

# ANTIBIOTIC RESISTANCE

FROM RESEARCH TO ACTION

The 59th ITM Colloquium

5-7 December 2018 - Phnom Penh

## PROGRAMME & ABSTRACT BOOK

#Colloq18

[www.antibiotic-resistance-2018.org](http://www.antibiotic-resistance-2018.org)

## 59th Colloquium of the Institute of Tropical Medicine Antwerp



Financed by the Directorate-general Development Cooperation and Humanitarian Aid



Hosted by ITM's partner organisations in Cambodia



Ministry of Health,  
Cambodia



National Center for  
Parasitology, Entomology  
and Malaria Control  
(CNM)



National Institute of Public  
Health, Cambodia (NIPH)



Sihanouk Hospital  
Center of Hope



National Center for HIV/  
AIDS, Dermatology and  
STD (NCHADS)

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# WELCOME MESSAGE

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Dear Participants,

It is our pleasure to welcome you at the 59th Colloquium of the Institute of Tropical Medicine Antwerp, jointly organised by ITM and its institutional partners in Cambodia: the National Institute of Public Health, the Sihanouk Hospital Center of Hope, the National Center for Parasitology, Entomology and Malaria Control, and the National Center for HIV/AIDS, Dermatology and STD.

The 59th Colloquium takes on one of the defining global health challenges of our times. Antibiotic resistance is truly a multisectoral challenge as it affects human and animal health, agriculture and the environment. This is reflected in the various themes of the conference, which include microbiological surveillance, antibiotic stewardship and infection prevention and control in a One Health approach. With this Colloquium we wish to offer a platform for researchers, health professionals and policy makers to identify how key research findings can contribute to solutions and inform policy-makers about containment of antibiotic resistance. The Colloquium is hosted in the beautiful, bustling city of Phnom Penh, and we would like to thank the organisers at ITM and in Cambodia for their hard and efficient work. We would also like to express our gratitude to the Belgian Directorate for Development Cooperation for their financial support.

We hope that you enjoy this Colloquium as well as your stay in Cambodia and wish you stimulating discussions and lively exchanges during the next days and thereafter.

***Chhea Chhorvann (NIPH) and Jan Jacobs (ITM), chairs of the scientific committee.***

# COMMITTEES

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## ORGANISING COMMITTEE

- **Lut Lynen** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Jan Boeynaems** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Michèle Bruyneel** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Cleo Maerivoet** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Willem van de Put** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Roeland Scholtalbers** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Chhea Chhorvann** | National Institute of Public Health, *Cambodia*
- **Heng Sopheab** | National Institute of Public Health, *Cambodia*
- **Ir Por** | National Institute of Public Health, *Cambodia*
- **Ly Penh Sun** | National Institute of Public Health, *Cambodia*
- **Tho Sochantha** | National Center for Parasitology, Entomology and Malaria Control, *Cambodia*
- **Thai Sopheak** | Sihanouk Hospital Center of Hope, *Cambodia*

## SCIENTIFIC COMMITTEE

- **Jan Jacobs**, co-chair | Institute of Tropical Medicine Antwerp, *Belgium*
- **Chhea Chhorvann**, co-chair | National Institute of Public Health, *Cambodia*
- **Stijn Deborggraeve** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Koen Peeters** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Pierre Dorny** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Wim Van Damme** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Marjan Peeters** | Institute of Tropical Medicine Antwerp, *Belgium*
- **Erika Vlieghe** | University of Antwerp, *Belgium*
- **Ir Por** | National Institute of Public Health, *Cambodia*
- **Uk Vichea** | National Center for HIV/AIDS, Dermatology and STD, *Cambodia*
- **Phe Thong** | Sihanouk Hospital Center of Hope, *Cambodia*
- **Mao Sokny** | National Center for Parasitology, Entomology and Malaria Control, *Cambodia*
- **Bart Jacobs** | GIZ, *Germany*
- **Heiman Wertheim** | Radboud University Nijmegen, *Netherlands*
- **Juan Carrique-Mas** | Oxford University Clinical Research Unit, *United Kingdom*
- **Liz Ashley** | Oxford University, *United Kingdom*
- **Miliya Thyl** | Angkor Hospital for Children, *Cambodia*
- **Paul Turner** | Cambodia Oxford Medical Research Unit, *Cambodia*
- **Sothyra Tum** | National Animal Health and Production Research Institute, *Cambodia*
- **Amaury Peeters** | Louvain Coopération, *Belgium*

# PRACTICALITIES

## LOCATION(S)

The conference will take place in the **Cambodiana Hotel in Phnom Penh**.

Address: 313 Sisowath Quay Daun Penh, 12200, Phnom Penh, Cambodia

Phone: +855 23 426 288

## POSTER PRESENTATIONS

- Poster sessions will take place in the Cambodiana Hotel, first floor.
- Posters will be up for one day.
- Poster presenters are asked to hang their posters themselves. Material (tape, pins) for this will be provided.
- Maximum size should be A0 (larger will not be accepted).
- Poster presenters are asked to present at the coffee breaks and/or at lunchtime.

## CONFERENCE DINNER

On 5 December there will be an opening reception and dinner, and guests will also have the opportunity to see a Khmer Dance Show. On 6 December, dinner will also be provided for the invited participants. Both dinners take place at the Cambodiana Hotel.

## BADGES

Please wear your badges at all times to promote networking and assist staff in identifying you.

## TOURIST INFORMATION

Tourist Information Center in Phnom Penh:

Preah Sisowath Quay, in front of Court of Appeal Phnom Penh, 12207, Cambodia

Tel: (855) 097 2473 773

[www.tourismcambodia.com](http://www.tourismcambodia.com)

## WIFI / INTERNET ACCESS

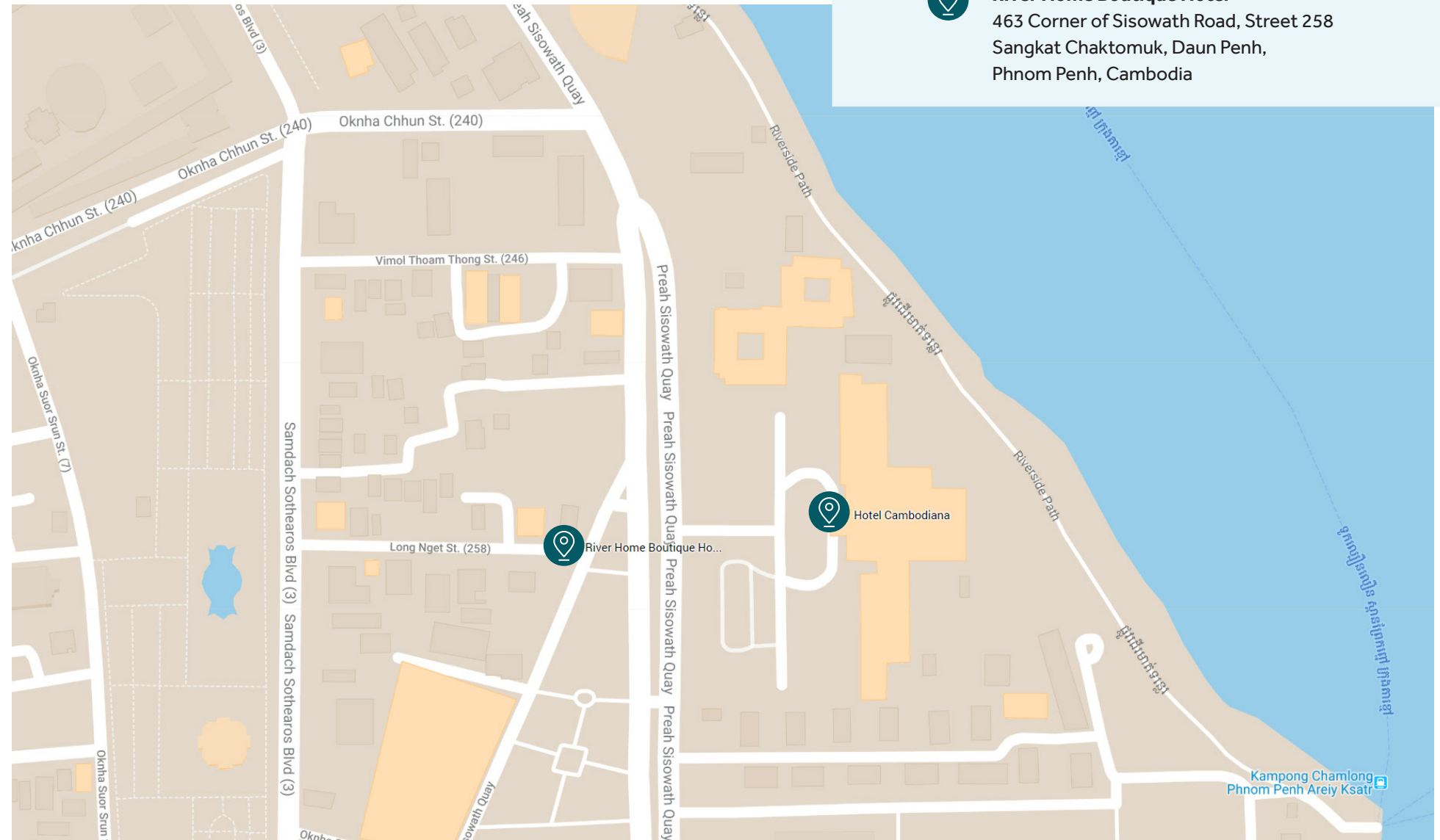
Wi-Fi is available free of charge at the conference venue. The login details are available at the registration desk.

## TWITTER & MEDIA

The official conference hashtag is **#Colloq18**. Please use this hashtag when tweeting about the conference.

For more resources on media and social media around the Colloquium, visit [www.antibiotic-resistance-2018.org/#media](http://www.antibiotic-resistance-2018.org/#media)

## Venue and area map



### Hotel Cambodiana

313 Sisowath Quay, Phnom Penh, Cambodia



### River Home Boutique Hotel

463 Corner of Sisowath Road, Street 258  
Sangkat Chaktomuk, Daun Penh,  
Phnom Penh, Cambodia

# PROGRAMME

## DAY 1 (05/12)

	TIME		SPEAKER	TITLE
SATELLITE SESSION	9:00-12:00		<b>Dr Ly Sovann</b> Department of Communicable Disease Control, MoH Cambodia	<b>Research Priority - Focusing on AMR</b> National Institute of Public Health, Cambodia
			<b>Prof Dr Chhea Chhorvann</b> National Institute of Public Health, Cambodia	
			<b>Prof Dr Ir Por</b> National Institute of Public Health, Cambodia	
	14:00-14:10	Welcome remarks	<b>Prof Dr Chhea Chhorvann</b> National Institute of Public Health, Cambodia	
	14:10-14:20	Objective of ITM colloquium	<b>Prof Dr Bruno Gryseels</b> Institute of Tropical Medicine in Antwerp, Belgium	
	14:20-14:25	Belgian non-governmental development cooperation in Cambodia	<b>Ms Charlotte De Grauwe</b> Embassy of the Kingdom of Belgium, Thailand	
OPENING SESSION: RESEARCH PRIORITY - FOCUSING ON AMR	14:25-14:35	Opening remarks	<b>H E Prof Mam Bunheng</b> Ministry of Health, Cambodia	
	14:40-15:20	KEYNOTE LECTURE	<b>Prof Dr Jan Jacobs</b> Institute of Tropical Medicine in Antwerp, Belgium	Key Aspects of Antimicrobial Resistance - the One Health Approach
	15:20-16:00	KEYNOTE LECTURE	<b>Prof Dr Nick White</b> Mahidol Oxford Research Unit, Thailand	Antimicrobial Resistance in the Sub- Mekong region



# PROGRAMME

## DAY 1 (05/12)

TIME		SPEAKER	TITLE
16:00-17:00	AMR programs in the Sub-Mekong region	<b>Dr Ly Sovann</b> Department of Communicable Disease Control, MoH Cambodia	Strengthening the Antimicrobial Resistance (AMR) Surveillance System in Cambodia
		<b>Dr Kumanan Rasanathan</b> Cambodia, WHO	
		<b>Dr Rattanaxay Phetsouvanh</b> Department of Communicable Diseases Control, Laos	Brief and comprehensive overview of AMR action plan
OPENING RECEPTION AND DINNER	17:00	<b>Dr Nithima Sumpradit</b> Ministry of Public Health, Thailand	First two-year experiences in implementing Thailand's National Strategic Plan on Antimicrobial Resistance 2017-2021: progress, enablers and challenges
		<b>Khmer Dance Show: Department of Culture and Fine Arts of Phnom Penh City</b> Reception and dinner	

# PROGRAMME

## DAY 2 (06/12) - RESEARCH // SURVEILLANCE

	TIME	SPEAKER	TITLE
<b>SESSION 1:</b> RESEARCH UPDATE - SURVEILLANCE  <b>8:00-9:45</b>	<b>8:00-9:05</b>	<b>Dr Ly Sovann</b> (chair) Department of Communicable Disease Control, MoH Cambodia	
		<b>Prof Stijn Deborggraeve</b> (chair) Institute of Tropical Medicine in Antwerp, Belgium	
		<b>Prof Dr Chau Darapheak</b> National Institute of Public Health, Cambodia	
		<b>Prof Dr Direk Limmathurotsakul</b> Mahidol Oxford Tropical Medicine Research Unit, Thailand	Microbiological surveillance: how it can be used to estimate the national and global burden of antimicrobial resistant infections
	<b>9:05-9:45</b>	<b>Prof Dr Jan Jacobs</b> Institute of Tropical Medicine in Antwerp, Belgium	Microbiological Surveillance
		<b>Ph Bin Chamroeun</b>	Microbiology Surveillance of Blood Culture Pathogen in Siem Reap Provincial Referral Hospital
		<b>Ph Chiek Sivhour</b>	Bloodstream infections detected from patients admitted to Battambang provincial referral hospital between 2014 and 2017
		<b>Dr Phe Thong</b>	Results of a 10-year surveillance of pathogens and their antibiotic resistance in bloodstream infections among Cambodian adults
<b>BREAK - POSTER SESSION</b>	<b>9:45-10:15</b>	<b>Prof Paul Turner</b>	Antimicrobial resistance in <i>Streptococcus pneumoniae</i> before and after the introduction of PCV-13 in Cambodia

## DAY 2 (06/12) - RESEARCH

### // ANTIBIOTIC STEWARDSHIP

	TIME	SPEAKER	TITLE
<b>SESSION 2:</b> RESEARCH UPDATE - ANTIBIOTIC STEWARD- SHIP  <b>10:15-12:00</b>		<b>Prof Paul Turner</b> (chair) Cambodia Oxford Medical Research Unit, Cambodia	
		<b>Dr Laura Kuijpers</b> (chair) Alrijne Hospital, The Netherlands	
	<b>10:15-11:20</b>	<b>Dr Phe Thong</b> Sihanouk Hospital Center of Hope, Cambodia <b>Dr Kim Savuon</b> Ministry of Health, Cambodia	Antibiotic stewardship in the human health sector in Cambodia
		<b>Prof Dr Erika Vlieghe</b> Antwerp University Hospital, Belgium	Antibiotic stewardship in LMIC: same same, but different?
	<b>11:20-12:00</b>	<b>Dr Sanjeev Singh</b>	The Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (Global-PPS): Results of antimicrobial prescribing in India
	Pitch presentations	<b>Dr Mari Rose De los Reyes</b>  <b>Dr Miliya Thyl</b>	Antibiotic prescribing among adult patients with pneumonia in the Philippines: Results of the 2017 pilot Global PPS in 16 hospitals  The global point prevalence survey of antimicrobial consumption and resistance (Global-PPS): 2017 results of antimicrobial prescribing at Angkor Hospital for Children
<b>LUNCH - POSTER SESSION</b>	<b>12:00-13:30</b>		

## DAY 2 (06/12) - RESEARCH

### // INFECTION PREVENTION & CONTROL

	TIME	SPEAKER	TITLE
<b>SESSION 3:</b> RESEARCH UPDATE - INFECTION PREVENTION & CONTROL  <b>13:30-14:45</b>	13:30-14:45	<b>Dr Thai Sopheap</b> (chair) Sihanouk Hospital Center of Hope, Cambodia	
		<b>Prof Dr Jan Jacobs</b> (chair) Institute of Tropical Medicine in Antwerp, Belgium	
		<b>Dr Miliya Thyl</b> Angkor Hospital for Children, Cambodia	Healthcare Associated Infection Surveillance and Infection Prevention and Control at Angkor Hospital for Children, Siem Reap, Cambodia
		<b>Prof Lê Thj Anh Thu</b> Ho Chi Minh City Infection Control Society, Vietnam	
		<b>Prof Ben Cooper</b> Mahidol Oxford Tropical Medicine Research Unit, Thailand	Effectiveness of key interventions to control priority organisms such as Klebsiella pneumoniae
<b>BREAK -</b> <b>POSTER SESSION</b>	14:45-15:15		

## DAY 2 (06/12) - RESEARCH

### // ONE HEALTH & ANTIBIOTIC RESISTANCE

	TIME	SPEAKER	TITLE
SESSION 4: RESEARCH UPDATE - ONE HEALTH & ANTIBI- OTIC RESISTANCE  15:15-17:00	15:15-16:20	Prof Dr Heng Sopheab (chair) National Institute of Public Health, Cambodia	
		Prof Dr Pierre Dorny (chair) Institute of Tropical Medicine in Antwerp, Belgium	
		Prof Dr Thomas Riley Edith Cowan University, Australia	Clostridium difficile and the “One Health” paradigm
		Dr Hayley MacGregor Institute of Development Studies, UK	Antimicrobial use in livestock in Myanmar and the relationship with human drug resistant infections: what can social science contribute?
	16:20-17:00	Dr Laura Kuijpers Alrijne Hospital, The Netherlands	Enteric fever in Cambodia: investigating antibiotic resistance from a multi- disciplinary perspective
		Dr Om Chhorvoin	Practices of antibiotics in human and commercial food animals in Cambodia
Dr Truong Thi Quy Duong		Characterization of Salmonella isolated from pig slaughterhouses to retail markets in Ha Noi, Vietnam	
Pitch presentations	Dr Noellie Gay	One health approach of Extended Spectrum Beta-lactamase producing Enterobacteriaceae in human, animal and drinking water in small breeder households, Madagascar 2018	
SATELLITE SESSION: PHAGE THERAPY	17:00-19:00	Dr Patrick Soentjens Institute of Tropical Medicine in Antwerp and Military Hospital Brussels, Belgium Jean-Paul Pirnay & Daniel De Vos Military Hospital Brussels, Belgium	Phagetherapy at the Queen Astrid Military Hospital, Brussels
DINNER	19:00		

