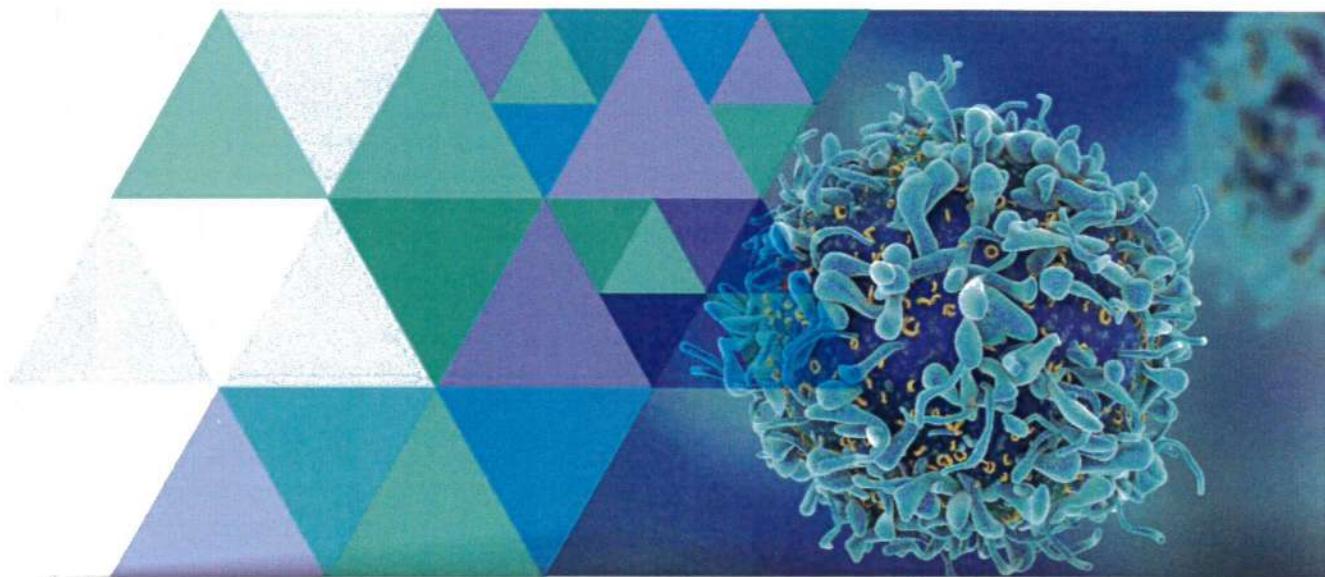


Antimicrobial Resistance National Strategy and Action Plan for the Cayman Islands

May 2017 Report



2017-2020

Foreword

Antimicrobial medicines are used around the world to treat infections of all types, both in animals and in humans. Resistance to antimicrobials has been gradually evolving since the introduction of the first antibiotics, the Penicillins; however, recent times have seen antimicrobials becoming less and less effective, with many everyday infections or diseases being untreatable and causing mortalities.

According to the World Health Organization (WHO), we are currently facing a global health crisis, as antimicrobial resistance (AMR) becomes increasingly present and we run the risk of returning to a pre-antibiotic era. The WHO estimates that unless drastic measures are taken to reduce antimicrobial resistance, in 2050, antimicrobial resistance will be the largest cause of death worldwide, causing the death of 10 million people annually.

The main contributing factor in the increase in antimicrobial resistance has been the chronic overuse and imprudent use of antibiotics across the human and animal health sectors. In May 2014, the WHO developed a global action plan to be implemented in 2017 to reduce the use of antimicrobial agents and control the emergence and spread of resistance. In alignment with this global action plan, nations are called on to develop national action plans which will incorporate five main strategic objectives:

1. Improve awareness and understanding of antimicrobial resistance through effective communication, education, and training
2. Strengthen the knowledge and evidence base through surveillance and research
3. Reduce the incidence of infection through effective sanitation, hygiene, and infection prevention measures
4. Optimise the use of antimicrobial medicines in human and animal health
5. Develop the economic case for sustainable investments that takes account of needs of all countries, and increase investment of new medicines, diagnostic tools, vaccines, and other interventions

This action plan recognises that AMR is a “one health” problem, and highlights the need for an effective “one health” approach. Subsequently, it has been developed because of a coordinated and collaborative effort among major stakeholders and actors, namely government representatives from; public health, agriculture/animal health, environmental health, pharmacy, infection control, and laboratory services.

