



ONE HEALTH REPORT TIMOR-LESTE, DECEMBER 2021

Environment, zoonoses and antimicrobial resistance.



A joint publication of the Ministry of Health, the Ministry of Agriculture and Fisheries, Bee Timor-Leste, EP and the Menzies School of Health Research.

This report summarises the presentations of the One Health Symposium held at the Hotel Timor, Dili, Timor-Leste on 14th December 2021.

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Australian Government

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1. FOREWORD

Human health depends on the health of the planet. The concept of One Health shows we understand that the environment, agriculture, animal husbandry, engineering, public health and clinical medicine all have a role.

We know that unless we all work together, putting aside professional boundaries, we cannot have healthy people.

This report showcases how the veterinarians, doctors, scientists, environmental health workers and epidemiologists of Timor-Leste, working in their separate fields, are united in their efforts to promote health.

Animal diseases can cause sickness in people and human infections can spread to animals. We must work together to prevent antimicrobial resistance in animal bacteria that can spread to people. At the same time, we strive in human medicine to prevent antimicrobial resistance increasing in people. We must maintain and share infrastructure to achieve all this.

Finally, science must translate into action through policy to achieve health for all in Timor-Leste.

1.1 A message Dr Alipio Gusmão Lopes, National Director of Pharmacy and Medicines of the Ministry of Health

This One Health Report is an important opportunity to share information on the unexpected consequences of the connections between human, animal, and environmental health, while exploring the impact of emerging diseases on communities and individuals.

If we address the health issues in Timor-Leste through a One Health approach it will, of course, support Timor-Leste's public health. Therefore, this One Health Approach is crucial for us to address shared health threats such as zoonotic diseases, antimicrobial resistance, food safety, and others. So, it is good for our human health, animals, and the environment.

The National Directorate of Pharmacy and Medicines (DNFM) has already prepared its National Action Plan on Antimicrobial Resistance (AMR) and submitted it to Minister of Health's office for approval.

The Ministry of Health is committed to working with other development partners, international agencies, and relevant ministries to address health threats and reduce antimicrobial resistance in humans and animals in Timor-Leste.

1.2 A message from Dra Joanita Bendita da Costa Jong, National Director of Veterinary Directorate, Ministry of Agriculture and Fisheries

This One Health Report discusses the interlocking issues of human, animal and environmental health in order to raise public awareness about antimicrobial resistance in people, animals and the environment in Timor-Leste.

The report shares the research conducted by the government's animal health team, together with the Menzies School of Health Research, on antimicrobial use and resistance in Timor-Leste, particularly antimicrobial use in animals.

In a developing country, we must pay close attention to the livestock sector's use of antimicrobials, especially in meat production. In Timor-Leste, at present, it is uncommon to use antibiotics in animals.

Accordingly, the Ministry of Agriculture and Fisheries could not undertake this research alone but co-operates with the Ministries Health, Environment and others, and with non-government partners, to find the best ways to solve the problem of antimicrobial resistance in Timor-Leste and to implement action plans.

The Ministry of Agriculture and Fisheries is strongly committed, along with the other relevant Ministries, to fight against the global threats encountered by this country, especially zoonoses and antimicrobial resistance.

1.3 A message from A/Prof. Joshua Francis and Dr Jennifer Yan, Project Leads, Menzies School of Health Research

When we work together in partnership, with collaboration between institutions and across sectors, we are able to achieve much more. There is a very good opportunity in Timor-Leste, for a truly One Health approach to addressing major health challenges, including the problem of antimicrobial resistance. It is a privilege for Menzies to be able to work alongside the Ministry of Health and the Ministry of Agriculture and Fisheries, with the support of the UK Government through the Fleming Fund and the Australian Government, to strengthen capacity within the health system to respond to infectious diseases including antimicrobial resistance, and to use antimicrobials effectively and appropriately.

Over the past three years, the Ministry of Health and Ministry of Agriculture and Fisheries have demonstrated excellent leadership and collaboration, and the impact of this can be seen in some of the brief updates contained in this report. There is more work to do, but there is so much that can be achieved when we work together.



2. ENVIRONMENTAL HEALTH

2.1 Bee Timor-Leste, Empresa Pública (BTL, EP)

Sr Carlos Peloi dos Reis, President BTL, EP

Bee Timor-Leste EP (BTL, EP) is an autonomous corporation established in September 2020 under the superintendence of the Ministry of Public Works. BTL, EP has the responsibility for securing the supply of drinking water, sanitation and drainage for the citizens of Timor-Leste. BTL, EP's functions are to promote new infrastructure, operate and maintain existing infrastructure, bring clean water, sanitation and sewerage to more of the population and to recoup the costs for these services.

Since its establishment BTL, EP while operating and maintaining most existing water systems, has maintained 6 superficial and 26 bore water supplies in Dili, repaired the freshwater systems in the municipalities of Ermera, Aileu, Manatuto and Maliana, contributed to the COVID response, supplied tank water in the centre of Dili, combated illegal connections, installed new connections and cleaned the drains and gutters of central Dili.

In 2021, BTL implemented and managed around 180 projects, including Master Plan Projects for the capitals of six municipalities (Aileu, Ainaro, Maliana, Suai, Gleno and Liquica) inherited from the General Directorate of Water and Sanitation (DGAS), and promoted around 35 new projects. These new projects included two Community Sewerage Treatment Systems, 5 new drainage systems in Dili and 8 basic sanitation systems in the municipalities, 17 fresh water projects at chief Postos including Lour, Alas, Metinaro, Laga, Quelicai, Vemasse, Sc. Mehara, Soibada, Baguia and Remexio.