# PROGRAMME

## DAY 3 (07/12) - ACTION

### // LESSONS LEARNED FROM MALARIA & HIV CONTROL IN THE MEKONG REGION

	TIME	SPEAKER	NAME
<b>SESSION 5:</b> LESSONS LEARNED FROM MALARIA & HIV CONTROL IN THE MEKONG REGION	8.00-9.05	<b>Dr Tho Sochantha</b> (chair) National Center For Parasitology Entomology And Malaria Control, Cambodia	
		<b>Prof Em Marc Coosemans</b> (chair) Institute of Tropical Medicine in Antwerp, Belgium	
		<b>Dr Siv Sovannaroeth</b> National Center For Parasitology Entomology And Malaria Control, Cambodia <b>Dr Soy Ty Kheang</b> University Research Co., Cambodia	Antimalarial Drugs Resistance Malaria in Cambodia
		<b>Dr Ngaug Bora</b> National Center for HIV/AIDS, Dermatology and STD, Cambodia	Arv Drug Resistance Monitoring for Plhiv Who are on ART in Cambodia: Implementation of an Enhanced Adherence Counseling Tool in 2017
		<b>Prof Koen Peeters</b> Institute of Tropical Medicine in Antwerp, Belgium <b>Dr Jeroen Dewulf</b> Ghent University, Belgium	'Saturated medicine' – Consequences of perceived treatment failure and suboptimal use of antibiotics in a malaria endemic area in South-central Vietnam: preliminary findings from a qualitative study  Antibiotic use and resistance in farm animals, problems and solutions
<b>BREAK -            POSTER SESSION</b>	9.45-10.15		

## DAY 3 (07/12) - ACTION

### // HUMAN HEALTH & ANTIBIOTIC RESISTANCE: RESEARCH TO POLICY & ABR

	TIME	SPEAKER	TITLE
<b>SESSION 6:</b> FROM RESEARCH TO PRACTICE - HUMAN HEALTH & ANTIBIOTIC RESISTANCE  <b>10:15-12:00</b>	<b>10:15-12:00</b>	<b>Dr Ly Penh Sun</b> (chair) National Center for HIV/AIDS, Dermatology and STD, Cambodia	
		<b>Prof Dr Erika Vlieghe</b> (chair) Antwerp University Hospital, Belgium	
		<b>Prof Dr Ir Por</b> National Institute of Public Health, Cambodia	From research to effective policy and action to control and contain antibiotic resistance: What can we learn from Cambodia?
		<b>Prof Dr Li Yang Hsu</b> National Centre for Infectious Diseases, Singapore	The State of Antimicrobial Resistance in Human Health
		<b>Prof Dr Marianne van der Sande</b> Institute of Tropical Medicine in Antwerp, Belgium	Information for action
	<b>11:35-12:00</b>	<b>Dr Pen Phalkun</b>	Introduction of surgical prophylaxis guidelines in the maternal child medical center of Siem Reap Provincial Referral Hospital
	Pitch presentations		
<b>LUNCH - POSTER SESSION</b>	<b>12:00-13:30</b>		

## DAY 3 (07/12) - ACTION

### // ONE HEALTH & ANTIBIOTIC RESISTANCE

	TIME	SPEAKER	TITLE
SESSION 7: FROM RESEARCH TO PRACTICE - ONE HEALTH & ANTIBIOTIC RESISTANCE  13:30-15:10	13:30-14:35	Dr Kristina Osbjer (chair) Emergency Center for Transboundary Animal Disease, Cambodia	
		Prof Dr Marianne van der Sande (chair) Institute of Tropical Medicine in Antwerp, Belgium	
		Dr Tum Sothyra National Animal Health and Production Research Institute, Cambodia	Antimicrobial Resistance Surveillance in Animal Health Sector in Cambodia
		Dr Juan Carrique-Mas Vietnamese Platform for Antimicrobial Reductions in Chicken production, Vietnam	High resolution data to quantify antimicrobial use in Vietnamese chicken farms: results from the baseline phase of the ViParc intervention trial
	14:35-15:10	Ms Stella Danek	The effectiveness of enhanced environmental hygiene interventions in preventing the transmission of antimicrobial resistance to humans: a systematic review
Pitch presen- tations		Dr Seng Sokerya	Case Study on One Health Approach in Addressing Antimicrobial Resistance in Cambodia
		Dr Joey Hernandez	Implementation Review of the Philippine Action Plan to Combat Antimicrobial Resistance 2015-2017
BREAK - POSTER SESSION	14:35-15:10		



## DAY 3 (07/12) - ACTION

### // ONE HEALTH & ANTIBIOTIC RESISTANCE

	TIME	SPEAKER	TITLE
<b>SESSION 8:</b> TAKE-HOME MESSAGES	<b>15:30-16:45</b>	<b>Prof Dr Wim Van Damme</b> Institute of Tropical Medicine in Antwerp, Belgium	A conversation to highlight the take-home messages from the colloquium, bridging research and action in AMR
<b>CLOSING SESSION</b>	<b>16:45-17:00</b>	<b>Prof Dr Chhea Chhorvann</b> National Institute of Public Health, Cambodia	
<b>CLOSING RECEPTION</b>	<b>17:00</b>		

# ORAL SESSIONS

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## Opening session: Research priority - focusing on AMR

H E Mam Bunheng

Chhea Chhorvann

Bruno Gryseels

Charlotte De Grauwe

Jan Jacobs

Nick White

Ly Sovann and Kumanan Rasanathan

Rattanaxay Phetsouvanh

Nithima Sumpradit

## The Colloquium is officially opened by:



**His Excellency Professor Mam Bunheng**

Minister of Health, Cambodia



**Professor Dr Chhea Chhorvann**

Director of the National Institute Of Public Health (NIPH) in Cambodia and the Dean of the School of Public Health of NIPH



**Professor Dr Bruno Gryseels**

Director of the Institute of Tropical Medicine Antwerp, Belgium



**Ms Charlotte De Grauwe**

Attaché at the Embassy of the Kingdom of Belgium in Thailand



## Prof Dr Jan Jacobs

Jan Jacobs (°1959) Medical doctor KU Leuven, (Belgium 1984), Clinical Pathologist (Belgium, 1989), Clinical Microbiologist (The Netherlands, 1991), PhD "*Streptococcus milleri*", Maastricht University 1996, Hospital Infection Control (KU Leuven 1991).

From 1990 to 2005, he was working at the University Hospital of Maastricht and involved in diagnostic microbiology, infection control and teaching. In 2006 he was appointed as Professor in Tropical Laboratory Medicine at ITM, and since 2014 as a part-time professor at the Catholic University of Leuven (KU Leuven).

He is currently involved in patient care (part-time supervising the diagnostic laboratory of the travel clinic of ITM), teaching (infection control and laboratory practicals at ITM) and in oversea capacity building projects about microbiological surveillance of invasive diseases and antibiotic resistance/infection control.

He is (co)-promoter of ITM projects in Cambodia, the Democratic Republic of the Congo, Benin, Burkina Faso, Peru and Mozambique. His main research focuses on tropical bacteriology in low-resource settings addressing microbiological surveillance and reaching out to infection prevention & control and antibiotic stewardship. He is particularly interested in invasive *Salmonella* infections and performs operational research in appropriate microbiological techniques and quality of in-vitro diagnostics in low resource settings.

He is technical advisor for the World Health Organization's Prequalification of Diagnostics Program (test product review, ISO 13485 manufacturing site inspections) and the WHO Expert Review Panel for Diagnostics (ERPD, 2016 - ) and the WHO Strategic Advisory Group of Experts on In Vitro Diagnostics (SAGE IVD, 2017-18).



## Key Aspects in Antibiotic Resistance – the One Health Approach

Antibiotics kill bacteria or inhibit their growth by targeting bacterial cell wall, nucleic acids, ribosomal transcription and metabolic pathways. Antimicrobial resistance occurs when bacteria destroy the antibiotic, eliminate or modify it or change the target molecules. Bacteria may acquire resistance by their progenitors (vertical transmission) or from other bacteria (horizontal) by exchange of resistance factors (plasmids, integrons) through cellular contacts.

Most antibiotics are derived from fungi and antibiotic resistance therefore is a natural occurrence, but the scale of emergence and spread of resistant bacteria is an unprecedented and recent phenomenon. Factors driving antibiotic resistance are human: they include the inappropriate use of antibiotics (overuse, underuse, wrong dosage, low quality) and the lack of infection prevention and control allowing resistant bacteria to spread. These factors occur in the sectors of human and animal health, food and feed production and the environment, making antimicrobial resistance a worldwide "One Health" problem. Spread of resistant bacteria is further facilitated by travel and trade whereas the "pipeline" of newly developed antibiotics has dried out.

Acknowledging the shared and multisectoral nature of antimicrobial resistance, the World Health Organization (WHO), the Food and Agriculture Organization (FAO) and the World Organisation for Animal Health (OIE) have recently worked out a coordinated global action plan to contain antimicrobial resistance. The plan targets 5 objectives: (i) awareness and education, (ii) surveillance of resistance and antibiotic use, (iii) infection prevention and control, (iv) optimal use of antibiotics and (v) research and development in antibiotics, diagnostics and vaccines. The presentation focuses on the (gaps in) scientific evidence of the One Health approach and depicts progress and potential barriers at the level of inter-sectoral national action plans with emphasis on low- and middle income countries.



**Prof Dr Nick White**

Professor Sir Nicholas John White FRS is Professor of Tropical Medicine at the Faculty of Tropical Medicine, Mahidol University, Thailand and at Oxford University, UK. He is also a Consultant Physician in acute general medicine at the John Radcliffe Hospital, Oxford. Professor White is a Wellcome Trust Principal Research Fellow who chairs the Wellcome Trust Tropical Medicine Research Programmes in Southeast Asia. His research focus is the pathophysiology and treatment of malaria. He has concentrated on characterising antimalarial pharmacokinetic-pharmacodynamic relationships to improve the treatment of malaria and to reduce the emergence of resistance. This led to artemisinin based combination treatment for *falciparum malaria*, and the change to artesunate for the treatment of severe malaria. He has authored over 1100 scientific publications and 50 book chapters. He has received the Prince Mahidol Prize for Medicine, the Canada Gairdner Foundation Global Health Prize, and the Royal Society of Tropical Medicine and Hygiene Manson medal. He co-chaired the WHO antimalarial treatment guidelines committee for twelve years and currently chairs the Scientific Advisory board of the Drugs for Neglected Diseases initiative.



### **Antimicrobial resistance in the Greater Mekong sub-region**

Antimicrobial resistance (AMR) patterns in the Greater Mekong subregion generally parallel those observed elsewhere in mainland East Asia and, apart from South Asia, are worse than elsewhere in the world although the true burden is unknown. In Gram positive pathogens AMR levels have not increased greatly. Methicillin resistance prevalence in *Staphylococcus aureus* in the community remains generally low (<10%) but increases in hospitalised patients. While resistance patterns for important regional pathogens such as *B. pseudomallei*, and *O. tsutsugamushi* remain stable, as these are not under natural selection, the greatest concern

is the recent increases in AMR in enterobacteriaceae and *Acinetobacter* species. Prevalences are usually highest in ICU patients, but worsening resistance extends far into remote rural communities. Plasmids carrying genes encoding extended spectrum beta-lactamases (ESBLs), which confer resistance to most available beta-lactams, and carbapenemases (particularly in *Klebsiella* sp), and most recently polymyxins, have spread. Infections with these usually multi-drug resistant pathogens are a major cause of morbidity and mortality in hospitalised patients. Untreatable infections are increasing. Amongst *Salmonellae* fluoroquinolone resistance is now widespread forcing a change to azithromycin as first line treatment for enteric fevers. Resistance in *Candida* species (particularly *C. auris*) and *N. gonorrhoeae* is also increasing. Antibiotics for human use are readily available without prescription throughout the region and are common components of commercial animal feeds.



**Dr Ly Sovann**

Dr Ly Sovann is currently the Director in the Ministry of Health in Cambodia. He has other responsibilities such as spokesperson for the Ministry of Health, IHR Focal, and Chair of the AMR Working Group. He has served in the past as an advisor to Samdech CHEA SIM 2006 to 2018, and the former President of the Senate of the Kingdom of Cambodia. His expertise in disease surveillance, investigation, public health emergency response and pandemic preparedness and response.

Dr Sovann has conducted research in many national and international projects, including a study on aspirin abuse in coordination with the University of Khon Kaen in Thailand; a prevalence study on leptospirosis; and outbreak investigation for diseases such as cholera, ARI, SARS, and avian influenza. He has interest IT technology and development in support of public health.

Dr Sovann received his MD from the University of Medical Science in Phnom Penh in 1994 and his Master of Clinical Tropical Medicine and a Diploma of Tropical Medicine from Mahidol University in 2000 and 2001 respectively.



**Dr Kumanan Rasanathan**

Dr Kumanan Rasanathan, MBChB, MPH, is a public health physician with 20 years' experience in health and related sectors, and currently works as Coordinator, Health Systems, at the World Health Organization in Cambodia, where he leads a team working on health systems and services, antimicrobial resistance and maternal and child health, with the Royal Government of Cambodia. He was previously Chief of the Implementation Research Unit, Implementation Research Unit and Delivery Science Unit and Senior Adviser Health for UNICEF in New York, working on implementation research focused on improving child service delivery, universal health coverage, district health system strengthening, health systems resilience post-Ebola, integrated community case management, the Sustainable Development Goals agenda, and multisectoral approaches to child health. Prior to this, Dr Rasanathan worked for WHO in Geneva on primary health care and the social determinants of health, and in a number of different countries as a clinician, researcher, policy maker, programme manager, and advocate. He started his public health career running Phase I and II vaccine clinical trials leading to the licensure and rollout of meningococcal B vaccine in New Zealand.



### **Strengthening the Antimicrobial Resistance (AMR) Surveillance System in Cambodia**

Anti-Microbial Resistance (AMR) surveillance is a global and national public health priority. The Cambodian Ministry of Health (MOH) launched the National AMR Surveillance system in November 2017. It was piloted at eight sentinel sites starting January 2018. The key objectives of this study are to review key successes, challenges and next steps to strengthen the National AMR Surveillance.

We monitored the AMR surveillance system by reviewing 22 field trip reports and AMR Surveillance Review Workshop Report and Refresher Training. The trips, Workshop and Training occurred from January to July 2018. The team (surveillance focal points, lab experts, and IT experts, and partners) met with the Hospital's management team, visited the microbiology lab and the hospital wards using a checklist, and met the Provincial Health Department's management team.

Each site has at least 4 microbiology staff, guidelines and SOPs, equipment and supplies from the MOH and partners, data reporting systems, and quality assurance programs. The demand for cultures has increased gradually because physicians have a better understanding of the need. However, the quality of microbiology laboratories in some laboratories did not meet the national set targets; some contract or volunteer staff are not fully trained; clinicians have a limited understanding of sample collection and infection prevention and control (IPC) practices and Antibiotic Stewardship Program has not been universally implemented. The AMR Database was finalized, but the validation of the data is really needed. The access to the existing reporting platforms is no available for some sites.

Despite some implementation challenges, the Cambodian AMR system is functioning at all the sentinel sites. Enhancement of microbiology lab quality; validation and consistency of the AMR Data and other variables are immediate priority. In the medium and long-term, an Antimicrobial Stewardship Program (AMS) and training in IPC are needed.

**Authors:** Sidonn KRANG, **Sovann LY**, Kimsan OU, Rattana OUCH, Vandarith NOV, Darapheak CHAU, Vanra IENG



**Dr Rattanaxay Phetsouvanh**

Dr Rattanaxay Phetsouvanh graduated from Leipzig University (Faculty of Medicine) in Germany in 1987. He obtained a Doctor of Medicine (Major in Clinical Parasitology) from the same university in 1990 and a Master of Science of Tropical Medicine from Mahidol University, Thailand in 1994.

He began his career with the Ministry of Health Lao PDR in 1992 as Head of the Research Unit at the Institute of Malaria, Laos, and between 1994-2002 had taken many position at the same institution including Head of the Training and Health Education Unit, Head of Service of Administration, Head of Technical Office and Head of the Laboratory and Outpatient Unit.

He has also been a guest lecturer at the Faculty for Post Graduate Study, University of Health Science and Francophone Institute for Tropical Medicine (IFMT) in Vientiane since 2003.

In 2013 he was appointed Deputy Director General of Department of Communicable Diseases Control; in charge of overseeing the malaria, HIV/AIDS, TB, dengue and NTD control programme in Lao PDR. He has also been working as a regional representative of CCM for Lao PDR for the RAI and RAI-ICC2 projects, and as co-chair of the Emerging Operation Center (EOC) for Communicable Disease surveillance, including dengue outbreak control.

Dr Rattanaxay is currently the Director General of Communicable Diseases Control, a position he has been occupying since November 2017.



#### **Brief and comprehensive overview of AMR action plan**

AMR is currently a priority agenda for the Ministry of Health, with the AMR Surveillance and Control committee established in 2015.



In Lao PDR, widespread unregulated provision of antibiotics, dispensing of insufficient doses, reduced adherence to complete dose regimens, and weak drug supply systems are all thought to contribute to the spread of AMR (Mahosot Microbiology Laboratory, 2013). Resistance have been reported for several pathogens, such as E.coli, Salmonella enteric, K. pneumoniae, etc. in various health service providers throughout the country.

Despite the existing drug and health care laws the legal enforcement have been faced with many challenges, non adherence to doctor prescription, issues of counterfeit and substandard drugs etc...

In the agricultural sector the country remains dependent on agriculture for their livelihoods, with 77% of all households actively involved in farming. Antibiotics have also been widely and indiscriminately used in livestock and fisheries as therapeutic agents to treat infections of bacterial diseases in intensive and extensive farming systems.

There are various contributing factors or causes of AMR in Lao PDR. These are primarily within three main sectors: health, agriculture, and environment.

An internal Joint External Evaluation (JEE) for IHR and GHSA was conducted by DCDC in Lao PDR in February 2017. The initial JEE self-assessment provides information on planning, capacity, laboratories, etc. The four indicators for AMR are: AMR detection, surveillance of infections caused by AMR pathogens, healthcare associated infection prevention and control programs, and antimicrobial stewardship activities.

Based upon these findings the Ministry of Health together with the Ministry of Agriculture and Forestry, WHO, FAO, OIE, KOICA and as well as international organizations have met together and jointly developed and drafted an AMR action plan for 2017-2020, which will be used as further reference for outlining strategies and activities in AMR in Lao PDR.