The action plan also recognises achievements and gains made by the Cayman Islands as it relates to AMR and the five strategic objectives outlined above. Other aspects addressed within the action plan speak to the resources available to combat AMR, economic factors related to AMR, drivers of AMR, and a detailed analysis of what needs to be done to further mitigate the problem.

AMR cannot be eradicated, and will remain a force to contend with for the foreseeable future. However, a multi-disciplinary approach to increase knowledge, education, surveillance, research, and governance surrounding AMR will limit its risks and minimise its impact on health, economics, and societal welfare, both now and in the future.

Given the severity of this issue, it will be imperative that all sectors respond to the call for action as outlined in this action plan if we are to successfully address this public health threat and preserve the future healthcare of The Cayman Islands.



*The Honourable Alden McLaughlin MBE, JP, MLA
Premier of the Cayman Islands
Minister of Home Affairs, Health, and Culture*



Table of Contents

Foreword	1
Table of Contents	2
Glossary	3
Abbreviations and acronyms	5
Executive Summary	6
Background	8
Introduction	8
Situational analysis	10
Country response	17
Governance	17
Strategic plan	18
Operational plan and budget	24
Monitoring and evaluation plan	25
References	26
Appendices	
1. Extended technical working group	
2. Survey: Antibiotics and Antimicrobial Resistance in the Cayman Islands	
3. Survey: Antimicrobials and Healthcare Professionals in the Cayman Islands	
4. Cayman Islands Health Services Authority (H.S.A.) Antibiogram January 2012- December 2016	
5. Photo of Antimicrobial Resistance National Action Plan Development Working Group for The Cayman Islands	



Glossary

Antibiogram	An antibiogram is the result of a laboratory testing for the sensitivity of an isolated bacterial strain to different antibiotics. An antibiogram indicates whether the pathogen in question is resistant or sensitive to the antibiotic used in the test.
Antibiotic(s)	Antibiotics are naturally occurring or artificially produced substances that can kill bacteria (bactericidal effect) or inhibit their growth (bacteriostatic effect). Antibiotics are used in human and veterinary medicine to treat bacterial diseases. They are not effective in viral diseases (e.g. colds and flus).
Antimicrobial	A drug that selectively destroys or inhibits the growth of microorganisms. Sometimes referred to as an ‘antimicrobial agent’. Examples include antibiotics (also known as antibacterials), antiviral, and antifungal agents.
Antimicrobial resistance (AMR)	Antimicrobial resistance occurs when microorganisms such as bacteria, viruses, fungi, and parasites change in ways that render the medications used to cure the infections they cause ineffective. When the microorganisms become resistant to most antimicrobials they are often referred to as “superbugs”. Antimicrobial resistance is the broader term for resistance in different types of microorganisms and encompasses resistance to antibacterial, antiviral, antiparasitic and antifungal drugs.
Antimicrobial stewardship (AMS)	The use of coordinated interventions to improve and measure the use of antimicrobials by promoting optimal drug regimen, dose, duration, and route of administration. The aim is for optimal clinical outcome and to limit selection of resistant strains. This is a key component of a multi-faceted approach to preventing AMR.
Communicable disease	An infectious disease transmissible (as from person to person) by direct contact with an affected individual or the individual’s discharges or by indirect means (as by a vector).
Incidence	The occurrence, rate, or frequency of a disease.
Microorganism	A microorganism is a microscopic creature which can usually not be seen by the naked eye. They include some fungi, single-cell parasites, bacteria, and viruses.
Monitoring	Monitoring is a continuous process of recording, administering, analysing, summarising and reporting data on the status, for instance the resistance situation, in a population over a given time. The purpose is to identify changes in the situation in order, for example, to check the effect of measures.
‘One Health’ approach	Collaborative multi-disciplinary work at local, national, and global levels to attain optimal health for people, animals, and the environment.
Pathogen/ Pathogenic	A pathogen is defined as an organism that causes disease. Pathogenic refers to the ability of an organism to produce or cause disease.
Penicillin	In 1928 Alexander Fleming discovered that fungi of the <i>Penicillium</i> genus kill germs. The antibiotic developed as a result, penicillin, is the oldest antibiotic in clinical use. Penicillin was the first drug available to doctors to treat infectious diseases. It has a relatively narrow spectrum of action, and many bacteria are naturally resistant to penicillin. However, it can still be used successfully to treat various diseases. A number of derivatives have been developed from this active ingredient. They all belong to the Penicillins class.
Phenomenon	A fact or event of scientific interest susceptible to scientific description and explanation.

