategy shall have the following guiding principles:

**Guiding principles**

- Understand the emergence and spread of resistance.
- Rationalize the use of available antimicrobial agents.
- Prevent emergence of resistance by reducing selection pressure by appropriate control measures.
- Bring about a change in behaviour of prescribers of antimicrobial agents and communities to ensure their rational use.
- Combat antimicrobial resistance by promoting discovery, development and delivery of new drugs/tools.
- Combat antimicrobial resistance through nationally coordinated efforts with defined functions by different sectors/programmes.

**Goal**

To minimize the morbidity and mortality due to antimicrobial-resistant infection and to preserve the effectiveness of antimicrobial agents in the treatment and prevention of microbial infections.

**Objectives**

- To establish a national alliance for prevention and control of antimicrobial resistance.
To institute a surveillance system that captures the emergence of resistance, trends in its spread and utilization of antimicrobial agents in different settings.

To promote rational use of antimicrobial agents at all levels of healthcare and veterinary settings.

To strengthen infection control measures to reduce the disease burden.

To support research to develop and/or improve use of antimicrobial agents.

Key strategic elements and major activities

Objective 1: To establish a national alliance for the prevention and control of antimicrobial resistance

Concerted and nationally coordinated efforts are needed to bring together various stakeholders and harness their expertise and the resources available within the country in different sectors to meet this Objective. Key elements and major activities that will accomplish Objective 1 are:

(1) Establish a national alliance against antimicrobial resistance

- Establish a cell in the Ministry of Health, preferably within the unit dealing with emerging infectious diseases (EID) or the implementation of IHR (2005) for coordinating national activities and sharing information with other countries in the Region.

- Designate national focal points for coordinating antimicrobial resistance-related activities.

- Forge national alliance of relevant programmes and stakeholders from both public and private sectors.

- Constitute an intersectoral steering committee under the chairpersonship of a high-level policy-maker.

- Establish national expert advisory committees.
• Develop a national strategic approach towards antimicrobial resistance with consensus of all stakeholders about their specific roles.

• Strengthen national regulatory mechanism.

• Allocate adequate resources to implement a strategy for the prevention and containment of antimicrobial resistance.

• Provide adequate representation to the private sector in the steering committee and advisory committees.

(2) **Strengthen national networks**

• Augment existing networks to fulfil Objective 2 (see below).

• Incorporate standards in the national regulatory framework.

• Establish/strengthen accreditation mechanism for hospitals which articulates the rational use of antimicrobials as an integral requirement.

• Enhance capacity and powers of the regulatory authority to implement national standards on the use of antimicrobials.

• Involve networks under IHR and World Alliance on Patient Safety (WAPS).

(3) **Collaborate with stakeholders**

• Develop linkages with stakeholders (potential stakeholders at Annex 4).

• Promote regular and formal interactions.

• Encourage the role of NGOs in community awareness and targeted education.

**Objective 2: To institute a surveillance system that captures the emergence of resistance, trends in its spread and utilization of antimicrobial agents in different settings**

Several networks may be operational in the country that generate and collate data on resistance in micro-organisms and consumption of antimicrobial agents. These should be activated to support national efforts towards containment of
antimicrobial resistance. If such networks are not functional, the same must be established. Key elements and major activities that will accomplish Objective 2 are:

(1) **Monitor resistance in micro-organisms**

- Quantify resistance in micro-organisms through networks of laboratories equipped with the capacity to perform quality assured antimicrobial susceptibility testing.
- Ascertain trends in emergence and spread of resistance.
- Detect and report new events.
- Assess effect of interventions on resistance.
- Communicate data to users and national focal points.
- Advocate the establishment of surveillance networks in the veterinary sector and develop linkages between human and veterinary networks.

(2) **Monitor use of antimicrobials**

- Evaluate prescription policies in health-care settings in the public and private sectors and the utilization of antimicrobial agents at various levels.
- Assess therapeutic and non-therapeutic use in animals.
- Appraise the impact of promotion of pharmaceuticals.
- Collate data and communicate to stakeholders.

(3) **Monitor disease and economic burden due to resistant organisms**

- Correlate data on utilization of antimicrobials and resistance.
- Determine impact of non-pharmaceutical factors on the emergence of resistance.
- Calculate economic losses due to resistance.
- Utilize data generated for policy formulation and programme development/improvement.
Objective 3: To promote rational use of antimicrobial agents at all levels of health-care and veterinary settings

This is the most complex and yet critical objective since it involves the strengthening of technical and regulatory requirements along with bringing about a change in the behaviour of the prescribers and users. Key elements and major activities that will accomplish Objective 3 are:

(1) **Promote optimal prescription**
- Develop standard national/local treatment guidelines (STGs) advocating evidence-based monotherapy or combination therapy.
- Train professionals in use of these STGs.
- Assure use of STGs through Hospital Committees.
- Provide effective curriculum on the rational prescription of antimicrobial agents in undergraduate and postgraduate education of medical, dental, veterinary and pharmacy students.