**Authors: Rattanaxy PHETSOUVANH,** Sithong Phiphakhavong, Bouakham Vannachone, Somphone Soulapthy



**Dr Nithima Sumpradit**

Dr Nithima Sumpradit is a senior pharmacist at the Food and Drug Administration, Ministry of Public Health, Thailand. She serves as an AMR multi-sectoral coordinator in developing and implementing Thailand's National Strategic Plan on AMR (NSP-AMR) 2017-2021, a secretariat team for the national AMR committee as well as sub-national committees. She is also the programme manager of the Royal Thai Government-World Health Organization Country Cooperation Programme on AMR (RTG-WHO CCS-AMR Programme) 2017-2021. Her expertise is in programme planning and evaluation. Her research background involves the application of social psychology and behavioral sciences to target behavioral changes, drug advertising, rational use of medicines and antimicrobial resistance. She received her Bachelor's Degree in Pharmaceutical Sciences, Mahidol University, Thailand. Her Master's Degree is in Health Promotion and Behavior from the University of Georgia, and her PhD is in Pharmacy Social and Administrative Sciences at the University of Michigan, USA.



#### **First two-year experiences in implementing Thailand's National Strategic Plan on Antimicrobial Resistance 2017-2021: progress, enablers and challenges**

Thailand's National Strategic Plan on AMR 2017-2021 (NSP-AMR), consisting of five goals and six strategies, is the first national plan addressing AMR particularly. The translation from the plan into actions is challenging as it confronts with emergent factors and non-linear dynamic interactions. This study is to share lessons learned from the NSP-AMR implementation during 2017-2018 in terms of progress, enablers contributing to the progress, and challenges ahead. The progress is observed via three pillars (a) the establishment of national governance mechanisms (i.e., the National Policy Committee on AMR and its sub-committees)

with the aims to lead high-impact policy move on AMR in extensive manner, avoid fragmented actions and bring better coordinated and more integrated actions among responsible agencies; (b) extensive partnership on AMR including advocates, civil society organizations, and public awareness raising; and (c) the strong scientific platform to strengthen integrated AMR surveillance system, track antibiotic consumption in human and animals, build up a new model of integrated AMR management in hospitals, and establish monitoring and evaluation system including research evidences to support policy and strategic direction. Key enablers are, for example, (a) political commitment at the government level that cascades from political declaration from UNGA, (b) core AMR taskforce consisting of strategic and policy experts, technical experts and social advocacy experts in planning strategic actions, and (c) multi-sectoral collaborations across ministries and other relevant sectors that required shared visions and trust building. However, several challenges remain, e.g., (a) inadequate national capacity to be responsive to tackle the complexity of AMR and (b) the traditional mindsets in addressing AMR need to change to enable shared ownership and partnership across sectors. In conclusion, Thailand is in an early stage for NSP-AMR implementation. While progress has been made, tons of challenges still lie ahead. Strong political support, AMR champions, and multisectoral collaboration are crucial to achieve the national goals.

**Authors:** Nithima Sumpradit, Wantana Paveenkittiporn, Noppavan Janejai, Thitipong Yingyong, Theerasak Chuxnum, Varaporn Thientong, Phairam Boonyarit, Chutima Akaleephan, Julaporn Srinha, Thitiporn Laoprasert, Kumthorn Malathum, Rathar Benjapalanon, Sukunya Num-sawat, Niyada Kiatying-Angsulee, Suriya Wongkongkathep

## ORAL SESSIONS

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### Session 1: Research update - microbiological surveillance

Ly Sovann (chair)

Stijn Deborggraeve (chair)

Chau Darapheak

Direk Limmathurotsakul

Jan Jacobs

Bin Chamroeun

Chiek Sivhour

Phe Thong

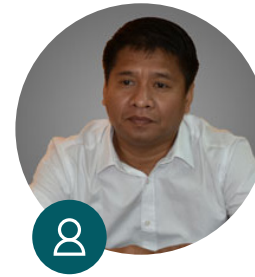
Paul Turner





**Dr Ly Sovann**

Find Ly Sovann's bio on page 40.



**Prof Chau Darapheak**

Professor Darapheak is the Head of National Referral Laboratory of National Institute of Public Health in Cambodia.



**Prof Stijn Deborggraeve**

Stijn Deborggraeve heads the Diagnostic Bacteriology Unit at the Bio-medical Sciences Department of the Institute of Tropical Medicine (ITM) in Antwerp, Belgium. He obtained a PhD in Pharmaceutical Sciences at the KU Leuven in 2009 and conducted postdoctoral research at ITM Antwerp and the University of California Santa Barbara in the USA. The Diagnostic Bacteriology Unit conducts research in novel approaches for the diagnosis of bacterial bloodstream infections and unraveling the mechanisms and spread of antibiotic resistance in the tropics.



## Prof Dr Direk Limmathurotsakul

Direk Limmathurotsakul, MD, MSc, PhD is the Head of Microbiology at Mahidol-Oxford Tropical Medicine Research Unit (MORU), Mahidol University. Since January 2012, Direk holds a Wellcome Trust Intermediate Fellowship in Public Health and Tropical Medicine. Besides facilitating other researchers' work, Direk runs his own fellowship-funded research programme, "Reducing the global burden of melioidosis". From 2018, Direk is also a board member of Surveillance and Epidemiology of Drug-resistant Infections Consortium (SEDRIC).

Antimicrobial resistance is one of Direk's main research areas. By integrating routinely collected data from a range of databases, he estimated that around 19,000 excess deaths are caused by multi-drug resistant bacteria in Thailand each year (eLife 2016). He also showed that under-use of bacterial cultures is a critical issue in low- and middle-income countries, and that may lead to an underestimate and underreporting of the incidence of antimicrobial-resistant infections (AJTMH 2017). These findings suggest that more studies with a systematic approach and appropriate statistical modeling are need to be done in other low- and middle-income countries (LMICs), especially in countries where microbiological laboratories are readily available and routinely used.

Direk also advocates the concept of 'antibiotic footprint' as a tool to communicate to the public the magnitude of antibiotic use in humans, animals and industry. Antibiotic footprint could be estimated by combining the total amount of antibiotics consumed by humans and animals in the country. A visual graphics tool ([www.antibioticfootprine.net](http://www.antibioticfootprine.net)) may encourage a reduction of overuse and misuse of antibiotic globally.



## Microbiological surveillance: how it can be used to estimate the national and global burden of antimicrobial resistant infections

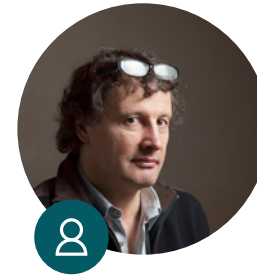
Estimating premature mortality and the burden of disease due to infections caused by pathogens that have acquired antimicrobial resistance (AMR) is critical, both to decide on resource allocation for interventions against AMR and to inform the implementation of action plans at global and national levels. With robust methods and reliable estimates, individual countries could track trends, determine the impact of actions on AMR, and compare these with others. It is also crucial for policy-makers to be able to compare the impact of AMR infections with other major communicable diseases such as HIV/AIDS, malaria and tuberculosis, as well as non-communicable diseases with a large global impact, including heart disease and cancer.

The Review on AMR, chaired by Jim O'Neill, estimated that around 700,000 deaths each year globally may be from infections with drug-resistant bacterial infections and multidrug-resistant and extensively drug-resistant tuberculosis. The Global Burden of Disease (GBD) study published in 2017 estimated that around 126,000 people died of multidrug-resistant and extensively drug-resistant tuberculosis in 2016, but the number of people who died of other drug-resistant bacterial infections, malaria and HIV were not estimated separately. National estimates of mortality from AMR infections have also been published for the United States (US), Europe and Thailand, among others. A direct comparison of these estimates is not possible because each used different methodology and data sources, including which types of infections were considered, when preparing the estimates.

Despite the importance of AMR as a public health threat, the lack of a robust and accepted methodology to assess its health and socioeconomic burden is widely acknowledged. Here, we compare and discuss the underlying assumptions, characteristics, microbiological surveillance data

used, limitations and comparability of the methods that have been used to quantify disease burden and mortality from AMR, and propose general guiding principles and potential approaches for improving these estimates in the future.

**Authors:** Direk Limmathurotsakul, Susanna Dunachie, Keiji Fukuda, Nicholas A. Feasey, Iruka N. Okeke, Alison H. Holmes, Catrin E. Moore, Christiane Dolocek, H. Rogier van Doorn, Nandini Shetty, Carmem L. Pessoa Da Silva, Jean Patel, Alan D. Lopez, Sharon J. Peacock, Surveillance and Epidemiology of Drug Resistant Infections Consortium (SEDRIC)



**Prof Dr Jan Jacobs**

[Find Jan Jacobs' bio on page 36](#)



### **Microbiological Surveillance**

The worldwide multi-sectoral plan to contain antimicrobial resistance (AMR) drafted by the “triparty” World Health Organization (WHO), Food and Agriculture Organization (FAO) and the World Organization for animal health (OIE) recommends 5 objectives, among which surveillance of AMR and of antibiotic use. As a concept, microbiological surveillance aggregates data from routine laboratory analysis and has beneficial effects for instance at the hospital level (drafting clinical guidelines and alerts to nosocomial outbreaks), the national level (guidance to public health interventions) and the global level (early warnings of emerging threats and information about long-term trends).

According to the results of the Country Self-assessment Questionnaire WHO/OEI/FAO (May 2018), about 50% and 33% of the member states reported a national surveillance system in humans and animals respectively, with - as expected - lower proportions among low- and middle-income countries (LMIC), which are however most suffering from the impact of AMR. Support in the human sector is given through the Global Antimicrobial Resistance Surveillance System (GLASS), in which 105 (approx. 55%) WHO member states have enrolled. In the agriculture settings, the Assessment Tool for Laboratory and AMR Surveillance Systems (ATLASS) has been developed and the guidelines for integrated surveillance of AMR in foodborne bacteria have been published (WHO-AGISAR).

Systems of national and supranational surveillance networks (such as GLASS and AGISAR) work well in resource-rich countries but in LMIC they face, apart from the well-known challenges (microbiological facilities, diagnostics and staff) specific barriers such as selection bias due to economic access to diagnosis and doctors' delay, under-use of laboratory capacity by clinicians, non-appropriate specimen selection and inadequate sampling. Extension of laboratory support initiatives - such as the Stepwise Laboratory Quality Improvement Towards Accreditation (SLIPTA) program of the WHO regional office for Africa - towards clinical microbiology could help to overcome these less-well studied barriers.



**Ph Bin Chamroeun**

Bin Chamroeun is a Microbiology Laboratory Manager at Siem Reap Provincial Referral Hospital since 2015. He graduated in 2007 as a pharmacist from the University of Health Sciences in Cambodia. He completed his MPH in 2011.

For four years he worked as a medical laboratory technician at the US Naval Medical Research Unit- 2 in Phnom Penh. In 2012 he was promoted Head of Microbiology at US. Naval Medical Research Unit- 2 Phnom Penh. From 2012 to 2015 he was teaching Microbiology at Puthisastra University and the Asia Institute of Sciences.



#### **Microbiology Surveillance of Blood Culture Pathogen in Siem Reap Provincial Referral Hospital**

Bloodstream infections are severe diseases characterized by high morbidity and mortality throughout the world, including Cambodia. Resistance among pathogens is increasing at an alarming rate, which is related to the incorrect use of antibiotics. This has been known to be one of the major factors leading to the occurrence of drug resistance. Cambodia is no exception, where drugs, often antibiotics are used without a prescription or the treatment does not always follow the doctor's prescription. Physicians often have to recommend second or third generation drugs and some time delay from diagnosis finding. Performing a blood culture is the best way to identify the pathogen when a bloodstream infection is suspected, and to find out what is the most appropriate antimicrobial for treatment. In Siem Reap Provincial Referral Hospital Cambodia, blood cultures have been collected since the laboratory opened in July, 2014. In this microbiology laboratory, we use conventional methods for bacteria identification and antimicrobial susceptibility testing following the CLSI guidelines to find out the most appropriate antibiotic for treatment.

Since July, 2014 to June, 2018, we have received 3815 cases of blood cultures. The most common pathogen are *Burkholderia pseudomallei* (78 cases), *Escherichia coli* 70 cases (ESBL 47 cases, = 67%, CRE 5 cases = 7%), *Klebsiella pneumoniae* 29 cases (ESBL 16 cases = 55%, CRE 1 case = 3.44%), *Staphylococcus aureus* 18 cases (MRSA 8 cases = 44.44%). The technical improvements such as development of an Antimicrobial Stewardship (AMS), Antimicrobial Resistance (AMR) committees, and External Quality Assessment (EQA) program are the key partners in limiting antimicrobial-resistant pathogen occurrence and spread. Together, they aim to increase the sensitivity and specificity of bacteria identification recovered from blood cultures, reduce the rate of blood culture contamination and antimicrobial resistance, and also improve surveillance and infection-control procedures.



**Ph Chiek Sivhour**

Chiek Sivhour is a medical biologist. She is currently the vice chief of Battambang Referral Hospital Laboratory, the Head of Microbiology and Clinical Laboratory and also a laboratory coordinator for molecular and stool projects. She is a trainer and mentor for the Strengthening Laboratory Management Toward Accreditation (SLMTA) programme, and a trainer for the International Teaching and Education Center for Health Programme.

Chiek Sivhour has been trained in quality management systems, bio-risk management, biosafety, IATA and SLMTA. She earned her pharmacist degree from the Faculty of Pharmacy at the University of Health and Science. She is currently completing her degree in DES Biologie Medical (Medical Biology).



#### **Bloodstream Infections Detected from Patients Admitted to Battambang Provincial Referral Hospital between 2014 and 2017**

Bloodstream infection (BSI) is a life-threatening medical condition. Since opening in 2011, the microbiology unit of Battambang Provincial Referral Hospital (BPRH) with laboratory strengthening partners and Ministry of Health has been building diagnostic capacity. We aimed to share blood stream infection data detected in hospitalized patients.

A retrospective review of the microbiology unit database was conducted in BPRH for January 1, 2014 through December 31, 2017. BPRH and other private clinic patients were included. Standard Operating Procedures in BPRH laboratory were used for isolation, identification and antibiotic susceptibility testing (AST).

Of 1,988 blood cultures collected, 157 (8%) were positive with 119 (6%) true positive and 38 (2%) deemed 'contaminated'. The most common blood cultures pathogens isolated were *Escherichia coli* 37 (31%),

*Staphylococcus aureus* 18 (15%), *Klebsiella pneumoniae* 13 (11%), *Burkholderia pseudomallei* 13 (11%) and *Salmonella* spp 5 (4%). We detected methicillin resistant *Staphylococcus aureus* (6), carbapenemase producing *Escherichia coli* (0) and *Klebsiella pneumoniae* (0). Extended-spectrum beta lactamases *Escherichia coli* (21) and *Klebsiella pneumoniae* (10) detected by key hold and confirmation test by comparing Caftazidime and Caftazidime/Clavulanic acid, Cefotaxime and Cefotaxime/ clavulanic acid grater or equal 5mm. Fluoroquinolone resistant *Salmonella* (2).

In order to understand AMR in these pathogens it is best to classify BSI as community-acquired (CA) or healthcare associated (HA) infections. A limitation of our study is the lack of patient data indicating CA or HA infection, previous clinic or self-treatment with antibiotics before patients were admitted. Expanding standard patient data records and improved appropriate and timely collection of blood cultures is required to better understand resistance data. Patient results contribute to improved patient care and Infection Prevention and Control in the facility.

**Authors:** Sivhour CHIEK, Joanne LETCHFORD



**Dr Phe Thong**

Dr Phe Thong, MD, MSc graduated as Medical Doctor from the Faculty of Medicine, University of Health Sciences, Phnom Penh in 2000, and completed his Master of Sciences in Tropical Disease at the Francophone Institute of Tropical Medicine in Lao PDR in 2003. He has also joined a number of postgraduate research courses, including the operational research course with MSF Luxembourg (2011-2012) and Short Course on Research and Evidence-Based Medicine (SCREM), Antwerp, Belgium (2009). From 2004 to 2007, he was working for Medecins Sans Frontieres Belgium (MSF-B) as a senior medical doctor in the Chronic Diseases Clinic and was involved in the CAMELIA Clinical trial on HIV/TB co-infection. Since 2008 he has been working for Sihanouk Hospital Center of HOPE in Phnom Penh. He is currently a clinical supervisor at the Infectious Diseases Department. He also coordinates the antibiotic stewardship programme and surveillance of antibiotic resistance in the hospital and is involved in a number of research projects in the hospital related to infectious diseases and antibiotic resistances. Since 2012, he has been a member of the National Working Group on Combating Antimicrobial Resistance, Ministry of Health. He is also a national trainer for the management of opportunistic infections and ARV delivery for HIV/AIDS patients.



### **Results of a 10-year surveillance of pathogens and their antibiotic resistance in bloodstream infections among Cambodian adults**

Bloodstream infections (BSI) are an important cause of morbidity and mortality worldwide. In Cambodia, data on microbiological surveillance are limited. We describe the data from a 10-year surveillance project (2007-2016) in Sihanouk Hospital Center of HOPE (SHCH), Phnom Penh, Cambodia.

Blood cultures (2x10ml, BacT/Alert, bioMérieux) were systematically performed in all adult patients suspected of BSI in SHCH since 2007.



Bacterial isolates were identified using standard microbiological techniques and antibiotic susceptibility testing was done using disk diffusion and additional E-tests where applicable according to international (CLSI) guidelines.

Between 2007-2016, 22,189 blood cultures from 16,358 adult patients (median age of 48 years [IQR=32-61; 55.6% female) yielded 1,888 (8.8%) clinically significant organisms (CSO). Gram-negative isolates were most predominant (79.1%). Key pathogens included *Escherichia coli* (n=558; 29.6%), *Salmonella* spp. (n=374; 19.8%), *Burkholderia pseudomallei* (n=183; 9.7%), *Staphylococcus aureus* (n=154; 8.2%) and *Klebsiella* spp. (n=125; 6.6%). Among *Salmonella* spp., *Salmonella* Paratyphi A was recently predominant (216/374; 57.8%). A total of 341/558 (61.1%) *E. coli* isolates were co-resistant to amoxicillin, SMX-TMP and ciprofloxacin and 59.1% were producers of extended spectrum beta-lactamase (ESBL). *Salmonella* Typhi isolates displayed high rates of decreased ciprofloxacin susceptibility (92.6%; 63/68) and high rates of multidrug resistance (48.1%) but susceptibility to third generation cephalosporin (97.1%; 66/68) was preserved. *S. aureus*, methicillin resistance (MRSA) was seen in 44/154 (28.6%). Carbapenem resistance was observed in 3 out of 45 *Acinetobacter* spp. isolates and one *Enterobacter cloacae* isolate. Overall, resistant rates increased from the first five-year (2007-2011) to the second period (2012-2016): ESBL(+) *E. coli* increased from 54.6% to 60.3%; *Salmonella* Typhi from 87.5% to 95.6% and MRSA from 21.5% to 37.4%.