Emergencies responded to in 2021 led to the redesign and implementation of the freshwater system in Tohumeta and Lakoto Mutudare (with the assistance of DFAT).

Plans for 2022 include continuing 17 projects to improve water supply and promote 31 freshwater projects in urban and 20 in rural areas.

From 2022-8, a \$US47million loan from the Asia Development Bank, co-financed by the Global Environment Facility and the Government of Timor-Leste will enhance the water and sanitation systems in the Municipalities of Viqueque, Manufahi and Lautem, benefiting 62000 people.

2.2 First Microbiological Diagnosis of *Salmonella* Typhi in Timor-Leste

Dra Elfiana Amaral, Hospital Nacional Guido Valadares (HNGV) and Menzies School of Health Research for HNGV and the National Health Laboratory

Contaminated water, poor sanitation, limited access to toilets, and poor health literacy make it likely that Enteric Fever, caused by *Salmonella* Typhi, is endemic in Timor-Leste. The isolation of *Salmonella* Typhi from a 23-year-old municipal healthcare worker with no travel history is consistent with this expectation. Culturing the bacteria from sterile body fluids is the definitive test for the diagnosis of typhoid fever. However, the facilities for doing this in Timor-Leste are limited at present to a recently established blood culture service at the HNGV and the adjacent National Laboratory of Health, both in Dili. The expansion of this diagnostic capacity through training of staff in the municipalities, the installation of blood culture incubators in referral hospitals and the establishment of regular specimen transport across Timor-Leste will improve surveillance and lead to better care for individual patients.

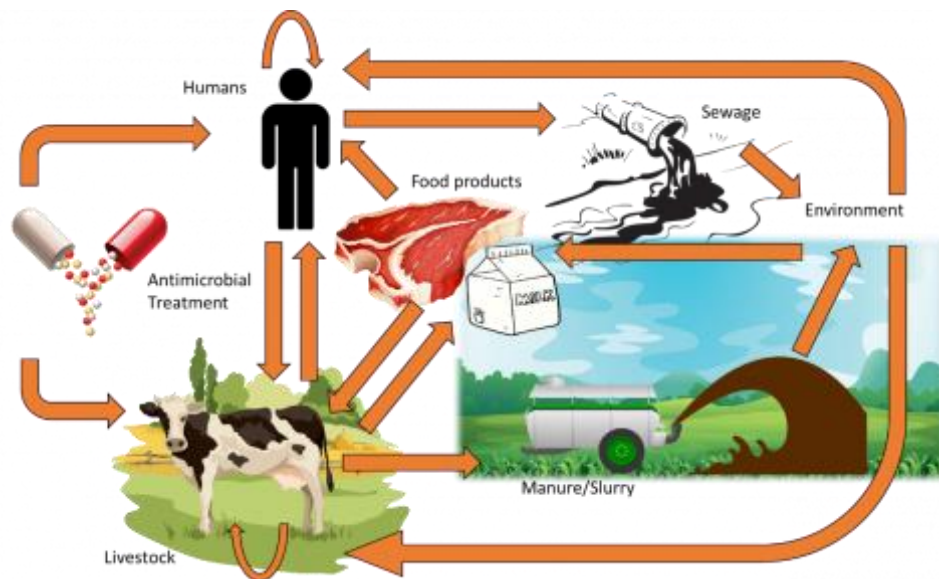
3. VETERINARY HEALTH

3.1 Surveillance of Animal Health, focussing on antimicrobial usage and resistance.

Dr Abrao Pereira and Dr Shawn Ting, Menzies School of Health Research, for the Ministry of Agriculture and Fisheries, Berrimah Veterinary Laboratory, University of Sydney and the Menzies School of Health Research.

Antimicrobial resistance is transmitted between humans, animals and the environment through multiple pathways (Figure 1).

Figure 1. The dissemination of antimicrobial resistant bacteria.



Traditionally animal health surveillance consisted of rapidly identifying new diseases, monitoring disease trends and informing interventions to reduce animal disease.

Surveillance should now also detect new types of antimicrobial resistance promptly, monitor trends both in resistance and antimicrobial usage and inform interventions to reduce antimicrobial resistance.

The data collected in surveillance of usage includes both the amounts and types of antimicrobials. These data are provided annually to the OIE, the World Organisation for Animal Health.

To improve antimicrobial usage, we need to know why and how antimicrobials are used. Our team has completed studies on the antimicrobial use practices of small-scale pig farmers. We have started interviews of government employed technicians. We plan similar studies for the broiler and layer industries.

Surveillance for resistance in chickens in markets is underway. In the future, Ministry of Agriculture and Fisheries and the Menzies School of Health Research plan to expand surveillance for resistance to broiler and layer farms to determine if antimicrobial resistance is higher in birds in those industries than in small-scale producers. Surveillance could also expand to day-old chicks, to determine the baseline level of resistance in imported chickens.

The National Health Laboratory for human health and the Veterinary Diagnostic Laboratory now share resources to better identify potential zoonotic pathogens and to characterise antimicrobial resistance more accurately in animal pathogens.