(2) **Make available quality laboratory data in real time**
- Ensure quality-assured laboratory determination of resistance.
- Utilize locally generated data for immediate use as well as for developing/modifying use of antibiotics guidelines.
- Build capacity of health-care providers to utilize the resistance data efficiently.

(3) **Rationalize use in veterinary sector**
- Ban non-therapeutic use of antimicrobial agents using the IHR (2005) as the regulatory framework.
- Develop standard treatment guidelines (STGs).
- Train professionals in use of STGs.
(4) **Promote compliance and proper public use**

- Educate communities on proper compliance and non-self-medication.
- Prevent over-the-counter availability of antimicrobial drugs.
- Provide continuous education to pharmacists/chemists in appropriate use of antimicrobial agents.

**Objective 4: To strengthen infection prevention and control measures to reduce the disease burden**

Since all the factors that promote or influence communicable diseases also facilitate resistance, efforts made to reduce the disease burden are bound to mitigate the extent of resistance. Key elements and major activities that will accomplish Objective 4 are:

(1) **Strengthen disease control programmes**

- Develop standard treatment guidelines (STGs) and assure their implementation.
- Train professionals in the use of STGs.
- Support activities at the community level to assure adherence.
- Monitor resistance and effect of interventions.
- Promote private-public partnership (PPP).

(2) **Augment infection-control practices in hospitals**

- Establish infection control practices, especially universal/standard precautions, and provide an enabling environment.
- Ensure the availability of an adequate number of trained healthcare staff.
- Provide personal protective equipment (PPE) and other infrastructural support.
- Institute and empower Hospital Infection Control Committees.
(3) **Promote infection control practices in communities**
- Launch comprehensive health education campaigns.
- Promote hygiene in school curricula.
- Collaborate with NGOs and local opinion leaders

(4) **Promote and strengthen disease prevention interventions**
- Strengthen immunization programmes.
- Conduct educational campaigns on hygiene and non-pharmaceutical practices.
- Strengthen disease prevention measures.
- Collaborate with the mass media to create awareness.

**Objective 5: To promote research in the area of antimicrobial resistance**

(1) **Encourage basic research**
-Ascertain the dynamics of spread, and the drivers of resistance.
- Understand the mechanism of resistance.
- Evaluate the impact of use of antimicrobials in agriculture and fishery on human health.

(2) **Support operational research**
- Develop optimum doses and duration of various drugs as monotherapy or in combinations.
- Understand impact of resistance on illness and economy.
- Develop rapid diagnostic tools.
- Determine factors that influence prescription habits.
- Elucidate behavioural aspects about self-medication and adherence, and develop interventions to bring about change.
(3) **Support the development of new antimicrobial agents and vaccines**

The development of new antimicrobial agents or alternatives thereof requires support from the government and from industry-supported research through:

- research grants, PPP, public contribution to research funding and R&D tax credits;
- remuneration for outputs from the R&D process, including advance purchase commitments or patent buyouts, and also through:
- reducing time to market entry through fast-track mechanisms of regulatory approvals.

**Implementation**

Resistance to antimicrobial agents is a cross-cutting problem that needs to be tackled by well-coordinated action. This Regional Strategy recognizes the need for a wide range of activities which are required to support the control of antimicrobial resistance and the need for commitment from a wide variety of players. It needs to be endorsed by all countries of the SEA Region and will lead to sustained action to combat this problem. Microbes are dynamic organisms and so should be our approach to tackling their resistance to antimicrobial agents.

The Strategy also recognizes the need for action across a wide range of interests and by many organizations and individuals. Since microorganisms do not recognise geographical boundaries and are increasingly spread through international travel and commerce, it also recognizes the need for the WHO Regional Office for South-East Asia to play its part by providing appropriate technical support in step-wise implementation of the Strategy at the national and local level.

The implementation framework may include the following:

(1) Obtaining national commitment towards prevention and containment of antimicrobial resistance.

(2) Constitution of an intersectoral steering committee with all stakeholders from the public and private sectors represented, which is chaired by a senior policy-maker.
(3) Establishment of a cell and focal point in the MoH within the unit responsible for emerging infectious diseases or International Health Regulations (2005) to coordinate with the national alliance (comprising mainly of existing programmes) and empowered to provide evidence-based directives for rational use of antimicrobial agents and on disease prevention and control interventions.