Gram-negative pathogens are predominant in our BSI surveillance, with high rates of antibiotic resistance which increased over the years. These data are contributing to adapting local treatment guidelines, nationwide surveillance and control interventions to contain antibiotic resistance.

**Authors:** Phe T, Vlieghe E, Lim K, Veng C, Kham C, Thai S, Peeters M, Teav S, Lynen L, Jacobs J



**Prof Paul Turner**

Paul Turner MB BS, PhD, FRCPCH, FRCPath is a clinical microbiologist and the director of the Cambodia Oxford Medical Research Unit (COMRU), based at Angkor Hospital for Children in Siem Reap. COMRU is a component of the Mahidol Oxford Tropical Medicine Research Unit, one of the Wellcome Africa and Asia Programmes.

Paul leads research on pneumococcal colonisation and disease, the nasopharyngeal microbiota, and paediatric invasive bacterial infection / hospital acquired infection epidemiology. His non-research work focuses on development of human and laboratory capacity for diagnostic microbiology in low-resource settings.



#### **Antimicrobial Resistance in *Streptococcus Pneumoniae* before and after the Introduction of Pcv-13 in Cambodia**

*Streptococcus pneumoniae* is a leading infectious cause of childhood morbidity/mortality globally. Introduction of pneumococcal conjugate vaccines (PCV-7/10/13) has significantly reduced the burden of disease caused by the serotypes covered by the vaccine and has also impacted on antimicrobial resistance (AMR) in several settings. Cambodia introduced PCV13 into the national immunisation schedule in 2015. An on-going study at Angkor Hospital for Children (AHC) aims to make a comprehensive assessment of PCV13 impact on paediatric pneumococcal carriage and disease.

Annual pneumococcal nasopharyngeal colonisation surveys have been conducted at AHC since 2014 (one-year pre-PCV13 introduction), with the most recent survey completed in January 2018 (three years post-PCV13 introduction). Since August 2013, nasopharyngeal swabs have been collected to detect pneumococcal colonisation in hospitalised pneumonia cases.

Passive surveillance for invasive pneumococcal disease (IPD) has been in place at AHC since 2007. Pneumococci are identified by standard methods with serotype determination by latex agglutination. Antimicrobial susceptibilities are determined following current CLSI guidelines. In 2017, 1,000 carriage and invasive isolates were submitted to the Global Pneumococcal Sequencing project for whole genome sequencing.

Since the study is on-going, only interim results will be presented. Between 2007 and 2016, a third of invasive *S. pneumoniae* isolates were macrolide/lincosamide resistant (29.7%, 49/165), half were penicillin resistant (50.7%, 73/144), and two-thirds were multi-drug resistant (MDR; 67.8%, 63/93). To date, over 2,000 children have been enrolled in the colonisation surveys. Between 2014 and 2017, 70.9% (997/1,406) of colonising pneumococci were MDR, with no clear trend over time. Resistance was less common in non-vaccine serotypes (42.9%, 199/464) compared to PCV13 serotype (86.9%, 742/854) and non-typeable isolates (63.6%, 56/88).

This study will provide important data on the impact of PCV13 on pneumococcal AMR in Cambodia. On-going surveillance will be required to monitor trends over time.

**Authors:** Ly S, Sar P, Soeng S, Leab P, Suy K, Miliya T, Day N, Ngoun C, Turner C, **Turner P**

## ORAL SESSIONS

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### Session 2:

#### Research update - antibiotic stewardship

Paul Turner (chair)

Laura Kuijpers (chair)

Phe Thong and Kim Savuon

Erika Vlieghe

Sanjeev Singh

Mari Rose De los Reyes

Miliya Thyl





**Prof Paul Turner**

Find Paul Turner's bio on page 61



**Dr Laura Kuijpers**

Laura Kuijpers is a medical doctor and an MSc Global Health graduate. Between 2013 and 2017 she conducted multi-disciplinary research on invasive *Salmonella* infections and associated antibiotic resistance. The research focus was on enteric fever, a clinical syndrome caused by *Salmonella Typhi* and *Salmonella Paratyphi A*, in Cambodia.

Laura combined quantitative and qualitative research methods to investigate antibiotic resistance trends in enteric fever and the landscape of antibiotic dispensing and use in the community. She collaborated with microbiologists, clinicians, molecular biologists, anthropologists and epidemiologists.

The different research projects that were part of a PhD programme, were conducted at the Sihanouk Hospital Center of HOPE in Phnom Penh (Cambodia) the Institute of Tropical Medicine in Antwerp (Belgium), the University of Leuven (Belgium) and the Institute Pasteur in Paris (France).

Laura currently works as an internal medicine resident at the Alrijne Hospital in Leiderdorp, The Netherlands.



**Dr Phe Thong**

Find Phe Thong's bio on page 59

Phe Thong presents his abstract together with Kim Savuon from the Ministry of Health.



#### **Antibiotic stewardship in the human health sector in Cambodia**

Antibiotic resistance (ABR) is a global threat in the area of infectious diseases. Treatment options for common infections are running out with rapid emergence of ABR while development of new antimicrobial drugs is limited. As part of the South-East Asia in the Western Pacific Region, Cambodia shares this burden with well-established data. The main barriers to combating ABR in Cambodia include limited awareness of ABR among most stakeholders; limited surveillance data to support evidence-based decisions and local guidelines; limited access to microbiological culture and diagnostic test; irrational use of medicines in health and animal; limited infection prevention and control measures in health facilities; and limited coordination among different sectors, especially the health, animal, agriculture and environment sectors. Despite these challenges, Cambodia has been taking many steps forward to address ABR. The first National Workshop for containment of ABR took place in 2011 and a national technical working group for combatting AMR was created in 2012 and is active functioning under the leadership of ministry of health. A national situation analysis on AMR for identifying the burden of AMR was conducted in 2013.

Cambodia is among the few countries having developed national policy and strategic plan for combatting AMR in 2014 which is a major milestone, completed by national SOP for national AMR surveillance system (2017) which was registered in the Global Antimicrobial Resistance Surveillance System (GLASS) developed by WHO. One of the seven strategies to combat AMR is to 'Regulate and Promote Rational Use of Medicines', which includes the development of antimicrobial stewardship programs in healthcare facilities as a specific objective. In line with this strategy, national guidelines for antimicrobial stewardship have been drafted and reviewed on the final revision.

**Authors: Thong Phe, Savuon Kim,** Sovann Ly, Krut Lim, Sopheak Thai, Joanne Letchford; Sothearith Bory, Paul Turner



**Prof Dr Erika Vlieghe**

Erika Vlieghe is an Infectious Diseases clinician with professional experience within and outside Belgium (UK, Uganda, Ecuador, Cambodia). She studied medicine at the Catholic University of Leuven, followed by a postgraduate course in tropical diseases at the Institute of Tropical Medicine Antwerp (ITM) and a specialization in internal medicine and infectious diseases at the Catholic University of Leuven.

From 2004 to 2017 she was working as a senior staff member and researcher at the ITM. Since 2017 she has been heading the Department of General Internal Medicine, Infectious Diseases and Tropical Medicine at the University Hospital of Antwerp (UZA); she teaches capita selecta of tropical medicine and infectious diseases at various undergraduate and postgraduate courses at the University of Antwerp and the ITM.

Over the past few years she has been involved in research and capacity building in the field of antibiotic resistance in low and middle income countries; she obtained a PhD in this field in 2014. Between October 2014 – October 2015 she was temporarily appointed the 'National Ebola-coordinator' in Belgium. Within this function she has worked in close collaboration with the national health authorities and many other partners to prepare the country for possible Ebola-infections.



#### **Antibiotic stewardship in LMIC: same same, but different?**

Antibiotic resistance is a worldwide and rapidly evolving problem. South-eastern Asia has been hit particularly hard, as very high rates of bacterial resistance threaten the health care outcomes of a large population and jeopardize the functioning of the region's already overburdened health care systems. Several common bacterial infections have become nearly untreatable, a silent and underestimated killer.

The historical widespread use of antibiotics for human and animal health is a well-known fueling factor to this problem. For decades, antibiotics have been used as the most easy and affordable solution to compensate for weak diagnostic and infection control capacity and small numbers of well-trained health care staff.

In 2015, the WHO issued its first Global Action Plan for the containment of antimicrobial resistance; which has been gradually translated into National Action Plan by the different member states. The way forward is nevertheless very challenging and still holds a lot of questions on the most effective strategies.

On a national and quantitative scale, the use of antibiotics within hospitals constitutes only the tip of the iceberg. Given their nature as places where care for the most vulnerable patients, possible transmission of health-care associated pathogens and medical training is concentrated, they remain nevertheless very relevant for the introduction of antibiotic stewardship and infection control activities. Most expertise and evidence on antibiotic stewardship has been generated in hospitals in high income settings; it is clear that these experiences cannot simply be transposed to low and middle income (LMIC) health care settings, which are struggling with particular problems.

A growing body of positive experiences with antimicrobial stewardship in LMIC health care settings, will be presented and can be an inspiration for all starting up similar programmes.



**Dr Sanjeev Singh**

Dr Sanjeev Singh is a paediatrician by training and did his masters in hospital management. He completed his PhD in Hospital Management and Infection Control in 2013.

He worked as a Regional Coordinator at WHO-India in a disease eradication programme for a couple of years before becoming Senior Medical Superintendent at the Amrita Institute of Medical Sciences at Kochi - a 1350-bed specialty university hospital.

He has done a fellowship on healthcare worker safety at University of Virginia and fellowship on health technology assessment (HTA) at the University of Adelaide. He is an Improvement Advisor at Institute of Healthcare Improvement, USA. He is a faculty member at the Indian Institute of Management, Kolkata (HEMP) and at IIM Bangalore.

Dr Sanjeev is also an Ambassador from India to the Society of Healthcare Epidemiology of America (SHEA) and has been adjudged as one of the "Heroes of Infection Control" by the Association of Professionals of Infection Control (APIC), USA. He is presently the Co-Chair of the Research Committee at NABH. He is Chairman of Technical Committee at AHPI and Health Sector Skills Council of India (GOI).



### **The Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (Global-PPS): Results of Antimicrobial Prescribing in India**

A uniform and standardized method for surveillance of antimicrobial use in hospitals was used to assess the variation in antimicrobial prescribing in India. BioMérieux provided unrestricted funding support for the survey.

PPS was conducted in Oct-Dec 2017, in 18 tertiary care hospitals across India. The survey included all inpatients receiving an antimicrobial on the day of PPS. Data collected included details on the antimicrobial agents, reasons and indications for treatment as well as a set of quality indicators. A web-based application is used for data-entry, validation and reporting as designed by the University of Antwerp ([www.global-pps.com](http://www.global-pps.com)).

#### Results:

- 1715 patients were surveyed - 720 (42%) medical and 273 (16%) surgical patients
- 250 (77.6%) patients received intravenous therapy and 99 (33.8%) patients received multiple antibiotics in the medical wards. 220 (80.3%) patients received intravenous therapy and 95 (35.6%) patients received multiple antibiotics in the surgical wards
- 225 (85.9%) patients received empiric therapy and 37 (14.1%) patients received targeted therapy in the medical wards. 43 (68.3%) patients received empiric therapy and 20 (31.7%) patients received targeted therapy in the surgical wards
- Community acquired infections were most common 418 (24.3%) followed by surgical prophylaxis 326 (19%) and healthcare acquired infections
- Ceftriaxone (24%), Piperacillin-tazobactam (8%), Meropenem (8%) were the commonest antimicrobial prescribed for medical prophylaxis.
- Antibiotic quality indicators such as reason in notes and post prescription review score low
- Prolonged surgical prophylaxis (SP) was most common (77%). Cefuroxime (36%), Amikacin (10%) and Ceftriaxone (8%) were most common prescribed for SP.

PPS suggests widespread antibiotic usage underlining the need for antibiotic stewardship to promote evidence based practice. The survey helped in identifying targets for quality improvement.

PPS has helped in bringing in uniformity of data collection, the simplicity of the protocol and data collection templates, data completeness and validation via the internet-based tool, and the opportunity for real time educational feedback of results to participating centers. This is helping us implement Antibiotic Stewardship across the organization.

**Authors: Sanjeev Singh,** Ann Versporten, Herman Goossens, Sharmila Sengupta



## Dr Mari Rose A De los Reyes

Dr Mari Rose A De los Reyes is an Infectious Disease Specialist at the Research Institute for Tropical Medicine in the Philippines. She currently heads the Medical Department and is the Programme Director of the Infectious Disease Training at the same institute. She is the former President of the Philippine Society for Microbiology and Infectious Diseases and Fellow of the Philippine College of Physicians.

Dr De los Reyes has more than 20 years of experience as a researcher, clinician, public servant and advocate. In 2017, Dr De los Reyes spearheaded the Global Point Prevalence Survey (PPS) in the Philippines, a collaborative project of the Department of Health (DOH), Research Institute for Tropical Medicine (RITM), Philippine Society for Microbiology and Infectious Diseases (PSMID) and the Pediatric Infectious Disease Society of the Philippines (PIDSP). This was participated by 16 private and government tertiary hospitals, the first PPS survey conducted in the Philippines and one of the key antimicrobial stewardship tools to combat antimicrobial resistance. Her network has expanded to 29 tertiary and secondary hospitals nationwide where surveys are now ongoing. She also conducts lectures on antimicrobial stewardship and has been responsible for implementing AMS programmes in private hospitals she is affiliated with.



### **Antibiotic prescribing among adult and pediatric patients with pneumonia in the Philippines: Results of the 2017 pilot Global PPS in 16 hospitals**

Antimicrobial resistance to microorganisms causing pneumonia is increasing. Rational prescribing, dispensing and use of antimicrobials are important approaches to combat antimicrobial resistance.

We aimed to determine the prevalence of antimicrobial use in selected public and private hospitals in the Philippines.

A one-day cross sectional survey of inpatient wards in 16 Philippines tertiary hospitals was conducted between September – November 2017 using a standardized and validated protocol and forms developed by the Global PPS. Data were manually completed on paper forms and then transferred onto the web-based Global-PPS application designed by the University of Antwerp, Belgium ([www.global-pps.com](http://www.global-pps.com)).

There were 5933 antimicrobial prescriptions of which 5355 (90.3%) antibiotics were for systemic use (ATC JO1). The overall prevalence rate of antimicrobial use were 57.2% and 53.3% for adults and children respectively. Pneumonia was the top diagnosis for which therapeutic antimicrobials has been prescribed in both adults (39.7%) and children (50.2%). Differences occur in antimicrobial prescribing when diagnosis was classified as community-acquired (CAP) or hospital-acquired pneumonia (HAP). Top three most used antibiotic for CAP in adults were azithromycin (26.6%), ceftriaxone (15.8%) and piperacillin-tazobactam (15.2%) while cefuroxime (16.1%), amikacin (14.4%) and ampicillin (13.9%) were the top three most used antibiotics for CAP in children. Among adults with HAP, piperacillin-tazobactam (26.7%) and meropenem (19.7%) were the most prescribed antibiotics while in children with HAP, the most prescribed antibiotics were meropenem (18.5%), cef-tazidime (16.7%) and amikacin (14.8%).

These data are important indicators of antimicrobial use and can be used for education and behavior change in hospitals. As mandated by the Philippines Department of Health, AMS programs are now in place in hospitals in the Philippines. We will evaluate the improvement in our program through a repeated PPS.

**Authors:** De los Reyes, M.A.; Versporten A.; Goossens H.



**Dr Miliya Thyl**

Doctor Miliya Thyl, MD, CoP & IPPC is a paediatric clinical microbiologist working at Angkor Hospital for Children (AHC), Siem Reap, Cambodia. He obtained his medical degree from the International University (IU), Phnom Penh in 2010. In 2013, he completed his paediatric residency at AHC, gaining the paediatric training certificate (CoP) from AHC and the International Postgraduate Paediatric Certificate (IPPC) from Westmead University, Australia. Following general paediatric training, he completed three years of clinical microbiology training at Angkor Hospital for Children. Thyl has been attached to the Cambodia Oxford Medical Research Unit (COMRU), a University of Oxford field station, since 2013. He is involved in research projects related to invasive bacterial infections, healthcare associated infections and antimicrobial resistance in children. Thyl's clinical work focuses on management of patients with suspected or proven infection, antimicrobial stewardship (AMS), and infection prevention and control (IPC). He provides training to clinical staff on a wide range of infection-related topics.



#### **The Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (Global-Pps): 2017 Results of Antimicrobial Prescribing at Angkor Hospital for Children**

A uniform and standardized method for surveillance of antimicrobial use in hospitals was used to assess antimicrobial prescribing in Cambodia. bioMérieux provided unrestricted funding support for the survey.

The point prevalence survey (PPS) was conducted in March 2017 at Angkor Hospital for Children (AHC), a non-governmental paediatric referral hospital located in Siem Reap, north-western Cambodia. The survey included all inpatients receiving an antimicrobial on the day of PPS and assessed the main AHC site and the Sot Nikom district Satellite Clinic.

Data collected included details on the antimicrobial agents, reasons and indications for treatment as well as a set of quality indicators. A web-based application is used for data-entry, validation and reporting as designed by the University of Antwerp ([www.global-pps.com](http://www.global-pps.com)).

A total of 91 admitted children were included in the survey. The overall antimicrobial prevalence was 53.9% (49/91). Prevalence was highest in surgical (70.0%; 7/10) and paediatric intensive care unit (66.7%; 6/9) patients. Beta-lactams were the most frequently prescribed antimicrobial class (75.9% [44/58] of all prescriptions), most commonly third-generation cephalosporins. The majority of prescriptions were empiric treatment for community acquired infections, with sepsis and pneumonia being the leading clinical diagnoses. Antibiotic appropriateness was generally good, as judged by compliance with hospital guidelines: >70% in all clinical areas. However, duration of surgical prophylaxis and documentation of antimicrobial stop/review dates were sub-optimal.