4. ANTIMICROBIAL USAGE, HUMAN AND VETERINARY

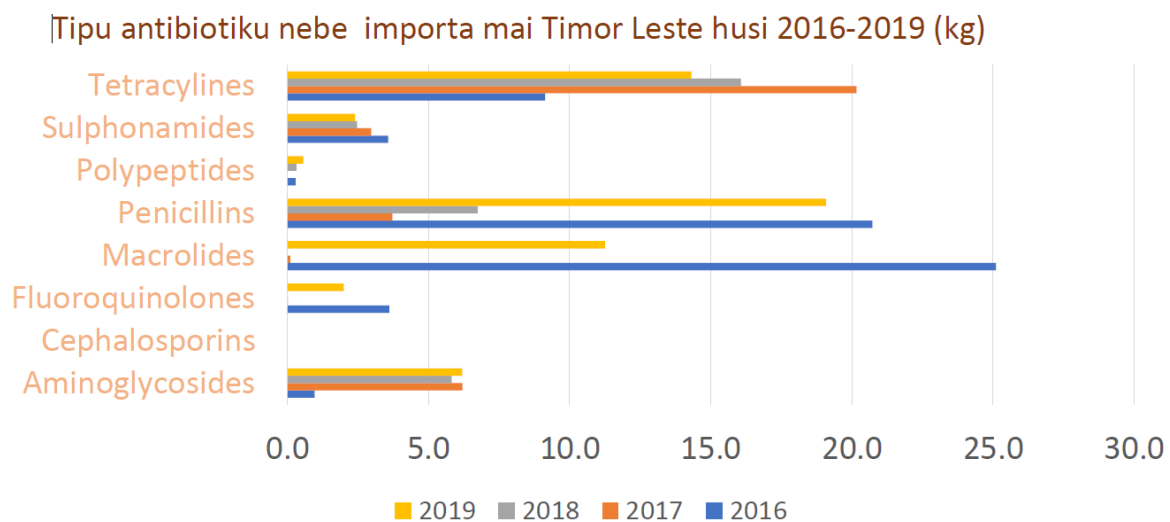
4.1 Antimicrobials imported into Timor-Leste for veterinary use (2016-2019)

Dra Joanita Bendita da Costa Jong, National Veterinary Directorate, Ministry of Agriculture and Fisheries.

Timor-Leste has no indigenous manufacturers of antimicrobials. The government imports them for distribution through veterinary technicians and livestock technicians at the municipal level for use on farms. Private individuals and companies import them for immediate use on farms and, in veterinary clinics and agricultural shops for pets and farms, either directly or through private animal health practitioners.

From 2016 to 2019 almost 184kg of were imported. Annual importation varied from a low of 31.4kg in 2018 to a maximum of 63.4kg in 2016. Over the whole time, tetracyclines and penicillins were the largest importations, but in 2016 more macrolide was imported than any other drug class, for use specifically as an oral medication in the layer-hen industry (Figure 2).

Figure 2. Importation of antibiotics into Timor-Leste 2016-2019



Importation of the WHO determined critically important antimicrobials for human medicine was negligible: less than 5kg of fluoroquinolones were imported in 2016 and 2019, and none in 2017 and 2018.

4.2 Knowledge, attitudes and practice of veterinary technicians in Timor-Leste toward antibiotics and antibiotic resistance

Dr Abrao Pereira and Sra Amalia de Jesus Alves, Menzies School of Health Research

Antibiotics may act as growth promotants in livestock, but their misuse and overuse leads to antimicrobial resistance. Most veterinary antibiotics in Timor-Leste are imported by the government. Government employed technicians distribute them and administer them to animals. Understanding these technicians' knowledge, attitudes and practice is important in improving antimicrobial use.

Researchers so far have interviewed almost 130 veterinarians, livestock technicians and other workers located in the capitals of municipalities who have access to veterinary antibiotics. Almost 90% reported correctly that antibiotics kill or inhibit bacteria, but one third stated incorrectly that they were effective against parasites. More than 85% also reported incorrectly that antibiotics had a direct anti-inflammatory effect. Sixty percent knew that antibiotic resistance reduced the effectiveness of antibiotics. Around 80% considered antimicrobial resistance important to human and animal health but fewer than 40% knew of the WHO list of critically important antimicrobials for human medicine.

The workers gave most antibiotics to pigs, cattle and water buffalo and very rarely to chickens. They dispensed almost always only oxytetracycline, penicillin, streptomycin and sulphonamides. One reported giving oral colistin, one of the WHO listed critically important antimicrobials for human medicine, to chickens. All reported using antibiotics for treatment, less than 50% for prevention and less than 5% for growth promotion. 15% reported using human antibiotics in animals. They preferred broad to narrow spectrum antibiotics and will shorten treatment duration if the animal recovers.

Laboratory data is important for choosing the correct antibiotic. Almost all workers reported they have access to laboratory services, but less than 70% have sent samples, and less than 30% have received a result.

These animal health workers need education about the mechanism of antibiotic action. A shortage of veterinary antibiotics forces them to use human antibiotics. A reliable laboratory service is needed to improve antibiotic prescribing. Reassuringly, antibiotics are rarely used in Timor-Leste for growth promotion in animals and poultry.

4.3 Small Scale Pig Farmer knowledge & use of antimicrobials & knowledge of antibiotic resistance.

Sr Paulo Vong da Silva, Sra Cristibela dos Santos, Menzies School of Health Research

Researchers selected 3 municipalities for this study, 2 near the capital Dili and one on the border with Indonesia. In each municipality, the researchers surveyed the farmers in one urban and one rural subdistrict. Study participants owned less than 10 sows, either currently or in the last 3 years. The study collected data on animal management, including feed, water and medicines. One hundred and sixty-five farmers participated: 55 from Aileu, 58 from Bobonaro and 52 from Liquica. The majority were women. 23% had no formal education, 63% had at least attended primary school and almost 14% had received tertiary education. Their average age was 43 years. Pig farming was the main source of income for only 8.5%. The average number of pigs each owner had was 1.5. The 165 owned a total of 185 pigs. Nearly 60% were kept penned, almost 40% tethered and just over 5% were free roaming. Only 13% of the farmers knew about antibiotics. Only one could explain how they worked. Only one already knew about antimicrobial resistance but he/she thought it made antibiotics more effective. Only 3.6% had knowingly used antibiotics on their animals but 73.3% were not sure. Of the 3.6% who knew their pigs had been treated with antibiotics, all the animals had received injections of either tetracycline or sulphonamides for clinical illness. Three had obtained the antibiotics from a technician, 2 from a farmer and one didn't remember. In summary, knowledge of antimicrobials is poor among small scale pig farmers in Timor-Leste, they rarely use antibiotics and don't use WHO defined critically important antimicrobials for human medicine.