(4) Constitution of a national expert advisory committee.

(5) Designation of subgroups in specialized areas.

(6) Development of public information campaigns.

(7) Establishment of a national surveillance system with a mandatory reporting system through efficient and quality laboratory networks and existing surveillance systems.

(8) Development of and making available various national standards, guidelines for surveillance and treatment and strengthening regulatory support for their implementation.

(9) Organizing continuing education for professionals and all healthcare workers, and the like, through medical and health-related institutions and professional bodies.

(10) Invoking IHR (2005) and other national measures to reduce or ban the use of antimicrobials as growth promoters in animals.

(11) Collation of research findings for developing actions.

(12) Establishment of a national forum of multidisciplinary professionals (health, veterinary, agriculture, fishery, etc.) to share information to promote the understanding of the impact of use of antimicrobial agents on human health.

(13) Collaborate with international agencies for technical support and to obtain information from other countries/sectors. WHO to coordinate the information exchange in the SEA Region.

(14) Conducting regular meetings to review, assess and modify the action plans.
**Indicators and targets**

The following are suggested as regional indicators:

- Number of countries with national intersectoral steering committee for antimicrobial resistance monitoring (AMR).
  
  **Target:** All countries of the SEA Region by 2013

- Number of countries with national alliances for prevention and control of antimicrobial resistance.
  
  **Target:** All countries of the SEA Region by 2015

- Number of countries with national networks for surveillance of antimicrobial resistance through quality laboratory services.
  
  **Target:** All countries of the SEA Region by 2015

- Number of countries with legislation banning over-the-counter sale of selected antimicrobial agents.
  
  **Target:** All countries of the SEA Region by 2015

- Number of countries with a ban in place on non-therapeutic use of antimicrobial agents in animals.
  
  **Target:** All countries of the SEA Region by 2015

- Number of antimicrobial agents for which resistance against nationally identified microorganisms has stabilized or decreased.
  
  **Target:** At least five drugs for which resistance has stabilized or decreased by 2015.

- Number of antimicrobial agents of which the annual use has declined by 25% as indicated by defined daily doses (DDD) by 1000 patient days.
  
  **Target:** At least five antimicrobial agents with annual utilization reduced by 25% as indicated by DDD by 2013.

- Percentage of hospitals that show a decrease in the rate of hospital-associated infections (HAI).
  
  **Target:** More than 25% of hospitals in at least five countries of the SEA Region by demonstrated decrease in rate of HAI by 2015.
- Percentage of hospitals in the public and private sector in a country with a policy for rational use of antimicrobials.

**Target:** At least 75% of hospitals in the public and private sector in at least five countries of the SEA Region having policy for rational use of antimicrobials by 2015.

- Number of countries with national hospital accreditation schemes with rational use of antimicrobials as an essential requirement for accreditation.

**Target:** All countries of the SEA Region by 2015

**Monitoring and evaluation**

A strong component of the monitoring and evaluation mechanism through an alliance utilizing the aforementioned indicators and targets shall be established. National baseline data should be established. The national steering committees must regularly review the data generated for this purpose and provide guidance for changes, if any, required to achieve the targets.

Regional annual reviews should be undertaken through the WHO intercountry coordination mechanism and mid-term assessment of the strategy during plan period made.

**Mainstreaming the national response**

Given the cross-cutting nature of the problem and complexity of the response, it is essential that every stakeholder has clarity about its role in combating this menace, both within its own mandate as well as for those issues which have a bearing upon activities of other sectors. Ownership of the strategy by all stakeholders is critical for it to move forward and yield the desired results.

Antimicrobial drug failure may occur for many reasons, but it impacts not only patient care and safety but also threatens effective management of public health and infectious diseases globally. A strategic approach is urgently needed to combat this emerging threat.
Suggested stakeholders

- National Regulatory Agency/Authority.
- Medical, veterinary and pharmacy professional bodies.
- Medical and veterinary councils.
- National medical and veterinary research organizations.
- Corporate hospitals.
- NGOs.
- Community opinion leaders.
- Mass media.
- Pharmaceutical industry.
- International agencies.
Antimicrobial resistance has been recognized as one of the most important problems being faced in the area of communicable diseases. To assist countries in developing national plans, a regional strategy for prevention and containment of antimicrobial resistance has been developed by WHO. This report briefly describes the strategy as well as the implementation steps debated by participants at the regional meeting held at Chiang Mai, Thailand from 8 to 11 June 2010.