The PPS provided a snapshot of antimicrobial prescribing at AHC. The high prevalence of antimicrobial use stimulated development of a hospital antimicrobial stewardship committee and an enhanced clinician education programme. A locally-adapted quarterly PPS protocol was implemented in June 2017 to monitor prescribing practices over time.

**Authors:** Miliya T, Versporten A, Fox-Lewis S, Ngoun C, Goossens H, Turner P



# ORAL SESSIONS

## Session 3: Research update - infection prevention & control

Thai Sopheak (chair)

Jan Jacobs (chair)

Miliya Thyl

Lê Thị Anh Thư

Ben Cooper



**Dr Thai Sopheak**

Thai Sopheak, MD, MPH is the Chief Executive Officer of Sihanouk Hospital Center of HOPE (SHCH) since 2015. She is also the Director of Infectious Disease Department Sihanouk Hospital Center of HOPE since 2003 and the Chairman of the Infection prevention and control committee in SHCH.

She was the principal investigator of operational studies and trials, such as the ID-TB/HIV study by US CDC, 2007; the implementation of an algorithm as proposed in the 2006 WHO guidelines to improve the diagnosis of tuberculosis among adults in HIV prevalent and resource constraint settings funded by WHO; and the STATIS trial supported by ANRS.

Dr Thai Sopheak graduated from the Medical University in Ho Chi Minh City in 1987. She studied international communication, leadership and management in Health at WHO-WPRO learning center, Manila, the Philippines, from 1994 to 1995. In 2004 she completed a course on human protection in health research at Brown University, and a TB and HIV management training in the Mariam Hospital, Providence, USA in 2004. These were followed by a Short Course on Antiretroviral Therapy in ITM, Antwerp, Belgium, in 2007, and a Master of Public Health in National Institute of Public Health, Phnom Penh, Cambodia in 2010.



**Jan Jacobs**

Find Jan Jacobs' bio on page 36



**Miliya Thyl**

Find Miliya Thyl's bio on page 74



### **Healthcare Associated Infection Surveillance and Infection Prevention and Control at Angkor Hospital for Children, Siem Reap, Cambodia**

Healthcare Association Infections (HCAI) are a frequent and avoidable complication of hospitalization. They result in significant morbidity and mortality and increase healthcare costs. Implementation of good Infection Prevention and Control (IPC) practices is a critical step to reduce the incidence of HCAI. Published data from LMICs on paediatric HCAI, and their prevention, is limited.

Angkor Hospital for Children started to develop IPC and HCAI surveillance activities in 2011. An IPC committee was formed and HCAI point prevalence surveys were conducted. IPC activities focused initially on staff education and hand hygiene. Monthly hand hygiene audits documented compliance of about 50% for WHO moment one (before touching a patient). Since then sustained improvements of compliance with all five moments have been documented. In 2011, overall HCAI prevalence was 13.8/100 patients at risk and the highest HCAI rate was in the intensive care unit. A prospective HCAI surveillance system was established in 2015, led by the AHC infectious disease / clinical microbiology (ID-Micro) team. HCAI case definitions were adapted from US-CDC and regular clinician training on identification and management of HCAI was commenced. Daily wards visits are done to review clinically suspected and laboratory confirmed HCAI cases. In 2015, there were 102 HCAI cases detected, an incidence of 4.6/1000 patient-bed days (95% CI 3.8–5.6). The incidence of HCAI was highest in neonates. The total in-patient treatment costs for these infections was estimated to be \$299,608.

*Klebsiella pneumoniae* and other Gram negative bacilli were the most frequently isolated pathogens: these organisms were often third generation cephalosporin resistant.

To control HCAI, core IPC activities which have been implemented at Angkor Hospital for Children. These low cost activities such staff training, good hand hygiene, and surveillance have helped to reduce the incidence of HCAI. A similar approach could be used in other healthcare settings within Cambodia.



**Prof Lê Thị Anh Thư**

Professor Lê Thị Anh Thư is the President of the Ho Chi Minh City Infection Control Society in Vietnam and the Chief of the Infection Control Department and Hospital Epidemiology, Pham Ngoc Thach University of Medicine, Ho Chi Minh City.





**Prof Ben Cooper**

Ben Cooper obtained a PhD in modelling transmission dynamics of healthcare associated infections from Warwick University in 2000 and has held postdoctoral positions at UCL and Harvard School of Public Health. He has also worked in the disease modelling team at the UK's Health Protection Agency. He has been based in the mathematical and economic modelling group at the Mahidol Oxford Tropical Medicine Research Unit in Bangkok since 2010 and has held an MRC Senior Non-clinical Research Fellowship since 2013. He is an associate professor in the Nuffield Department of Medicine, University of Oxford.

His work uses mathematical modelling and statistical techniques to help understand infectious disease dynamics and evaluate potential control measures. This involves developing mathematical models to help evaluate the likely impact of control measures, developing and applying statistical approaches based on mechanistic models for the analysis of longitudinal infectious disease data (increasingly making use of whole genome sequence data), and designing and analysing epidemiological studies. Applications of previous work include SARS, MRSA, pandemic influenza, Ebola, and hepatitis E. His current work focuses on multi-drug resistant Gram-negative bacterial infections and the use of adaptive trial designs in emerging epidemics.



**Effectiveness of key interventions to control priority organisms such as *Klebsiella pneumoniae***

Effective and cost-effective interventions are needed to reduce the burden of disease caused by antibiotic-resistant bacteria. This is particularly true in hospital settings, where multiply drug-resistant Gram-negative bacteria represent a major global challenge.

The first part of the talk will be about new insights into the epidemiology of priority organisms such as *Klebsiella pneumoniae* resulting from prospective carriage studies in Southeast Asia and their implications for control efforts. The second part will be a review of recent evidence for the effectiveness of key interventions including hand hygiene, antibiotic stewardship and selective decontamination. The final part will highlight new directions for research and emphasise the importance of generating robust evidence for what works with methodologically strong research. New tools to support this endeavour will be introduced.

# ORAL SESSIONS

## Session 4: Research update - One Health & antibiotic resistance

Heng Sopheab (chair)

Pierre Dorny (chair)

Thomas Riley

Hayley MacGregor

Laura Kuijpers

Om Chhorvoin

Truong Thi Quy Duong

Noellie Gay



**Prof Dr Heng Sopheab**

Prof Heng Sopheab, MD, MPH, PhD is the Deputy Director of the National Institute of Public Health and Head of Academic Affairs at School of Public Health (SPH). He is a public health researcher with about twenty-years of experience in HIV/STI-related studies, surveillance and M&E, maternal and child health and sexual and reproductive health. Dr Sopheab graduated from the University of Health Science, Phnom Penh, Cambodia with a Medical Degree in 1994. In 2001, he got his MPH in Health Services (International Health Program) from the School of Public Health and Community Medicine, University of Washington, Seattle, USA. In 2009, he was awarded his PhD from the Centre for International Health, University of Bergen, Norway. He has published a number of articles in international peer reviewed journals and many research and technical reports in Cambodia. He teaches biostatistics, epidemiology, data management and analysis with STATA, and research proposal writing to prepare students for their thesis development.



**Prof Dr Pierre Dorny**

Professor Pierre Dorny PhD, DVM, postgraduate tropical animal health, diplomate EVPC. After one year in veterinary practice, he became a researcher at the Laboratory of Parasitology at Ghent University (1983-1990). His PhD was on diagnosis and control of gastrointestinal nematodes in cattle. From 1990-93: VLIR project in Malaysia on control of nematodes in small ruminants. In 1994: parasitology consultant in a USAID project on sheep production in Indonesia. In 1995 he joined ITM and the University of Ghent (UGent) to continue research in parasitology. In 2000 he became a lecturer in veterinary helminthology at ITM and guest professor at UGent. He was chairman of the Department of Animal Health, ITM (2003-11). He was appointed full professor at ITM in 2008. Besides his teaching assignments in veterinary helminthology and parasite zoonoses at ITM and UGent, he coaches PhD and MSc students. The laboratory is National Reference Centre for trichinellosis. He is the (co-)author of 296 papers listed in PubMed.



**Prof Dr Thomas V Riley**

Professor Thomas Riley, BAppSc Curtin, MAppEpid ANU, PhD UWA, FASM, FRCPath, FAAM, FFS(RCPA). After 15 years working in diagnostic laboratories and completing a PhD part-time at The University of Western Australia (UWA) in 1984, Tom did postdoctoral studies in the Anaerobe Reference Unit of the Public Health Laboratory Service in England and then in the Division of Infectious Diseases at Johns Hopkins University in Baltimore, USA. He returned to Australia in 1987 and was appointed Senior Medical Scientist in Charge of the Department of Clinical Microbiology at Sir Charles Gairdner Hospital in Perth in 1988. In 1993-94, he completed a Master's Degree in Applied Epidemiology at the Australian National University and in 1995 was appointed Associate Professor, Department of Microbiology at UWA and Principal Research Scientist at the Western Australian Centre for Pathology & Medical Research, now PathWest Laboratory Medicine. In 2002, he was awarded a Personal Chair at UWA. He is currently a Professorial Research Fellow at Edith Cowan University and Professor of Public Health at Murdoch University, both in Perth. He maintains his appointment with PathWest. Tom is a Fellow of the Royal College of Pathologists, the Australian Society for Microbiology, the American Academy of Microbiology and the Faculty of Science of the Royal College of Pathologists of Australasia and has published nearly 400 book chapters and refereed journal articles. He has had a longstanding interest in healthcare related infections, particularly the diagnosis, pathogenesis and epidemiology of *Clostridium difficile* infection (CDI), and started working on CDI in animals over 20 years ago. The main focus of his research currently is CDI and One Health.



### **Clostridium difficile and the “One Health” paradigm**

The One Health concept is a worldwide strategy for interdisciplinary collaboration and communication in all aspects of healthcare for humans, animals and the environment. In recent years, 70% of emerging or re-emerging infections have been vector-borne or zoonoses - animal diseases transmissible to humans. *Clostridium difficile* infection (CDI) should always have been considered a zoonosis, either direct or indirect. It would appear that *C. difficile* colonises the gastrointestinal tracts of all animals during the neonatal period, multiplies and is excreted, but cannot/does not compete well when other bacterial species start to colonise. Adult humans treated with antibiotics fool *C. difficile* into thinking it is colonising a neonatal gut. In the 1980s and 90s, there was an expansion of CDI in hospitals that continues today driven by cephalosporins. Since 1990 worldwide, cephalosporins have been licensed for use in food animals. Thus there has been amplification of *C. difficile* in these animals, with subsequent contamination of meat, and vegetables grown in soil containing animal faeces. In fact, anywhere that animal faeces ends up, such as in gardening products and lawn, is now heavily contaminated with *C. difficile*. These animal strains of *C. difficile* are now infecting humans. Mutation to fluoroquinolone (FQ) resistance and excessive FQ use drove *C. difficile* (RT027 strain) spread in North America once it entered the hospital system. In Australia, RT014 is the most common strain isolated from humans and pigs, and whole genome sequencing suggests transmission from pigs to humans. In Asia, a different clade of *C. difficile* exists (clade 4) that is often non-toxigenic but alarmingly antimicrobial resistant. *C. difficile* continues to expand in food animals, driven by antimicrobial use, and animal strains of *C. difficile* are driving the worldwide epidemic of CDI. It is essential that a One Health approach is used to solve this problem.



**Dr Hayley MacGregor**

Dr MacGregor originally trained as a medical doctor in South Africa, at the University of Cape Town, and worked clinically in the Eastern Cape Province. She pursued further studies in social anthropology and completed her PhD at the University of Cambridge in 2003 on the experience of mental disturbance in a low-income urban settlement in South Africa. Her research interests include emerging infectious disease; the anthropology of antimicrobial resistance; informality in health provision; and concepts of care and chronicity in responses to lifelong illness, principally HIV. Her primary ethnographic work has been in South Africa, but she is involved in work elsewhere in Africa, and in Southeast Asia. She has been a Research Fellow at the Institute of Development Studies since 2007 and co-lead the Health and Nutrition research cluster. She retains clinical registration with the General Medical Council of the UK, with a focus in psychiatry.



### **Antimicrobial use in Livestock in Myanmar and the relationship with human drug resistant infections: what can social science contribute?**

Antimicrobial resistance (AMR) is considered one of the biggest global health threats, and there are gaps in knowledge regarding links between antimicrobial use in livestock, and drug resistant infections in humans. Empirical research to date has struggled to adequately characterise this relationship, which requires interdisciplinary work on the transmission and dynamics of zoonotic organisms and their resistance elements, the intersections between formal and informal human and veterinary health systems, and the nature of access to and provision of care.

We conducted social science research (combining anthropology, agricultural economics and health systems and policy research) on the pig sector in Myanmar, as part of a broader interdisciplinary project concerned with identifying the risks for zoonotic disease transmission and AMR in intensifying pig production systems. We employed qualitative methods to explore attitudes to antimicrobials, what antimicrobials were used in what proportions in pigs raised by small- to large-scale pig farmers, the actors providing veterinary healthcare to farmers, trajectories of care for animals and the rationales for drug use.

Pig-rearing formed an important livelihood resource and economic safety net, especially for small farmers. Farmers feared the death of pigs. Despite the fact that Myanmar's law prohibits people without official veterinary certificates from injecting antimicrobials, we found that pig farmers injected them or relied on informal providers of veterinary services. In addition, Community Animal Health Workers, who are trained by the government but not authorized to inject antimicrobials, also applied antimicrobials because farmers have limited access to officially certified veterinarians. When farmers had questions about pig treatment, they most often referred to informal (yet trusted) lay people who were con-

sidered experts in pigs, and often also provided other services to farmers and thus were a part of their social networks. Healthcare providers acknowledged that they sometimes used human drugs in animals, and observation confirmed that these included drugs that should be restricted for human use. Local drug shops were a further direct source of antimicrobials for farmers.

On account of the informal nature of these practices, farmers, unofficial providers and some drug shop retailers were reluctant to provide accurate information regarding the use of drugs. We sought to overcome this difficulty in data collection by using ethnographic and other qualitative research methods. In-depth qualitative data is thus an important complement to conducting large-scale quantitative surveys in order to develop reliable data on antimicrobial usage in contexts like Myanmar, where informal providers are crucial for drug access.

In tackling AMR at a regulatory level, it is also vital to recognise the prominent role of informal, and/or private, actors in providing access to antimicrobials for both human and animal use, particularly where formal human and veterinary health systems are weak and may not adequately reach poor and marginalized people.

**Authors:** Hayley MacGregor, Ayako Ebata, Michael Loevinsohn, Khine Su Win, Dan Tucker and the interdisciplinary ZELS-funded Myanmar Pig Project



**Dr Laura Kuijpers**

[Find Laura Kuijpers' bio on page 64](#)



### **Enteric fever in Cambodia: investigating antibiotic resistance from a multi-disciplinary perspective**

The development and spread of antibiotic resistance are complex problems which require a multi-disciplinary research approach that also includes behavioral determinants of using and dispensing antibiotics.

Antibiotic resistance is increasingly reported for enteric fever, a clinical syndrome that is characterized by fever and several other non-specific symptoms. It is caused by the bacteria *Salmonella Typhi* and *Salmonella Paratyphi A, B and C*, which can invade the blood stream after oral ingestion of a minimally effective dose. Humans are the only host to these bacteria and disease transmission follows a fecal-oral route. The disease is endemic in both urban and rural Cambodia.

The Sihanouk Hospital Center of HOPE (SHCH), in Phnom Penh, Cambodia, observed an unusual increase in *Salmonella Paratyphi A* infections during 2013–2015. During this period, decreased susceptibility against ciprofloxacin, an affordable antibiotic and the current first-line treatment, emerged and was detected in 50% (18/39) of the *Salmonella Paratyphi A* isolates in 2015.

Molecular analysis was conducted on a subset of isolates using whole genome sequencing. Decreased susceptibility against ciprofloxacin was found to be a result of the acquisition of a mutation in the *gyrA* gene. Isolates with and without this mutation belonged to the same genetic clade, meaning that the emergence of decreased susceptibility was not a result of the recent introduction of a new and more resistant bacterial clone.

The development and spread of resistance were likely a result of increased drug pressure. Observations in the community revealed that irrational use of antibiotics for symptoms associated with enteric fever was common. In-depth-interviews with confirmed enteric fever cases, health care staff and drug vendors in Phnom Penh revealed underlying reasons, including diagnostic uncertainty and limited household finances. Strategies to contain antibiotic resistance in Cambodia should therefore also include development of new diagnostic methods and forms of social health insurance.



**Dr Om Chhorvoin**

Dr Chhorvoin has over 15 years of experiences in Cambodian health sector and has a high academic profile. He earned his Diploma of Medical Doctor in Cambodia in 1997, a Master's Degree in International Public Health from Sydney University, Australia in 2003 and PhD degree from the University of New South Wales (UNSW), Australia in 2017. His PhD research focused on antibiotic use and prescribing in the Cambodian context. He conducted a KAP survey of physicians from public hospitals across the country to explore antibiotic prescribing practices. The KAP survey was followed by a qualitative exploration to gain deep understanding of facilitators and barriers to appropriate antibiotic prescribing. He also explored antibiotic practices in the community by interviewing community members including patients, pharmacy attendants and health centre staff. Antibiotic practices in commercial food animals were also explored as part of this.



#### **Practices of antibiotics in human and commercial food animals in Cambodia**

Antibiotics are widely used in Cambodia and this study investigates practices of antibiotics in human and commercial food animals.

This study used KAP survey with 689 physicians from 19 public hospitals and 17 focus group discussions (FGDs) with 103 surveyed physicians. In-depth interviews (IDIs) and FGDs were held with 10 pharmacy attendants and nurses from 6 health centers, respectively. IDIs were also given by 16 commercial food animal farmers. The study was approved by Cambodia Ethics Committee for Health Research, Department of Animal Health and Production, and also ratified by UNSW, Australia.

Over half (54%) and 81% of physicians believe that antibiotics are inappropriately prescribed in hospital and community, respectively.

The majority (86%) and 36% of surveyed physicians choose to prescribe antibiotics for uncomplicated common cold and diarrhea in children < 5 years, respectively. FGDs with physicians revealed that antibiotic prescribing was driven by prescribing habit. Several factors influencing prescribing habit include absence of microbiology service, pre-admission use of antibiotics, poor IPC, fear of bad clinical outcomes, patient's demand, perceived resistance to narrow spectrum antibiotics, and perceived poor quality of culture results. Pharmacies also prescribed antibiotics based on symptoms presented by their clients. An untrained pharmacy attendant mentioned that "For normal cold without high temperature, patients can take Amoxicillin. If they cough or have high temperature, they take Augmentin or Cefixime." Nurses also prescribe antibiotics at their private practices and mentioned that "If sickness becomes more severe, we have to use IV injection and Ceftriaxone." Widespread antibiotic use occurs on all farms participating in the study and is driven by four key facilitators: belief that antibiotics are necessary for animal raising, limited knowledge, unrestricted antibiotic access, and weak monitoring and control systems.