4.4 A point prevalence survey of antimicrobial use in human health in Timor-Leste

Sr Guilherme Ximenes Soares, Menzies School of Health Research for the Ministry of Health and the Menzies School of Health Research.

Antibiotic use, overuse and inappropriate use drive antibiotic resistance. Antibiotic resistance is a problem for human health in Timor-Leste. In data collected by the National Health Laboratory from Hospital Nacional Guido Valadares (HNGV) in the first 6 months of 2021, among major human pathogens, more than 10% of *Staphylococcus aureus* were methicillin-resistant and 75% of *Klebsiella pneumoniae* resistant to ceftriaxone. Of these *Klebsiella*, 44% were resistant to the alternative therapy of gentamicin and 28% to ciprofloxacin.

Up to now there has been no information how antibiotics are used in human health in Timor-Leste. In this study, researchers performed single day point-prevalence surveys in the wards of the National Hospital in Dili and in the 6 rural referral hospitals located in Suai, Maubisse, Maliana, Baucau and Oecusse, to measure how many people were receiving antibiotics, what antibiotics they were receiving and the appropriateness of the prescription.

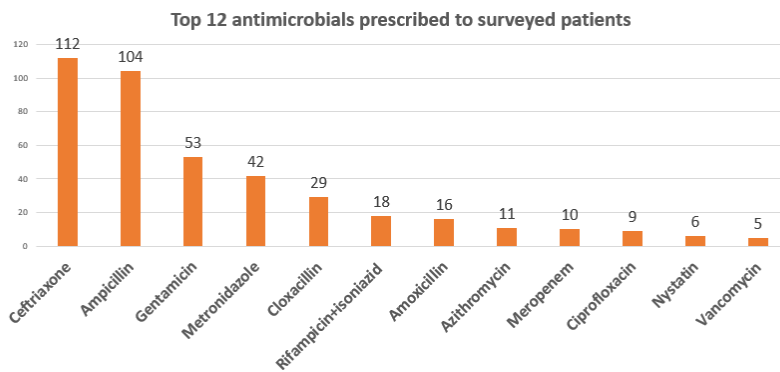
74% of hospitalised patients were receiving antibiotics (Table 1)

Table 1. Hospital location and number of patient records surveyed and the percentage receiving antimicrobials.

Hospital	Number of Patients surveyed	Number of Patients on an Antimicrobial	% Patient prescribed antimicrobial(s)
HNGV	259	188	72.5%
Suai	20	13	65%
<u>Maubesse</u>	18	16	88.8%
<u>Baucau</u>	40	28	70%
Maliana	33	29	87.8%
<u>Oecusse</u>	22	16	72.7%
Total	392	290	74%

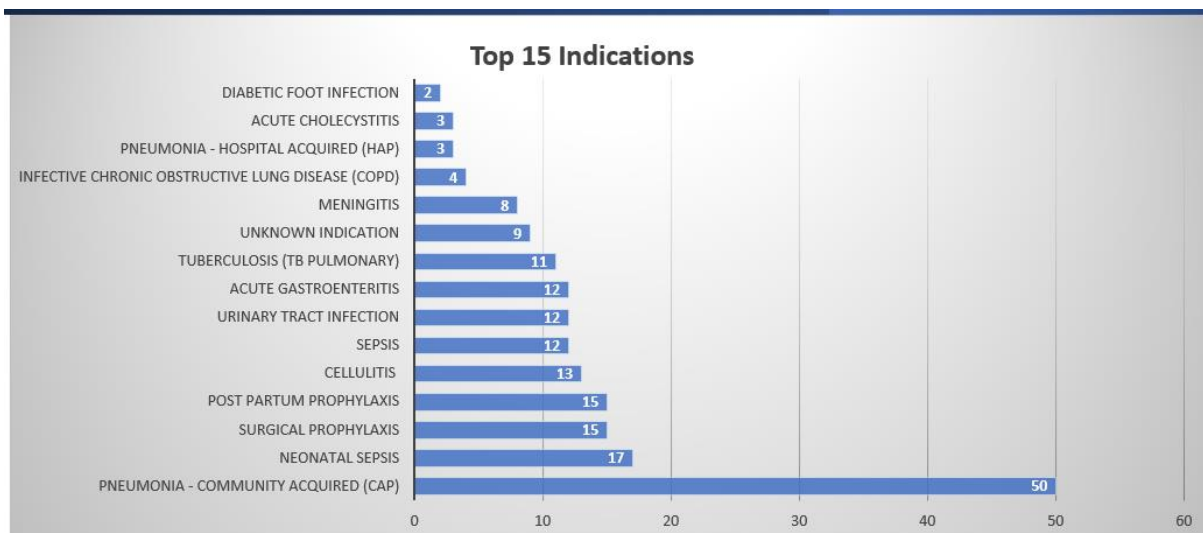
Ceftriaxone, a very broad spectrum antibiotic, and ampicillin, a narrow spectrum antibiotic were the most prescribed (Figure 3).

Figure 3. Top 10 prescribed antibiotics



Community acquired pneumonia was by far the commonest indication for antimicrobial therapy (Figure 4).