Improvement of antibiotic use in human and food animals is urgently required in Cambodia.

**Authors:** Chhorvoin Om, Frances Daily, Erika Vlieghe, Mary-Louise McLaws, James C. McLaughlin





## Dr Truong Thi Quy Duong

Truong Thi Quy Duong has been a researcher since 2008 at the National Institute of Veterinary, one of the leading veterinary science institutions in Vietnam, engaging in scientific research, training, technology transfer, international cooperation and collaboration and consultation services.

Truong has worked on food-borne bacteria such as *Salmonella*, "*E.coli*", "*Camplobacter*", *Listeria*... and AMR. Truong has been involved in national and international food-safety and AMR projects as a researcher. Truong is the author and co-author of nine publications regarding her interest. Currently she is a second-year Master's student at ITM.



### Characterization of Salmonella Isolated from Pig Slaughterhouses to Retail Markets in Hanoi, Vietnam

*Salmonella enterica* is an important zoonotic foodborne pathogen in the world. Pigs are one of the animals that are responsible for the transmission of *Salmonella* to humans through the consumption of contaminated pork. Poor hygiene during the slaughter process and storage is considered as a main risk for the transmission of *Salmonella* to humans. The aim of this study is to determine the prevalence and characteristics of *Salmonella* in pork from pig slaughterhouses and retail markets in Ha Noi, Viet Nam. Feces, pork and carcass swabs were sampled from 43 pigs in 12 family – slaughterhouses and retail markets from 3 districts in Ha Noi city during 10 visits from June to November 2017. The results show that *Salmonella* prevalence in carcass swabs, feces and pork samples were 23.3% (10/43), 34.9% (15/43) and 32.6% (14/43), respectively. Ten different *Salmonella* serovars were identified in total 31 *Salmonella* isolates, and *S. Typhimurium*, which is the main serovar causing salmonellosis in human, was the most commonly (20/31) identified serovar and was isolated from all 3 sample types. *Salmonella* isolates showed high resis-

tance to ciprofloxacin (51.6%), tetracycline (82%), colistin (82.%) and ampicillin (79.5%). All *Salmonella* isolates were co-resistant to at least 3 antibiotics. The genetic relationship of 7 *S. Derby*, 19 *S. Typhimurium*, 4 *S. Weltevreden* strains was characterized by pulsed field gel electrophoresis (PFGE) using the restriction enzyme *Xba I*. We found that within a serovar *Salmonella* isolates could be regarded as highly related (carcass swabs and pork samples in the same animal gave a 83.7-94.4% similarity index; within slaughterhouses this was 75-89.4%; and within markets this was 74-81%). We also found that two *Salmonella* isolates from two pork samples collected from two different markets originating from pigs that were slaughtered in two different slaughterhouses had the same origin (similarity index was 100%). It may evidence of *Salmonella* environmental contamination in pork. Our data shows that antibiotic resistant *Salmonella* is highly prevalent in the pork supply chain in Hanoi, it may be a risk for transmission to human.

**Authors:** Truong Thi Quy Duong, Stijn Deborggraeve, Pierre Dorny, Pham Thi Ngoc





**Dr Noellie Gay**

Since 2011, Noellie Gay has been involved in zoonosis epidemiological research in tropical regions. She is currently PhD researcher at the University of La Reunion. Noellie is working on One Health approaches of multidrug-resistant bacteria in South Western Indian Ocean.

During the past years, she was mainly involved in research programmes on pathogens transmission between wildlife and humans. She also worked as an epidemiologist for emerging disease surveillance and control (Zika, chikungunya in Americas) and emergency response (cholera outbreak after Hurricane Matthew).

During her PhD research, she identified priorities regarding antimicrobial resistance in Indian Ocean countries and evaluated the incidence of multidrug resistant bacteria in hospitalised patients from the Indian Ocean region. This incidence was high particularly for Extended-spectrum beta-lactamase and carbapenemase-producing-Enterobacteriaceae (ESBL-E and CPE) when compared to mainland France. High occurrence of multidrug resistant bacteria was also identified in livestock farms from Madagascar, Reunion and Mayotte and control measures to reduce occurrence in farms explored.

Finally, she is coordinating a study regarding ESBL-E transmission between humans, animals, and environment in Madagascar. She is involved in supervising postgraduate veterinary students.



#### **One Health approach of Extended Spectrum Beta-Lactamase-producing Enterobacteriaceae in human, animal and drinking water in small breeder households, Madagascar, 2018**

Madagascar is a hotspot of antibiotic resistance in Indian ocean with high prevalence of Extended Spectrum Beta-Lactamase (ESBL)-producing Enterobacteriaceae reported both in humans (i.e. 18.5% of colonization

in women at delivery) and animals. In 2016-2017, prevalence in semi-intensive breeding farms (beef cattle, poultry and pigs) ranged from 66.7% to 86.7%. However, patterns of ESBL-E transmission between humans, animals and through the environment remained unclear in low-income countries.

Study objectives were: i) evaluating the closeness of ESBL-producing Escherichia coli in animal species (companion and farms animals), human in community, and drinking water; ii) identify the risk factors of carriage in both human and animals.

From May to October 2018, 80 households of small breeders located in Andoharanofotsy commune, Antananarivo district, were sampled. Included households owned almost three different animal species. Inhabitants, animals and drinking water from households were sampled (exhaustive survey). Antibiotic therapy in animals and humans up to six months before visit, interaction types between animals and humans, as well as socio-demographic features of the household were recorded. Whole genome sequencing was obtained for 500 E. coli.

Preliminary data pointed high prevalence of ESBL-producing E. coli both in human community, companion and farm animals. Highest prevalences were observed in pigs, dogs, and ducks (80.3%, 57.5%, and 55.6% respectively). Among drinking water samples 22.7% were positives for the presence of ESBL-producing E. coli. Carriage in humans was 33.7%. E. coli closeness between hosts and in drinking water together with risk factors analysis are still ongoing.

Finally, high prevalence of community acquired ESBL-E in Madagascar was observed in animals and humans probably linked to shared habitat between humans and animals, low sanitation conditions, and misuse of antibiotic drugs. Phylogenetic analysis and risk factors of ESBL-E carriage will be presented.

**Authors: Noellie Gay,** Ilo Ramahatafandry, Noah Rabenandrasana, Florence Rakotonindrina, Harielle Panandiniaina, Jean-Marc Collard, Eric Cardinale

# ORAL SESSIONS

## Session 5: Lessons learned from malaria & HIV control in the Mekong region

Tho Sochantha (chair)

Marc Coosemans (chair)

Soy Ty Kheang and Siv Sovannaroth

Ngauv Bora

Koen Peeters

Jeroen Dewulf



**Dr Tho Sochantha**

National Center for Parasitology, Entomology and Malaria Control (CNM), Cambodia



**Prof Em Marc Coosemans**

Until January 2018, Prof Marc Coosemans was Head of the Medical Entomology and Vector Control Unit at the Institute of Tropical Medicine, Antwerp, Belgium.

He has longstanding research experience on malaria vectors and their control. Network and research activities were developed in Africa (Burundi, Rwanda, Uganda, RD Congo, Burkina Faso, Cote d'Ivoire, Tanzania), Southeast Asia (Vietnam, Cambodia, Laos, Thailand, Sri Lanka, India and Nepal) and in the Americas (Cuba and Brazil). In Cambodia, from 1996 to 2018, he worked in close collaboration with the National Center of Malaria Control (CNM) through different research and capacity strengthening projects.

As a WHO expert, he was member of different WHO commissions on vector control and chaired the working group of the WHO public health Pesticide Evaluation Scheme (WHOPES) for more than ten years.

Professor Coosemans is still involved in teaching activities at ITM.



**Dr Soy Ty Kheang**

Dr Soy Ty Kheang has twenty years of experience working on health projects in Southeast Asia. For the last 10 years, he has served as the Chief of Party and then as Regional Director at University Research Co. (URC), where he managed large and complex infectious disease programmes in Cambodia, Myanmar, and Thailand. There, he led technical teams in strategy development, adapting interventions to the local context and for scale-up, and planning and conducting programme activities to ensure smooth implementation.

In his current recent role as Regional Director for Malaria and Infectious Diseases at URC, he provides oversight, leadership, technical support and management for seven projects in the region: USAID | PMI Defeat Malaria, USAID | PMI Cambodia Malaria Elimination Project, ADB Malaria Surveillance and Quality Assurance Project in Myanmar, DFID Pro-active Case Detection and Community Participation Project, and the UNOPS Mobile and Migrant Population Survey.



**Dr Siv Sovannaroth**

Dr Siv Sovannaroth has eighteen years of experience working at the national malaria programme in Cambodia. In 2000 he was promoted from the malaria entomologist to Chief of Vector Control Unit and further to be the Chief of Technical Bureau and Malaria Programme Manager, which is his current function.

Additional to the current government role, he holds a position as Principal Implementer Manager to manage the GF Malaria Grant in Cambodia (Regional Artemisinin Initiative for Malaria Elimination).



#### **Antimalarial Drugs Resistance Malaria in Cambodia**

The epidemiology of malaria in the Greater Mekong Sub-region is complex and rapidly evolving. Malaria control and elimination efforts face many challenges, one of the crucial of them being multidrug-resistant parasites. Western Cambodia is recognized as the epicenter of *Plasmodium falciparum* multidrug resistance globally. Recent reports of the efficacy of dihydroartemisinin-piperaquine, the latest of the artemisinin-based combination therapies (ACTs) recommended by the WHO, have prompted further investigations. It is indeed alarming that four out of five of the current available ACTs have failed to treat *Plasmodium falciparum* in Cambodia.

Therapeutic efficacy study (TES) has been conducted by National Malaria Control Program (CNM) with technical support from the World Health Organization to look at the efficacy of different ACTs for the national drug policy decision. Prior to identified molecular marker of artemisinin resistance, Day-3 delay parasites clearance time (Day-3 positive), considered as early warning sign of ACT resistance, has been conducted at community level and comprehensive local response to the situation.

It is indicated that community Day-3 surveillance is feasible to have early detection of drugs resistance. TES-sentinel surveillance provides timely status of the antimalarial situation. Drug policy changes based on the surveillance findings move toward malaria elimination.



**Dr Ngaouv Bora**

Dr Ngaouv Bora, MD, MPH, is currently the Deputy Head of Technical Bureau, Vice Chief of the AIDS Care Unit, National Centre for HIV/AIDS, Dermatology and STD (NCHADS), where he has worked since 2004.

He graduated in 1988 as Medical Doctor from the University of Health Science. He received Master of Public Health Orientation on Disease Control (Option Reproductive Health) in 2010 from the Institute of Tropical Medicine Antwerp, Belgium. He obtained a certificate of Global Intensive Professional Programme in HIV-Public Health Stream at the University of Sydney in 2014.

In 2016 he completed the course on Airborne Infection Control Management at Harvard University, Boston, USA.



#### **Arv Drug Resistance Monitoring for Plhiv Who are on ART in Cambodia: Implementation of an Enhanced Adherence Counseling Tool in 2017**

Cambodia introduced the Enhanced Adherence Counseling (EAC) tool in 2017 with the aim of improving quality of care, preventing unnecessary switches to costlier and less tolerable second-line regimens, and optimizing treatment outcomes for PLHIV. While routine viral load monitoring has been in use in Cambodia since 2015 to monitor efficacy of HIV drug treatment and determine treatment failure, access to VL tests routinely are still limited to some ART sites.

Program data were used. All patients with Viral Load equal to or greater than 40 copies per ml are supposed to receive three EAC sessions within one month interval, then a follow-up VL test was performed after those EACs.

Data from January to December, 2017, collected from four provinces showed that patients with a viral load 40–999 copies received more often an EAC than those with 1000+ copies/ml (42% (597/1407) vs. 83% (849/1018) ( $P < 0.0001$ ). Among patients with a viral load of 40–999 copies/ml and who received an EAC, 65% (388/597) had a viral load follow-up test after receiving three enhanced adherence counseling and 64% (249/388) of these tests were  $< 40$  copies/ml. Among patients whose viral load were 1000+ copies/ml and had received EAC, 41% (347/849) had a viral load follow-up test after receiving three enhanced adherence counseling and 28% (97/347) of these tests were  $< 40$  copies/ml.

Among patient who received EAC, the percentage of patients who had a viral load follow-up test was higher among patients with 40–999 copies/ml than among those with 1000+ copies/ml and a bigger proportion of patients with 40–999 copies / ml returned to  $< 40$  copies per ml.

EAC can contribute to enhance drug adherence in Cambodia. Viral load follow-up still needs to be encouraged among patients with viral load at 1000+ copies /ml.

**Authors:** Ngaun B, Samreth S, Ky S, Barrett C, Delvaux T, Ouk V, Ly P



**Prof Koen Peeters**

Professor Koen Peeters heads the Unit of Medical Anthropology at the Institute of Tropical Medicine in Antwerp. Prof Peeters is also a senior lecturer at the Nagasaki University School of Tropical Medicine and Global Health in Japan. He holds a PhD in social and cultural anthropology and has conducted extensive research on sociocultural factors related to infectious disease transmission dynamics, perceptions on health and illness, and their impact on the effectiveness of prevention, control and elimination strategies. His professional experience is characterised by high international mobility and extensive field research in low-income countries, including West Africa, Latin America and Southeast Asia.



**‘Saturated medicine’ – Consequences of perceived treatment failure and suboptimal use of antibiotics in a malaria endemic area in South-central Vietnam: preliminary findings from a qualitative study**

Despite available data on the emergence of antibiotic resistance (ABR) in Vietnam, there has been limited evidence on the use of medicine and treatment seeking for non-malaria febrile illnesses.

An ethnographic study was conducted in Bac Ai – an impoverished mountainous district in Vietnam with the majority of inhabitants of Ra-glai ethnicity. Sampling was theoretical. Data collection consisted of interviews and participant observation; analysis was retroductive and concurrent to fieldwork.

Among the Ra-glai, medical terms for antibiotics and bacteria, viruses or parasites are non-existent and are referred to as ‘medicine’ and ‘worms’ respectively. No public health materials are accessible in Ra-glai. Antibiotics, including mostly amoxicillin, gentamycin and cephalexin, are available free of charge at public health providers and at a charge in the private sector. At the onset of febrile symptoms patients tend to take

medication for two to three days in line with their capacity to pay and perceptions on illness recovery, either in unlabeled tablets or grinded to powder in mixed-medicine bags. During this period the patient evaluates the drug efficacy against the symptoms. If symptoms abide, treatment is abandoned. If symptoms do not decline different types of biomedicine are sought from different providers.

When treatment is perceived to fail, “stronger” medicines are purchased at private providers and hardly ever at public health facilities, leading to increased risk of delaying appropriate treatment. Local grocery shops and mobile vendors are preferred due to their geographic and cultural proximity. Shamanic healing is considered part of the Ra-glai holistic health system and often practiced in parallel to biomedical treatment for perceived severe and relapse febrile illnesses.

Suboptimal antibiotic use amongst the poverty-stricken Ra-glai minority presents a risk of ABR and requires urgent health interventions for which formative research including community participation can contribute to finding contextualized solutions.

**Authors:** Nguyen Thuan T., Ronse M., Truong Hieu M., Vu Dung K.A., Tran Duong T., Nguyen Xa X., Muela Ribera J., **Peeters Grietens K.**



**Dr Jeroen Dewulf**

Jeroen Dewulf graduated in 1998 as a veterinarian from the Faculty of Veterinary Medicine of the Ghent University, Belgium. In 2002 he finished his PhD on the epidemiology and control of classical swine fever. In that same year he received a Master of Science degree in Veterinary Epidemiology from the University of Utrecht, the Netherlands (cum laude). He became a diplomat in the European College of Veterinary Public Health in 2005.

Since 2006 he is an Associate Professor in Veterinary Epidemiology at the Faculty of Veterinary Medicine of the Ghent University. In 2014 he was appointed as Full Professor in Veterinary Epidemiology. His main research interests are quantitative epidemiology and control of zoonoses with a specific emphasis on antimicrobial resistance and antimicrobial use in animal production as well as the prevention of epidemic and endemic diseases with a focus on the application of biosecurity measures. He is the Head of the Veterinary Epidemiology Unit and is supervising over 10 PhD students who are doing research in the field of veterinary epidemiology. He is (co-)author of over 265 A1 publications in the field of veterinary epidemiology with a H-index of 34.



### **Antibiotic use and resistance in farm animals, problems and solutions**

Antimicrobial resistance (AMR) is seen as one of the world's largest health threats. Not only is the

problem expanding at an alarming rate, it is also a particularly complex issue. Human, animal and environmental factors as well as the interaction between these three players all have an impact on antibiotic resistance. Antimicrobial usage (AMU) is identified as the main driver in the development and spread of AMR. Therefore any strategy to control AMR should primarily include strategies to control AMU.

In this presentation I give a short overview on the epidemiology of antimicrobial resistance and the possible routes of interaction between animals and humans illustrating the one health potential of antimicrobial resistance, yet at the same time taking away some of the common misunderstandings on antimicrobial resistance.

In the second part of my presentation I illustrate how, through basic interventions in infectious disease prevention and biosecurity measures (using Biocheck.UGent™) one can drastically reduce the need for antimicrobials in animal production (illustrated by multicenter studies on pigs and poultry) without jeopardizing animal health, production results and economical profitability.

This holistic and herd specific approach, with a focus on biosecurity and herd management, turned out to be the key success factor in antimicrobial reduction. This "Check, Improve and Reduce" approach might also prove successful in other countries around the world.

## **ORAL SESSIONS**

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### **Session 6:**

### **From research to practice - human health & antibiotic resistance**

**Ly Penh Sun (chair)**

**Erika Vlieghe (chair)**

**Ir Por**

**Li Yang Hsu**

**Marianne van der Sande**

**Pen Phalkun**





**Dr Ly Penh Sun**

Dr Ly Penh Sun has started his HIV career in 1996 as an officer working for the HIV Sentinel Surveillance Unit at the National Center for HIV and AIDS, Dermatology and STD (NCHADS) in Cambodia. After graduating with an MSc in Epidemiology from UP Manila in 1998, he was promoted to be the Chief of the Surveillance Unit at NCHADS. Since then he has been conducting HIV sentinel surveillance, behavioral surveillance, STD prevalence studies, and others. He has collaborated with other academic institutions such as UCSF and the University of New South Wales in preparing clinical trial (Tenofovir Study for HIV Pre Exposure Prophylaxis). He has also been involved in the policy, guideline development for HIV Continuum of Care since April 2003, when most of the patients had limited access to care and support. In 2004 he was promoted to be Deputy Director of NCHADS. As the assistant to the Director, he was in charge of all technical aspects including surveillance, research, developing national policy guideline for HIV prevention, care and treatment. In February 2015, he was promoted to be Director of NCHADS and he is now responsible for the implementation of his country's HIV-programme. They are working towards achieving UNAIDS targets of 90-90-90, and are strongly committed to testing and treatment coverage and improving retention.



**Prof Dr Erika Vlieghe**

Find Erika Vlieghe's bio on page 67



**Prof Dr Ir Por**

Dr Ir Por is an Associate Professor and Head of the Technical Bureau at the National Institute of Public Health (NIPH) in Cambodia. He is a medical doctor holding a Master's degree in Public Health from the Institute of Tropical Medicine in Antwerp, and a PhD from the Free University of Brussels, Belgium. He has worked for more than 20 years in various disease control and health system strengthening projects. Throughout his career, he has participated in many academic and research activities, nationally and internationally, and has published several articles, book chapters and working papers on health systems and health financing, in particular results-based financing, access to health care for the poor and vulnerable, water sanitation and hygiene, and reproductive, maternal, neonatal and child health. He has contributed to health policy development in Cambodia not only through his research findings but also his active participation in national technical working groups for strategy and policy development and programme evaluations. He is currently leading NIPH's Health Systems Research and Policy Support Unit to develop institutional capacity and mechanisms to improve health research governance and the utilisation of research findings for health policy in Cambodia.





## From research to effective policy and action to control and contain antibiotic resistance: What can we learn from Cambodia?

Antibiotic resistance is an increasing public health concern worldwide. Addressing such concern requires evidence-based effective and acceptable public health measures to control and contain it. These include strengthening of knowledge and evidence base through surveillance and research. The latter necessities not only research to generate policy relevant knowledge and evidence, but also effective mechanisms to translate research findings into policy and actions. However, Cambodia still lacks of policy relevant research and effective governance and co-ordination to ensure the alignment of research with national priorities and effective use of research findings for health policy and action. We examined a number of initiatives to improve this. The National Institute of Public Health in consultation with key stakeholders has initiated the development of a National Agenda for Health Systems Research and a coordination mechanism to bridge research-to-policy gap. The Agenda highlights key stakeholders, their respective roles, and national priorities for health systems research, including research on antimicrobial resistance, such as inappropriate use of antibiotic in agricultural sector, over the counter use of antibiotics and infection prevention and control in health care facilities. In addition, the multi-sectorial Technical Working Group on Antimicrobial Resistance also plays a crucial role in coordination of research in this area. Its recent country situation analysis identified priority areas for and gaps of research on antibiotic resistance and related challenges, and called for joint actions to address the challenges and bridge the research gaps. Further discussion with national and international key stakeholders on these initiatives will allow drawing lessons for further improvement and contribution to controlling and containing antibiotic resistance.



**Prof Dr Li Yang Hsu**

Dr Li Yang Hsu, MBBS (Singapore), MPH (Harvard), is an infectious diseases physician who has spent the past decade researching and treating patients with antibiotic-resistant bacterial and invasive fungal infections. He is currently Clinical Director of the National Centre for Infectious Diseases in Singapore and Head of the Infectious Diseases Programme at the Saw Swee Hock School of Public Health.

Dr Hsu has served in several Ministry of Health committees, in particular co-chairing the RIE2020 infectious diseases workgroup, promoting the causes of antimicrobial stewardship, better control of antimicrobial resistance (leading to the launch of Singapore's National Strategic Action Plan on Antimicrobial Resistance in November 2017), as well as tuberculosis. He continues to work with the MOH on a scheme part-time professional scheme. He has also served as a technical advisor on surveillance of antimicrobial resistance to the western pacific regional office of the World Health Organization.



## The State of Antimicrobial Resistance in Human Health

Antimicrobial resistance (AMR) is a major global public health threat. The rates of AMR are high in Asia - including Singapore - relative to many parts of the world, and the socioeconomic burden of AMR is likely to be highest in Asia in the long run. AMR is a One Health wicked problem, with different critical issues in different aspects of human society. This talk will discuss the state of AMR in human health, particularly in the region and Singapore, and the efforts being made to contain it. The focus will also be on antimicrobial stewardship and how it can possibly be implemented in lower-resource settings.



## Prof Dr Marianne van der Sande

Marianne van der Sande, MPH, MD, heads the Department of Public Health at the Institute of Tropical Medicine (ITM) in Antwerp since July 2017 as a Professor of Public Health Epidemiology. She is also connected to the Utrecht Institute for Global Health. Before joining ITM, for 10 years she was the State Epidemiologist of the Netherlands, heading the Centre of Epidemiology and Surveillance of Infectious Diseases at the Dutch National Institute for Public Health and the Environment (RIVM). During this period, she was a member of the scientific advisory committee of the European Centre of Disease Control, and co-director of the WHO-Collaborating Centre for AMR Surveillance and Epidemiology. Upon graduating, she has worked as tropical doctor with MSF-Holland in Darfur-Sudan and Soroti-Uganda, and with Memisa in Sichili-Zambia. Afterwards, she joined the MRC The Gambia, where she worked as a medical epidemiologist, first in the Non-Communicable Disease Programme, later in the Virology Programme. She has published over 200 peer-reviewed articles.

### Information for action

Reduced susceptibility towards antibiotics can have direct negative impact on health of patients as well as functioning of health services, but indirectly affects society as a whole, making this a complex, wicked problem to address. To preserve the beneficial contribution of antibiotics for human health and well-being, WHO has proposed an action plan with 5 pillars, including awareness, surveillance, appropriate antibiotic uses, infection control, and research. Each of these activities requires a comprehensive multi-sectorial effort to have sustainable impact. This needs to involve patients, health professionals, communities, policy makers and non-health professionals. Long term, systematic surveillance can provide a strong evidence-based foundation for targeted,

relevant, context-specific public health action. Modifiable drivers of the emergence, transmission and adverse outcomes related to reduced antibiotic susceptibility at different levels such as patients, health systems, and communities can be identified, but need to be understood in their context. Information to be analysed could include data (in humans and animals!) on microbial characteristics, diagnostics used, antibiotic prescriptions and use, indicators of quality of care, personal and environmental hygiene, utilisation of health services and diagnostics. However, design and interpretation of surveillance trends is not always straight forward. To avoid misinterpretation, insight is needed into the context from where the data emerge, which includes insight in perceptions and practices on hygiene, infections, antibiotics, health services. Also, insight into how, when and why certain information is, and is not, included in surveillance, can be crucial for proper interpretation and translation into action. The effect of interventions related to awareness, testing, treatment, infection control and communication interventions, may be reflected in surveillance trends, but also here one should be aware of possible misinterpretations and oversimplification. More in-depth assessment and rigorous evaluation might be needed to understand direct and indirect effects on patients, health services and communities, and to enable sustainability of beneficial interventions.



## Dr Pen Phalkun

Dr Pen Phalkun is a Cambodian physician, serving as the Director of Siem Reap Provincial Referral Hospital since 2006. He has previously served as Chief of Internal Medicine as well as Chief of Anesthesia and Surgical Intensive Care Unit of Siem Reap Provincial Referral Hospital. He has earned his degrees in medicine (1991), Anesthesiology, Reanimation and Medical Emergency (1999), and Hospital Management (2007) in Phnom Penh. Dr Phalkun recognises the importance of addressing antimicrobial resistance, and has been a strong advocate for implementation of antimicrobial stewardship activities at his hospital.



### Introduction of surgical prophylaxis guidelines in the Maternal Child Medical Center of Siem Reap Provincial Referral Hospital

Antimicrobial agents play a key role in preventing surgical site infections from surgical incisions. Antibiotics used for surgical prophylaxis ideally should exhibit a narrow spectrum of activity targeting likely pathogens to cause a surgical site infection, be administered within one hour prior to incision, and not be continued post-operatively unless specifically indicated. At Siem Reap Provincial Hospital, surgical prophylaxis guidelines indicating appropriate antibiotic selection for type of surgery have been developed and implemented by hospital management in collaboration with Diagnostic Microbiology Development Program (DMDP). The guidelines recommend for most surgical procedures the use of intravenous cefazolin, a first-generation cephalosporin included in Cambodia's Essential Medicines List that is the most widely studied antimicrobial agent with proven efficacy for antimicrobial prophylaxis. The surgical prophylaxis guidelines were initially implemented in the Maternal Child Medical Center ward in January, 2018. Monthly retrospective audits were conducted in January, February, and May 2018 assessing progress of implementation of surgical prophylaxis guidelines.

Across the three months, 225 patients had operations; 194 of patients should have received cefazolin, of which 179 (92%) did receive cefazolin. 177 (99%) of the patients received cefazolin within 1 hour prior to incision. Antimicrobial consumption monitoring was conducted comparing five months before (August – December 2017) and after (January – May 2018) guideline implementation. Total Defined Daily Doses per 1,000 patient bed days for total antibiotics decreased from 1093.4 to 532.1, a 51.3% decrease. For the same time periods, average length of stay decreased from 4.4 to 3.4 days. Surgical prophylaxis guidelines aim to minimize the risk of surgical site infections, but also have the potential to reduce inappropriate antibiotic use and reduce hospital length of stay. Improving antibiotic surgical prophylaxis and introducing the use of cefazolin has been an effective antimicrobial stewardship intervention and should be considered in other hospitals throughout Cambodia.

**Authors:** Narith S, Vanna M, Khim G, Hessel J, **Pen P**

# ORAL SESSIONS

## Session 7: From research to practice - one health & antibiotic resistance

Kristina Osbjer (chair)

Marianne van der Sande (chair)

Tum Sothyra

Juan Carrique-Mas

Stella Danek

Seng Sokerya

Joey Hernandez



**Dr Kristina Osbjer**

Dr Kristina Osbjer is the Team Leader of the Emergency Center for Transboundary Animal Disease (ECTAD) in Cambodia for the Food and Agriculture Organization (FAO) of the United Nations. Under her engagement with the FAO, she has expanded disease control efforts, supported the legislative framework for animal health and production, participated in building stronger collaborative networks between the government, academia and development partners, and in extending coordination on antimicrobial use and resistance.

As a graduate of the Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden, she earned her DVM and MSc degree in Veterinary Medicine in 2005. Upon completion, she began her career with the Swedish Board of Agriculture in large and small animal clinical practice. She joined FAO in 2007 as an Associate Professional Officer, working with the Avian Influenza Programme in Lao PDR, followed by a position at the ECTAD regional office in Nairobi, Kenya with coordination and technical inputs to disease outbreak management throughout Eastern Africa. In 2011, she returned to SLU from where she earned her PhD degree in Epidemiology and Veterinary Public Health in 2016 with the doctoral thesis "Zoonoses in Rural Cambodia - A One Health Perspective on Influenza and *Campylobacter*" before returning to FAO to head the FAO ECTAD program in Cambodia.



**Prof Dr Marianne van der Sande**

Find Marianne van der Sande's bio on page 112

He undertook a PhD programme from 2006 to 2009 at Murdoch University, Western Australia, on epidemiology and economic studies to support the establishment of a progressive zoning approach for the control of foot and mouth disease in the Mekong Basin.

He worked with the Food and Agriculture Organisation (FAO) of the United Nations as a regional epidemiology expert at the FAO Regional Office for Asia and the Pacific from March 2011 to September 2014.

From January to December 2016 he was appointed Director of National Veterinary Research Institute (NaVRI). Since December 2016, he is the Director of the National Animal Health and Production Research Institute (NAHPRI) and the General Directorate of Animal Health and Production (GDAHP), in Phnom Penh, Cambodia.



**Dr Tum Sothyra**

Dr Tum Sothyra graduated from the Royal University of Agriculture, Phnom Penh, Cambodia in 1989 with a Bachelor Degree in Veterinary Sciences and then worked for the Directorate of Animal Health and Production (DAHP). During this time he was involved in a *Fasciola gigantica* control programme in cattle and buffalo.

From 2001 to 2003 he undertook an MSc programme at James Cook University (JCU), Queensland, Australia on the application of geographic information systems (GIS) for the control of fasciolosis in Cambodia. After graduation, he was promoted to be the Chief of the Veterinary Public Health Office and was responsible for slaughterhouse management and meat quality issues. He also participated in a number of national animal disease control programs including foot and mouth disease (FMD) and highly pathogenic avian influenza (HPAI).



## Antimicrobial Resistance Surveillance in Animal Health Sector in Cambodia

The impact of antimicrobial resistance (AMR) has been concerning by the Royal Government of Cambodia (ROC), and the General Directorate of Animal Health and Production (GDAHP) has been designated for monitoring and control AMR. In GDAHP, the National of Animal Health and Production Research Institute (NAHPRI) plays vital role in conducting AMR surveillance for public good.

The harmonised antimicrobial susceptibility testing (AST) protocol for animal health sector in ASEAN has been initiated and used in 2016. At the same time, human capacity and laboratory facilities has been developed. The National AMR surveillance began in early of 2018 by NAHPRI (GDAHP) with three on-going projects.

The preliminary result showed that multidrug resistance was observed in *E.coli* and *Salmonella* spp isolated. The AMR profile of *E. coli* was 94.4% Sulfamethoxazole (100µg); 90.7% Ampicillin (10µg); 89.4% Kanamycin (5µg); 87.6% Streptomycin (10µg); 62.1% Chloramphenicol (30µg); 47.2% Nalidixic acid (30µg); 34.8% Gentamycin (10µg); 22.4% Ciprofloxacin (5µg); 19.3% Florenicol (30µg); 5.1% Tetracycline (10µg) and 3.7% Ceftazidime (30µg), while AMR profiles for *Salmonella* spp. was 90.5% Tetracycline (10µg); 90.5% Streptomycin (10µg); 85.7% Chloramphenicol (30µg); 85.7% Sulfamethoxazole (100µg); 69.0% Nalidixic acid (30 µg); 66.7% Kanamycin (K) (5µg); 59.5% Ampicillin (10µg); 52.4% Florenicol (30µg); 28.6% Ciprofloxacin (5µg); 26.2% Gentamycin (10 µg) and 2.4% Ceftazidime (30µg).

The result from these surveillance programs will be useful for formulating the AMR national policies for animal health sector in Cambodia.

**Authors:** Tum Sothyra, Sovann Sen, Chetra Sar, Sok Koam, Rortana Chea, Hout Sotheany, So Pheany, Theng Heng, Tep Bengthay, Tan Phanara



Dr Juan Carrique-Mas

Juan's training background includes a degree in Veterinary Medicine (University of Cordoba, Spain), an MSc in Tropical Veterinary Medicine (Edinburgh University, UK), and a PhD in veterinary epidemiology (Warwick University, UK). Juan also completed a fellowship of the European Programme for Intervention Epidemiology Training (EPIET) at the Swedish Institute for Infectious Disease Control. He has been involved in numerous multi-disciplinary research projects on livestock in the UK, Bolivia, Sweden and Vietnam. In February 2010, Juan joined the Food and Agriculture Organization of the United Nations (FAO) as technical advisor on the Vietnam programme to control highly pathogenic avian influenza (HPAI) H5N1. Since September 2011, Juan has been working for the Wellcome Trust Major Overseas Programme at Oxford University Clinical Research Unit (OUCRU) in Vietnam, where he has been conducting research on topics such as avian influenza, non-typhoidal *Salmonella*, *Campylobacter*, *Bartonella*, leptospirosis and antimicrobial resistance (AMR). In March 2016 he was awarded an Intermediate Clinical Fellowship by the Wellcome Trust. He is currently the PI of the ViParc Project, a randomised field trial to help chicken farmers of the Mekong Delta (Vietnam) reduce antimicrobial use. Juan has been active in several international and regional initiatives to reduce antimicrobial usage and AMR in animal production systems.





### **High resolution data to quantify antimicrobial use in Vietnamese chicken farms: results from the baseline phase of the ViParc intervention trial**

Small-scale farming is widely practiced in much of southeast Asia. ViParc ([www.viparc.org](http://www.viparc.org)) is a randomized, controlled before-and-after trial being conducted in the Mekong Delta province of Dong Thap (Vietnam) aimed at helping farmers raise chickens using lesser amounts of antimicrobials. A total of 112 randomly selected farms are being investigated over a baseline period, followed by intervention phase (18 months each). The intervention consists of the provision of a locally-adapted veterinary support system free of charge to 91 farms, whilst 21 farms serve as control (i.e. no veterinary support). Data from the baseline study was analysed in order to: (1) identify all commercial feeds and health-supporting products, highlighting those that contained antimicrobials, quantifying the active principle using a range of internationally used metrics; (2) describe the critical time points for antimicrobial use (AMU) during the production cycle, including seasonality and the potential association with disease status; and (3) investigate the propensity of farmers for repeated behaviour over subsequent cycles. Farmers were provided with a diary book and trained on data collection. A dedicated box was provided in each farm to keep packages of all commercial feeds and health-supporting products used. AMU was calculated using a range of metrics: (1) weight of antimicrobial related to: (i) weight of birds sold; (ii) all bird live-weight output (i.e. including weight of dead birds); (iii) weight of bird at treatment time; (2) number of Animal Daily Doses (ADD) based on the gross amounts of antimicrobial active principle, and the age/weight of chickens at the time of administration. A total of 185 flock cycles were investigated (median duration 18 weeks [IQR 16-20]). A total of 264 products (39%) contained antimicrobial agents. A median of 5 antimicrobial active ingredients were used in each flock cycle [IQR 2-8]. Full results will be presented in the Colloquium.



**Ms Stella Danek**

Stella Danek is an associate at McKinsey's Berlin Office where her work focuses on consulting public sector and pharmaceutical industry clients on strategic and organisational topics. Prior to joining McKinsey, Stella worked as an external consultant for the Health Division of the Organization for Economic Cooperation and Development (OECD). As part of Michele Cecchini's and Franco Sassi's team, she researched the economics of public health policies in the area of nutrition and obesity as well as antimicrobial resistance. During this engagement, she supported the OECD's forthcoming publication on AMR policies and reviewed the cost-effectiveness of several prevention strategies. Stella previously completed a postgraduate degree in Health Policy and Health Economics at the London School of Hygiene and Tropical Medicine (LSHTM) and the London School of Economics and Political Science (LSE), and an undergraduate degree in European History, Economics and Politics at Sciences Po Paris.