Figure 4. Top 15 reasons for prescribing antibiotics



Overall, 33% of prescriptions were assessed as inappropriate i.e. inconsistent with the Antibiotic Guidelines Timor-Leste 2016, or not as advised by an infectious diseases consultant, or not correct for the sensitivity of the microorganism/s identified.

In other quality markers of antibiotic usage: nurses recorded a patient's weight, critical for correct dosing, in fewer than 50% the patients. Similarly, doctors ordered appropriate microbiology in fewer than 50% of patients and recorded a stop date for just over 10% of patients.

5. ANTIMICROBIAL RESISTANCE, HUMAN AND VETERINARY

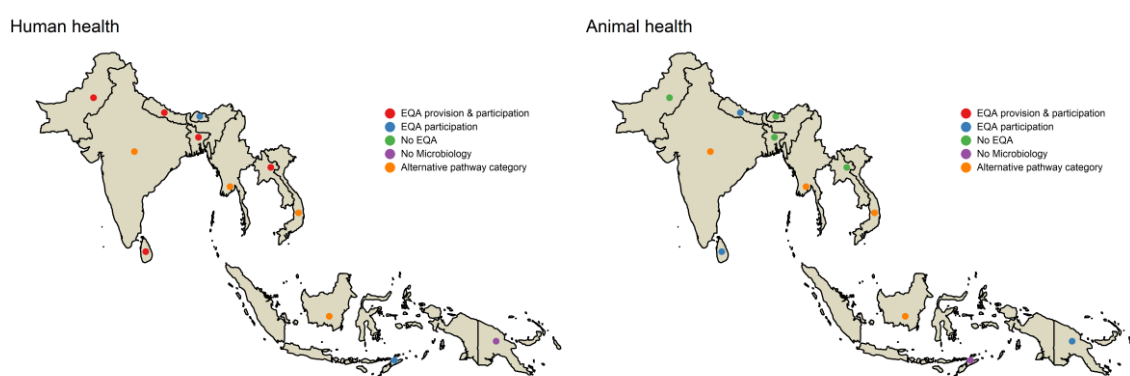
5.1 Quality Assurance for the laboratory detection of antimicrobial resistance in human health and veterinary laboratories

Dr Marianne Holm, International Vaccine Institute (IVI), EQASIA (lead grantee, Technical University of Denmark (DTU))

Effective surveillance of antimicrobial resistance (AMR) relies on the quality of the microbiology laboratory that produces the data. The EQASIA project (“Strengthening External Quality Assurance for AMR in Asia”) responds to the challenges of differing capacities and limited efforts at regional coordination to establish standardized regional external quality assurance (EQA).

This three-phase project has mapped the coverage, availability and uptake of EQA programs across One Health sectors in Asia, strengthened the provision of EQA services to the National Reference Laboratories across the One Health Sector and now continues to provide proficiency testing and training in the region (Figure 5).

Figure 5: Mapping EQA participation across national reference laboratories for human health, food testing and veterinary health in South and Southeast Asia



EQASIA’s survey found that most human health (HH) laboratories participate in EQA programs but that few food safety and veterinary laboratories do. The main limits on participation are cost and lack of management support for participation and corrective actions.

Two current EQA providers have joined the EQASIA consortium to continue and further strengthen their existing service across the Asian region: NIH Thailand, WHO-CC, provides EQA for HH, and CU Thailand, supported by the Food and Agriculture Organization (FAO), for the animal sector. The Technical University of Denmark (DTU) provides the EQA panels for propagation by the regional labs. The EQASIA program offers a free-to-user service, covers all the WHO GLASS and FAO priority pathogens, provides an IT module for instant reporting, and training workshops and follow-up for underperformance.

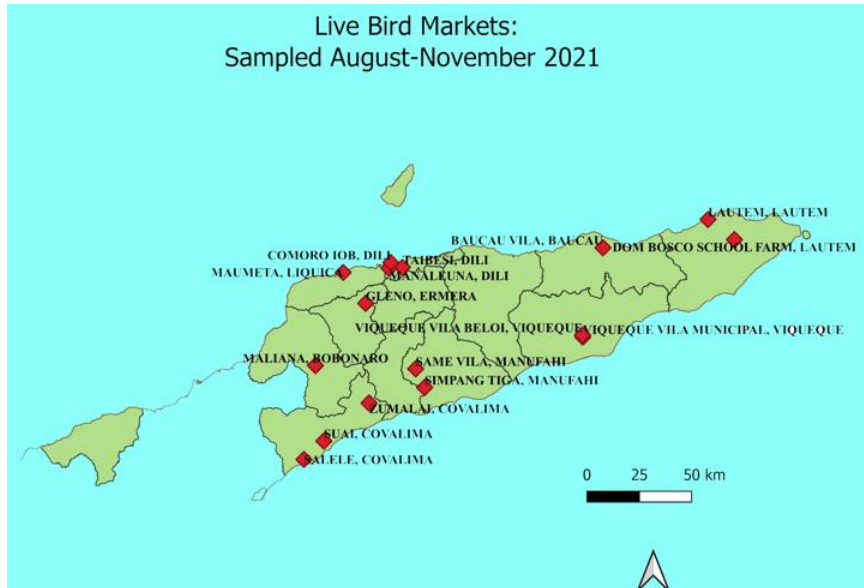
Staff from Timor-Leste attended the virtual workshops including those covering General Quality Management, Use of polymerase chain reaction (PCR) in AMR detection and Introduction to Whole Genome Sequencing. The human and animal health laboratories have taken part in two rounds of organism identification and antimicrobial susceptibility testing during 2021 and have enrolled for the third.