### **The effectiveness of enhanced environmental hygiene interventions in preventing the transmission of antimicrobial resistance to humans: a systematic review**

Environmental surfaces are a key vector for AMR transmission. Enhanced environmental hygiene (EHH), including no-touch cleaning, disinfectant substitution and improved techniques, has therefore been considered as measure for curbing the spread of AMR. Its effectiveness however has not yet been adequately evaluated.

To systematically assess the available evidence on the effectiveness of EHH in curbing human acquisition of AMR and identify the most successful intervention types.

MEDLINE, EMBASE and Web of Science from 01/2001 to 08/2017, grey literature from OECD and WHO and reference lists of eligible articles were searched. Randomized and non-randomized trials, controlled before-after, interrupted time series and cohort studies evaluating the effect of EHH on human acquisition of the eight most prevalent drug-resistant pathogens in high- and upper-middle-income countries and containing any comparative assessment were included. A qualitative synthesis of outcomes based on GRADE methodology presented.

The analysis of 2 randomized trials and 9 quasi-experimental studies evaluating 15 interventions revealed that EHH may reduce AMR transmission. Although several significant and strong effects on AMR acquisition were reported, the certainty of this evidence remains low due to imprecision, unclear risk of bias across studies and most evidence stemming from non-randomized study designs. No-touch and disinfectant substitution interventions appear more beneficial than improved cleaning technique in reducing AMR acquisition.

Heterogeneity of quality and data provided did not allow a definite or quantitative conclusion regarding the role of EHH or specific intervention types. The results are nonetheless promising and show that further research with improved study designs and diligent reporting is urgently needed.

**Authors:** Danek, S. Cecchini, M. Pierzchalski, S.



**Dr Seng Sokerya**

Emergency Center for Transboundary Animal Diseases (ECTAD), Food and Agriculture Organization of the United Nations (FAO), Phnom Penh, Cambodia.

Dr Seng Sokerya is the National Coordinator on Antimicrobial Resistance (AMR) in Cambodia and has joined the ECTAD, FAO in Cambodia in September 2017. She is currently engaged in a tripartite project for Cambodia under “Supporting countries in South and South-East Asia and sub-Saharan Africa to develop and implement national action plans to combat antimicrobial resistance using a One Health approach”. This project, funded by the Fleming Fund of the United Kingdom (UK) Department of Health, aims to minimise the bilateral human-animal transmission of antimicrobial resistant microorganisms and/or determinants via the food chain and environment.

Under this project Dr Seng Sokerya has coordinated the implementation in Cambodia, including the liaison and close working arrangements with the relevant government institution of Cambodia, the international donor community and multilateral agencies, in particular WHO and OIE. Additionally, she has facilitated the support on One Health capacity and platforms through enhancing collaboration and coordination with the public health, wildlife, environment, education, and other relevant sectors with respect to AMR and antimicrobial use (AMU) using existing and new tools and guidelines.



#### **Case Study on One Health Approach in Addressing Antimicrobial Resistance in Cambodia**

Witnessing a growing threat of antimicrobial Resistance (AMR), Cambodia requires a One Health (OH) approach at national level. A Multi-Sectoral Action Plan (MSAP) was recently developed to guide Cambodia's



continuing work on AMR by engaging the Ministry of Health (MOH), Ministry of Agriculture Forestry and Fisheries (MAFF) and Ministry of Environment (MOE).

Along the MSAP development process, a case study was conducted to describe challenges, successes and lessons learned and to illustrate the efforts of the national stakeholders towards the development of a One Health mechanism. Government institutions and partners of the most relevant sectors (health and agriculture) were targeted to respond to a written questionnaire followed by a face-to-face meeting.

A majority of the respondents perceived that the country is applying a multi-sectoral One Health approach to define the MSAP. A contributing factor was the establishment of the joint technical working group (TWG) on AMR that includes technical staff from the key Ministries and development partners. Major challenges encountered were: multi-sectoral coordination and data sharing, limited resources (financial and human), absence of regulation and law enforcement, and limited awareness and evidence-based knowledge on AMR leading to lack of commitment. To improve the multi-sectoral collaboration, identification of a key leading agency and coordination support from external partners, were listed as key. Furthermore, it was suggested to raise up the issue of resources (financial and human) to the policy level, to develop capacity with technical departments and the academia and increase community awareness by providing alternative solutions.

Cambodia is undergoing an effort towards achieving a long term and sustainable action to address AMR in line with the Global Action Plan on AMR and with a full One Health perspective. The MSAP is a fundamental step, allowing the definition of roles and responsibilities of key national stakeholders and effective implementation.

**Authors:** Seng Sokerya, Osbjør Kristina and Patriarchi Alessandro



**Dr Joey Hernandez**

Dr Joey Hernandez is a public health physician and an independent consultant for the Alliance for Improving Health Outcomes and Physicians for Peace, Philippines; two public health consulting firms in the Philippines. His current engagements are with World Health Organization Philippines, United Nations Children's Fund and Philippine Health Insurance Corporation with focus areas on antimicrobial resistance, child injury prevention and benefit package development. He formerly served in remote communities under Doctors to the Barrio Programme of the Philippine Department of Health, with priority initiatives on maternal and reproductive health. His expertise is in the fields of local health systems development, health policy, research and project management. He is also currently involved with the Philippine Society of Public Health Physicians as its Secretary-General.



#### **Implementation Review of the Philippine Action Plan to Combat Antimicrobial Resistance 2015-2017**

The development of the Philippine Action Plan to Combat AMR 2015-2017 aimed to address increasing concerns about improper use of antimicrobials and the resulting drug resistance in human and animal health. The Plan harmonized pre-existing efforts in hospitals and laboratories to monitor hospital-acquired infections and antibiotic resistance.

The Inter-Agency Committee on Antimicrobial Resistance (ICAMR) led a review of the implementation of the plan. In close coordination with ICAMR and WHO, the researchers conducted desk review of documents (national issuances, minutes of meetings, annual general appropriations act and local researches related to AMR), interview with key government officials and stakeholders, and thorough online search.

Analysis was done using a four-color traffic light system indicating the completion levels of objectives and activities. Outputs, recommendations and identified priorities from the review shall guide the development of a National Multisectoral Action Plan 2019-2022, consistent with political and government agency timelines.

Most planned activities were completed or ongoing as part of routine government functions of the Health and Agriculture departments. Activities in human health were clearly more developed than animal health. Significant achievements include prescription requirements prior to dispensing of antibiotics in humans strengthened by the development of national antibiotic guidelines, and financing mechanisms ensuring free antibiotics for the poor. In addition, Antimicrobial Stewardship program was started in many hospitals. Furthermore, the animal health sector developed policies including listing of banned antibiotics in animal feeds. Clearly, the lack of international guidelines, e.g. integrated AMR surveillance, in humans and animals limits country-level efforts.

The next challenge revolves around the Philippines moving forward maximizing local and international expertise and experience. Analyzing policy-regulatory frameworks to guide policy development is crucial along with enforcement. Mechanisms for maximizing efforts and for innovation in AMR work are promising, especially for a middle-income country like the Philippines.

**Authors:** Barcelona, Carmela; Guerrero, Melissa; Castro, Samuel Joseph; Geroy, Lester S A; **Hernandez, Joey Francis**; Langit, Maria Christina; Ungson, Jose Paolo; Reyes, Ma Sophia Graciela; Ong, Alberto M Jr.

# ORAL SESSIONS

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## Session 8: Take-home messages

**Moderator:** Wim Van Damme



## Prof Dr Wim Van Damme

Wim Van Damme, MD, MPH, PhD, is a Professor in Public Health & Health Policy at the Institute of Tropical Medicine, Antwerp. He has worked in many countries, such as South Africa, Guinea, Ethiopia, Peru, Sudan, and Guinea, including four years in Cambodia (1999-2002). In each of these countries he worked in primary health care development and health systems strengthening. He made a PhD on refugee health in Guinea. Currently he leads ITM's institutional collaborations in Guinea, and with the National Institute of Public Health in Phnom Penh.

His main research interests are related to health policy and health systems strengthening in fast changing societies:

- Pro-poor health financing and health policy in South-East Asia, with a special focus on Health Equity Funds in Cambodia.
- International health policies, mainly new funding mechanisms, such as the Global Fund to Fight AIDS, TB and malaria, and their impact on national health systems in donor-dependent countries, such as Ethiopia, Mozambique and Malawi.
- Delivery models for AIDS and diabetes care in countries with high prevalence.

He is co-author of over 100 scientific articles; H-index = 45 (Google Scholar).

He teaches health policy in ITM's MPH programme and is the supervisor of several PhD students and PhD holders, including Cambodians.

## POSTER SESSIONS

## Day 2 (06/12) - Posters of pitch presentations

Presenter	Title
Chamroeun B.	Microbiology Surveillance of Blood Culture Pathogen in Siem Reap Provincial Referral Hospital
Chhorvoin O.	Practices of antibiotics in human and commercial food animals in Cambodia
De Los Reyes M.	Antibiotic prescribing among adult patients with pneumonia in the Philippines: Results of the 2017 pilot Global PPS in 16 hospitals
Gay N.	One Health approach of Extended Spectrum Beta-lactamase producing Enterobacteriaceae in human, animal and drinking water in small breeder households, Madagascar 2018
Hernandez J.	Implementation Review of the Philippine Action Plan to Combat Antimicrobial Resistance 2015-2017
Miliya T.	The global point prevalence survey of antimicrobial consumption and resistance (Global-PPS): 2017 results of antimicrobial prescribing at Angkor Hospital for Children
Phalkun p.	Introduction of surgical prophylaxis guidelines in the Maternal Child Medical Center of Siem Reap Provincial Referral Hospital
Singh S.	The Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (Global-PPS): Results of antimicrobial prescribing in India

Presenter	Title
Sivhour C.	Bloodstream infections detected from patients admitted to Battambang provincial referral hospital between 2014 and 2017
Sokerya S.	Case Study on One Health Approach in Addressing Antimicrobial Resistance in Cambodia
Stella D.	The effectiveness of enhanced environmental hygiene interventions in preventing the transmission of antimicrobial resistance to humans: a systematic review
Thi Quy Duong T.	Characterization of Salmonella isolated from pig slaughterhouses to retail markets in Ha Noi, Vietnam
Thong P.	Results of a 10-year surveillance of pathogens and their antibiotic resistance in bloodstream infections among Cambodian adults
Turner P.	Antimicrobial resistance in Streptococcus pneumoniae before and after the introduction of PCV-13 in Cambodia

## Day 2 (06/12) - Poster presentations

Presenter	Title
Baiye W.	Bloodstream bacterial pathogens and their antibiotic resistance patterns in hospitalised patients in the University Teaching Hospital Yaounde
Bhattarai N.	Comparative evaluation of conventional method versus Polymerase Chain reaction for detection of Methicillin Resistant Staphylococcus aureus isolated from bloodstream infections
Chanyasith R.	Monitoring and Improvement of Antibiotic Susceptibility Testing Errors on Worksheets and Cambodia Laboratory Information System (CAMLIS) at Cambodian Government Microbiology Laboratories Supported By Diagnostic Microbiology Development Program (DMDP)
Chrea M.	Development of a Centralized Media Making Laboratory in Cambodia
Derbie A.	Bacterial isolates and their current drug susceptibility profile from urine among asymptomatic pregnant women attending at the Felege Hiwot Referral Hospital antenatal clinic, Northwest Ethiopia
Djebara S.	Microbiological and Demographic Characteristics of Patients Seeking Phage Therapy at the Queen Astrid Military Hospital (QAMH), Brussels: A Retrospective Analysis of 260 Patients
Herbas E.	Phage therapy in the Queen Astrid Military Hospital, Brussels: science fiction or reality?
Hessell J.	Successes and Challenges of Cumulative Antibigram Development in Cambodian Provincial Hospitals

Presenter	Title
Hu J.	Risk factors and outcomes of Extended-spectrum $\beta$ -lactamase-producing (ESBL) Enterobacteriaceae among paediatric patients in Asia-Pacific Region: A systematic review and meta-analysis
Khanal B.	Bloodstream infections and antimicrobial susceptibility patterns in a tertiary care hospital of eastern Nepal.
Manzi O.	High Prevalence of Antimicrobial Resistance Among Common Bacterial Isolates in a Tertiary Healthcare Facility in Rwanda
Montalban E.	Emergence of Salmonella enterica serovar Infantis infection in humans, Peru
Nhem S.	Key Blood Pathogens and Resistance Patients in Kampong Cham Provincial Hospital
Oeng S.	Implementation of resistance tracking using Clinical and Laboratory Standards Institute Antibiotic Susceptibility Testing standards M100 and M02 in government laboratories in Cambodia
Ombelet S.	Change in laboratory procedures improved time-to-detection of Burkholderia pseudomallei in blood cultures, Phnom Penh, Cambodia
Peeters M.	Performance characteristics and quality indicators of an adapted blood culture system in Phnom Penh, Cambodia.
Raj Mishra D.	Study of Microbiological and Antibiotic Sensitivity Pattern of Ventilator Associated Pneumonia (VAP) in ICU of a Tertiary Care Hospital in Nepal

Presenter	Title
Rathanin S.	Molecular Epidemiology of Methicillin Resistant Staphylococci Isolates in Northern Thailand
Soentjens P.	change in laboratory procedures improved time-to-detection of Burkholderia pseudomallei in blood cultures, Phnom Penh, Cambodia
Soentjens P.	Bacteriophage Therapy for Chronic Osteomyelitis: A Case Report
Sosorphea S.	Methicillin Resistance Staphylococcus Aureus in Takeo Provincial Hospital, Cambodia, 2015-2017
Tadesse M.	Xpert MTB/RIF assay for detection of rifampicin-resistant M. tuberculosis from presumptive drug resistance tuberculosis patients in Ethiopia
Tchuinte P.	Phenotypic and molecular characterization of clinical carbapenem-resistant Acinetobacter baumannii strains isolated in Madagascar.
Turner P.	Genomic Analysis of Structure, Diversity of Klebsiella Pneumoniae Population and Dominant Prevalence of Klebsiella Quarsipneumoniae Multidrug Resistant In Cambodia
Viso S.	Surveillance Blood Culture Report at the National Pediatric Hospital from 2013-2017

## Day 3 (07/12) - Posters of pitch presentations

Presenter	Title
Chamroeun B.	Microbiology Surveillance of Blood Culture Pathogen in Siem Reap Provincial Referral Hospital
Chhorvoin O.	Practices of antibiotics in human and commercial food animals in Cambodia
De Los Reyes M.	Antibiotic prescribing among adult patients with pneumonia in the Philippines: Results of the 2017 pilot Global PPS in 16 hospitals
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Turner P.	Antimicrobial resistance in Streptococcus pneumoniae before and after the introduction of PCV-13 in Cambodia

## Day 3 (07/12) - Poster presentations

Presenter	Title
Chaibva B.	Coordinated efforts towards management of typhoid fever in gweru, zimbabwe: what hospital antimicrobial stewardships should learn from
Chandrashekhara S.	Use of antibiotics for childhood diarrhea in low- and middle-income countries: analyses of survey data and a systematic review of literature
Deroxas J.	Point Prevalence Surveillance (PPS): Antimicrobial Stewardship (AMS) In A Private, Tertiary Hospital In The Philippines
Khim G.	AMS Program in Siem Reap Referral Hospital: Experience from the Emergency Department
Matin A.	What influences antibiotics sales in rural Bangladesh? A supplier's perspective
Nair M.	"Without antibiotics, I cannot treat" – a mixed-methods study of knowledge, attitudes, and practices related to antibiotic use in Paschim Bardhaman District, West Bengal
Parthesarathy R.	One tablet for each symptom" - profit overtakes rational drug use in private pharmacies: Qualitative Study
Puangserree J.	Correlation and cross resistance between antibiotic and biocide resistance in Escherichia coli isolated from pig and pig products in Thailand.
Sharma S.	Antibiotic Procurement Analysis for a Comprehensive Primary Health Care Clinic in Grahamstown, South Africa
Thong P.	Case series of melioidosis in Sihanouk Hospital Center of HOPE, Phnom Penh, Cambodia

Presenter	Title
Michel J.	Antibiotic stewardship in an MSF trauma hospital, Aden, Yemen
By Y.	Serotype distribution and antiobiotic susceptibility profile of clinical Streptococcus pneumoniae isolates before the introduction of the 13-valent pneumococcal conjugate vaccine in Cambodia
De Vos D.	Bacteriophages (phages) as potential anti-bacterial agents for controlling and treating gastrointestinal infections: our experience.
Derbie A.	Surfaces and air bacteriology of selected wards at a referral hospital, Northwest Ethiopia: a cross-sectional study
Garcia C.	Prevalence of Hospital-acquired Infections in a Secondary Health Care Centre in Lima, Peru
Msami K.	Considerations in in setting up and improving hand hygiene by use of system approach of the WHO multimodal hand hygiene improvement strategy: an example from a cancer center in Tanzania.
Saria V.	Knowledge, Attitude and Practice of Hand Hygiene using Alcohol Based Hand Rub among Residents at Kilimanjaro Christian Medical Center (KCMC), Tanzania
Asaduzzaman M.	Intestinal colonization of antibiotic resistant bacteria in humans with chronic exposure to arsenic-Linkage of AMR with Climate Change
Kuldee M.	Antimicrobial resistance and ESBL characterization in E. coli and Salmonella isolated from cultivated oysters and estuarine waters

Presenter	Title
Mashe T.	Investigation of foodborne pathogens and their antimicrobial resistance using One Health Approach in Zimbabwe– preliminary results of the pilot project
Nadimpalli M.	Evidence for meat and fish as sources of community exposure to ESBL-producing Escherichia coli in Cambodia
Prasad B.	E.Coli Contamination and Antibiotic Resistance in Flourishing Fish Meat Market of Chitwan, Nepal
Prathan R.	Prevalence, antimicrobial susceptibility and virulence factors of Streptococcus suis in clinically healthy pigs and pork in Northern Thailand
Quynh G.	Stop prescribing antibiotics for disease prevention': Planned actions to forge attitude change among Vietnamese veterinary pharmacists
Nguyen T.	Saturated medicine' – Consequences of perceived treatment failure and suboptimal use of antibiotics in a malaria endemic area in South-central Vietnam: preliminary findings from a qualitative study
Nguyen Y.	Prevalence of antimicrobial residues, non-typhoidal Salmonella, Vibrio spp. and their associated antimicrobial resistance profile in retail shrimps from Ho Chi Minh City (Vietnam)