5.2 Preliminary data on *Escherichia coli* antimicrobial resistance (AMR) in live bird markets

Sr Natalino de Jesus Filipe, Veterinary Diagnostic Laboratory and Menzies School of Health Research

The targets for this study are commensal bacteria from the gastrointestinal tract of chickens that may carry antimicrobial resistance genes transmissible to humans. Chickens from 15 live bird markets were sampled in 9 municipalities and from the Dom Bosco battery farm (Figure 6).

Figure 6. Location of live bird markets surveyed



One hundred and twenty-three isolates of *E. coli* were detected from 143 samplings. 86% of isolates were sensitive to all antibiotics tested. The remainder were resistant to up to 5 antibiotic classes (Table 2).

Table 2. Susceptibility of isolates of *Escherichia coli* from poultry at 15 live markets

98 isolates susceptible to all tested antibiotics. 25 isolates non-susceptible to at least one antibiotic.						
AMP	STR	TCY	SXT	SSS	ENR	
R	R	R	S	R	I	3 x 5 Non-susceptible
R	R	R	R	R	S	
R	R	R	R	R	S	
S	I	R	R	R	S	1 x 4 Non-susceptible
S	S	R	R	R	S	4 x 3 Non-susceptible
S	S	R	R	R	S	
R	S	R	S	R	S	
R	R	S	S	R	S	7 x 2 Non-susceptible
R	S	R	S	S	S	
R	S	R	S	S	S	
R	S	R	S	S	S	
I	I	S	S	S	S	
I	S	S	S	S	R	
S	S	R	S	R	S	
R	S	S	S	S	S	10 x 1 Non-susceptible
R	S	S	S	S	S	
R	S	S	S	S	S	
R	S	S	S	S	S	
S	I	S	S	S	S	
S	S	S	S	S	R	
I	S	S	S	S	S	
I	S	S	S	S	S	
I	S	S	S	S	S	
I	S	S	S	S	S	

These rates are lower than those published for similar samples in other Southeast Asian countries, and lower than what has been found in human samples.

In 2022, sampling will include egg farms and broiler farms, imported day old chicks and passive surveillance in pigs. The number of bacterial species surveyed will increase to include *Enterococcus* and *Campylobacter* species. Veterinary isolates will be screened for resistance against antibiotics used in humans at the National (Human) Health laboratory.

5.3 Cumulative Antibiograms for Human Health

Sra Virginia Conceicao and Sra Carolina da Costa Maia, Menzies School of Health Research and the National Health Laboratory

The National Health Laboratory processes up to 400 patient samples per month, mainly from the Hospital Nacional Guido Valadares (HNGV). The installation of 2 blood culture incubators, a MALDI-TOF for organism identification and an automated system for rapid sensitivity testing, combined with a laboratory information system with epidemiological software, underpin the production of systematic antimicrobial resistance data in the standardised format of the cumulative antibiogram (Table 3).

Table 3. Cumulative Antibiogram for the Calendar Year 2020

CUMULATIVE ANTIBIOGRAM FOR 2020

	Phenotype	Beta lactam	Aminoglycoside	Fluro-quinolone	Macrolide	anti-folate	Glyco-peptide	Others	No. of isolates	MRSA%	ESBL%	Carbapenemase %	Antibiotics																																									
													Ampicillin	Cloxacillin	Amoxicillin/clavulanate	Cefazolin	Ceftriaxone	Ceftazidime	Piperacillin-tazobactam	Cefepime	Meropenem	Gentamicin	Tobramycin	Amikacin	Ciprofloxacin	Levofloxacin	Clindamycin	Erythromycin	Azithromycin	Trimethoprim/sulfamethoxazole	Vancomycin	Fosfomycin																						
GRAM POSITIVE																																																						
<i>Staphylococcus aureus</i> all	171	39%											0	68	68	68				68																																		
MSSA													0	100	100	100				100							90	86				82	100																					
MRSA													0	0	0	0	0	0	0	0	0						93	91				77	100																					
<i>Streptococcus pneumoniae</i>	132	(screening samples)																																																				
<i>Streptococcus pyogenes</i>													100	100	100	100	100	100																																				
<i>Enterococcus spp</i>	4												75																																									
GRAM NEGATIVES																																																						
<i>Escherichia coli</i>	174	37%	0%										8		29		63	64	89	64	100					62	68							26		100																		
<i>Klebsiella spp</i>	69	75%											0		28		25	25	52	23	100					36	31							23																				
<i>Citrobacter</i>	11	18%											0		25		82	82	78	82	100					83	91	100	100						50																			
<i>Salmonella (non-Typhi)</i>	9	0%											100		100	0	100	100	100	100	100																																	
<i>Enterobacter spp</i>	29		9%										0	0	0		0	0	67	18	91					36	27	82	36	27					36																			
<i>Pseudomonas aeruginosa</i>	75												0	0	0		92	96	86	89						87	90	97	80	75					0																			
<i>Acinetobacter baumannii complex</i>	56												0		0		0	0	0	0	80					52	58	95	2						70																			

Númeru = Percentagem husi sensitividade mikroorganismu nian

The cumulative antibiogram collects together the sensitivities of the very first bacterium of a species from individual patients in the hospital isolated in a calendar year for clinical reasons. The data is presented by bacterial species with percentage antimicrobial susceptibility.

The cumulative antibiogram format can provide statistically robust information for determining optimum empirical therapy for individual patients. If produced annually, it can demonstrate changes in antimicrobial resistance patterns over time.

Critical information provided in the 2020 cumulative antibiogram for HNGV is that 75% of *Klebsiella* species were resistant to ceftriaxone (and must be treated with toxic or last line antibiotics) and

almost 40% of *Staphylococcus aureus* were methicillin-resistant (MRSA) (and must be treated with second line, relatively inferior, anti-staphylococcal antibiotics).

6. SPECIFIC PATHOGENS AFFECTING ANIMAL AND HUMAN HEALTH

6.1 Brucellosis Seroprevalence in Livestock in Timor-Leste

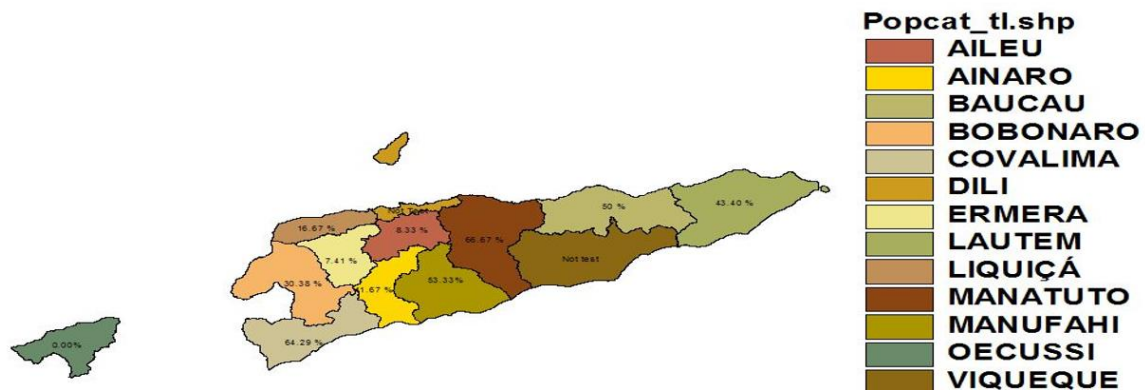
Dr Feliciano da Conceicao, Veterinary Diagnostic Laboratory, Timor-Leste

Brucellosis is a zoonotic infection that causes abortion in cattle and sheep, and a febrile illness in humans that can be complicated by bone infection, epididymo-orchitis, endocarditis and meningitis. It is an occupational hazard for cattle ranchers, dairy farmers, veterinarians, abattoir workers, meat inspectors and laboratory workers, and a recreational hazard for travellers & hunters. It can also be acquired through unpasteurised milk. It is one of Timor-Leste's Priority Animal Diseases.

An *ad-hoc* survey in 2012 of 1075 cattle in 13 Municipalities using an ELISA showed a national average of 14.5%, range 1.6% (Ermera) to 20.7% (Lautem) (Figure 7).

Figure 7. Seropositivity to *Brucella* in cattle and buffalo in Timor-Leste 2012

Prevalence of Brucellosis in Farm/Household in Cattle and Buffalo in Timor Leste 2012



A more detailed survey within the Bobonaro municipality in 2016 showed an overall prevalence of 16.9% with a range between Administrative Posts of 7.7% to 23.7%.

A repeat study in 2017 in four municipalities showed an apparent decrease in seroprevalence in those areas: Bobonaro (19.5% to 11.4%), Covalima (26.8% to 17.5%), Liquica (6% to 1.8%) and Manatuto (30.8% to 9.1%).

A study in sheep and goats in 9 municipalities in 2018/9 showed a national average of 4.5%, ranging from 1.2% in Oecusse to 21.7% in Manufahi. Manufahi's rate was much higher than any other municipality, the second highest being 6.7% in Dili.

6.2 The situation of the Tuberculosis (TB) Program in Timor-Leste: “Unite to end TB”

Sr Costantino Lopes, National TB Program, Timor-Leste

Tuberculosis is chronic infectious disease, spread by the respiratory route, usually affecting the lung but capable of spreading to all organs of the body. If untreated, symptomatic TB is fatal. Almost half of the cases of TB worldwide are in Southeast Asia. In Timor-Leste the estimated annual incidence is approximately 500/100000 population. Each year 1400 Timorese die of TB. For the individual, a diagnosis of TB is a catastrophic social and financial burden, leading to loss of work and schooling, and debt.

Ordinarily the cases of TB detected in Timor-Leste are one half of the estimated actual burden of disease but the detection rate, and the likelihood of treatment, has fallen to 1 in 3 during the COVID pandemic.

Males are affected more than females. HIV infection increases the risk of disease by a factor of 20. Almost 75% of cases occur in the economically productive cohort of 17- to 54-year-olds.

The 5 components of the TB Program in Timor-Leste, as elsewhere, are political commitment, accurate laboratory diagnosis, adequate drug supply, directly observed therapy and accountability.

Simultaneously, the social and economic determinants of TB - poverty, overcrowding, malnutrition, illiteracy and poor health literacy (complicated by traditional beliefs), and tobacco and alcohol consumption-must be overcome. On International TB Day in 2019 the President of Timor-Leste succinctly summarised the challenge: “To eliminate TB is to eliminate poverty, to eliminate poverty is to eliminate TB, to eliminate TB a multisectoral political intervention is needed”. The Government of Timor-Leste has committed to the elimination of TB by 2025 through implementing the National Strategic Plan for Ending TB 2020-2024.

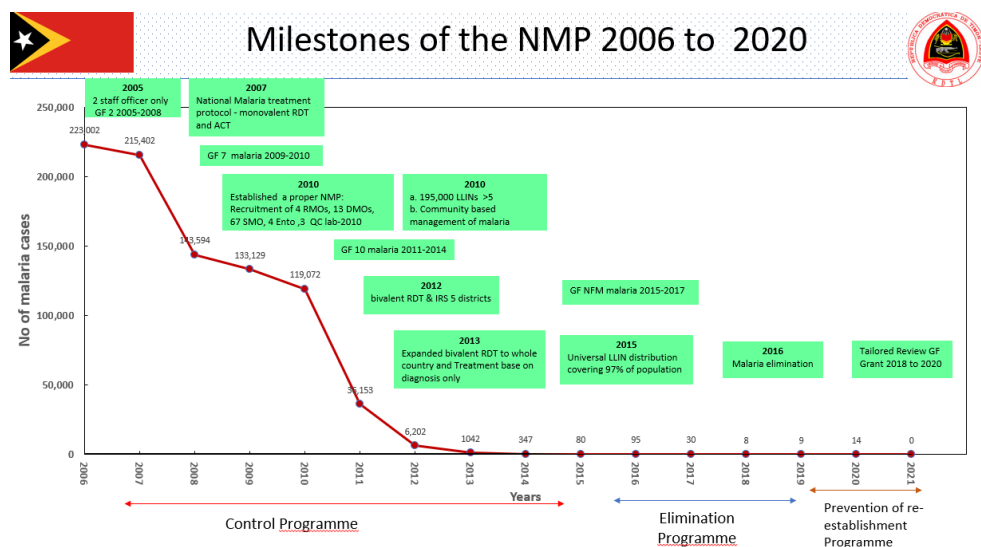
6.3 The success story of the National Malaria Programme: “Draw the line against malaria”

Sra Maria do Rosario de Fatima Mota, National Malaria Program

Malaria is a debilitating febrile illness caused by species of the *Plasmodium* family of parasites and spread by the bite of *Anopheles* mosquitos. Its severity depends on the specific species of *Plasmodium*. *P. falciparum* infection is often fatal, especially in pregnant women and infants.

In 2009 there were over 130,000 presumed and confirmed cases in Timor-Leste, including more than 35,000 infections with *Plasmodium falciparum* and 56 recorded deaths. By 2015, 5 years after the start of an effective National Malaria Program in Timor-Leste, case numbers had decreased to less than a hundred annually and, for the first time, there were no deaths from malaria. The last indigenous case of malaria in Timor-Leste was diagnosed in 2017 (Figure 8).

Figure 8. Epidemic curve of malaria in Timor-Leste, 2006 to 2020



Political commitment through funding, policy and endorsement, cross-border co-operation, strong technical advice, officers of an active malaria team located at all levels of government, community engagement and monitoring, evaluation, and quality assurance of all activities contributed to this outcome.

Public health facilities – the National Hospital, the 5 Referral Hospitals, 72 Community Health Centres and 350 Health Posts, along with 33 private laboratories and clinics and faith-based clinics and 35 community health volunteers (CHVs) performed passive surveillance for infection.

Public sector mobile units and community volunteers carried out active surveillance along the Indonesian border and among migratory workers, including fishermen.

The Program used both rapid detection tests and microscopy. The quality of the diagnostic service was, and is, maintained through initial and refresher training and external QAP.

Cases were notified within 24 hours of diagnosis and followed up within 2 days by case investigation and a 1.5 km focus investigation and clearance of mosquito breeding sites, all completed within 2 days.

Where a case was reported, mass distribution of long-lasting insecticide impregnated nets (LLINs) followed and continued for 3 years. Mass distribution of LLINs also occurs every 3 years in a 2km corridor along the main border with Indonesia and on Atauro Island. LLINs are continuously supplied to risk groups (e.g. pregnant women) along the main border, in Oecusse and on Atauro Island. LLIN usage is monitored by CHV visits and bio-efficacy by testing a sample each quarter when the nets are delivered to Timor-Leste.

Indoor residual spraying (IRS) is done annually in a 2km corridor along the main border, in Oecussi before the malaria season and in a 1.5km radius around detected cases. QC/QA for IRS is done at the same time as spraying.

For entomological surveillance, cattle baited traps and nets, indoor resting catches, human landing catches, light traps and larval surveys are performed in Oecusse and at Hera for trend observation

every second year and whenever a case is detected. Insecticide resistance is monitored twice a year on mosquitos from Oecusse and Hera.

An international, external review has set the scene for progress towards certification of the elimination of malaria in Timor-Leste in 2025.

The 3 key planned interventions are 1. focused intensified surveillance 2. case management and 3. malaria prevention with two supporting elements: expanding research and innovation for improved delivery of services, and strengthening the enabling environment.

Municipalities and submunicipalities are now classified from very high to very low risk of transmission according to their proximity to the Indonesian border, the frequency of population migration, the presence of slash-and-burn agriculture and their elevation. All suspected cases will have a Rapid Diagnostic Test (RDT) or microscopy performed and be notified to the field team within one day. Within 3 days the case and household will be investigated and the case/s classified as locally acquired or imported. Within 7 days, expanded case detection and entomological assessment will be finished, and interventions planned and completed.

The response to a primary case is to intensify vector control, IRS, distribution of LLINs and screening the workforce at any implicated construction site. Response to an introduced case is to screen residents of all houses within a radius of 2 km, alert all health staff of the province and all other districts to intensify screening of all febrile patients, maximise the diagnostic capacity of the area, contact tracing and radical mass drug treatment for high-risk groups.

Challenges include illegal immigration in border regions, on-going advocacy for domestic funding to at all levels of government and the need to establish a Task Force and a National Advisory Committee.

The immediate problems are that most malaria officers in Timor-Leste are still paid from the Global Fund, serious shortcoming with the quality of diagnostic microscopy and the porous border.

The next steps forward are a scoping study of cross border interventions with Cross Sector Development Initiative (XSDI) Australia, a malaria seroprevalence study with the Menzies School of Health Research, chemoprophylaxis for travellers to malaria endemic countries, border screening of returnees from those countries at point-of-entry and advocacy for the malaria elimination project to the health sector, universities and the general public, and to engage the private sector.

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