Prevalence	The frequency of a disease or symptom in a population at a given time.
Prevention	Preventing or minimising future disorders, impairments or damage in order to prevent problems. The aim of disease prevention is to apply targeted measures in order to prevent the occurrence of disease.
Stakeholder	A stakeholder is defined as an individual or group with a justified interest in the course or outcome of a process or project.
Surveillance	Surveillance is a three-stage process, the first of which consists of identifying and recording diseases (monitoring). In the second stage the data obtained are assessed. After this, consideration is given to what measures need to be taken to contain or prevent a medical problem such as an infectious disease.
Vaccination	A vaccination is a preventive measure against infectious diseases. Administration of dead or weakened pathogens or parts of pathogens mimics a natural infection. This triggers the body's immune system to produce defensive substances that subsequently protect the person who has received the vaccination against the disease in question for a certain time.
Zoonosis/Zoonotic	A disease that normally exists in animals but that can spread to humans. Examples include Brucellosis, Anthrax, and Lyme disease. The term 'zoonotic' pertains to zoonosis.

Abbreviations and acronyms

AMR	Antimicrobial Resistance
AMS	Antimicrobial Stewardship
AMU	Antimicrobial Use
CARPHA	Caribbean Public Health Agency
CPD	Continuing Professional Development
FOA	Food and Agriculture Organisation
GLASS	Global Antimicrobial Resistance Surveillance System
IPC	Infection Prevention and Control
JCI	Joint Commission International
M & E	Monitoring and Evaluation
NAP	National Action Plan
NAPDWG	National Action Plan Development Working Group
OIE	World Organisation for Animal Health
PAHO	Pan-American Health Organisation
SO	Strategic Objective
SOPs	Standard Operating Procedures
WHO	World Health Organisation
WHA	World Health Assembly

Executive Summary

The discovery and subsequent development of antibiotics (the major class of antimicrobial) has been classified as one of the most important achievements in medical science. These drugs have allowed us to cure serious diseases such as pneumonia and septicaemia, which often proved fatal in the pre-antibiotic era. However, excessive and sometimes non-judicious use of antibiotics and other antimicrobials has led to increasing resistance to the agents which once killed and stopped them in their tracks.

The problem of increasing antimicrobial resistance (AMR) not only affects human medicine, but also impacts veterinary medicine, agriculture, and the environment. Drug resistant microorganisms can circulate in populations of humans and animals, through food, as well as through water and the environment. Transmission is influenced by social and economic interactions such as trade, travel, human migration, and animal migration. Bearing this in mind, a joint, cross-sector approach is vital if the associated challenges of AMR are to be faced.

Following the WHO's appeal to prioritise AMR as a major public health issue, and to subsequently develop a national action plan to mitigate the surrounding risks of AMR, this document has been made possible through close cooperation among the bodies involved representing human/public health, animal health/agriculture, environmental health, pharmacy, and microbiology/laboratory services. Other directly affected stakeholders have also been involved to ensure that the content is as broadly supported as possible. These include in particular universities which offer medical programmes, representatives of various government sectors/departments, and other key associations and individuals. The main objectives of this national action plan mirror the strategic objectives set out by the WHO, and revolve around filling knowledge gaps on AMR among the general public and public health professionals, conducting surveillance to get a true picture of the AMR burden across all sectors, and ensuring that antibiotics and other antimicrobials remain safe and effective for human and animal use in the long term.

The key issues are as follows:

Information and education: Gaps in knowledge and information surrounding the development of AMR and possible preventive measures must be closed so that antimicrobials (particularly antibiotics) are used responsibly and only when warranted. This means providing targeted information to specialists such as doctors, veterinarians, pharmacists, farmers and food producers, as well as to the general public.

Surveillance: Collecting and maintaining information regarding AMR incidence, prevalence, and trends must be done in order to better understand AMR drivers and patterns. Emphasis on surveillance and evidence-based research will inform policies and actions and assist with the creation of regulations

surrounding antimicrobial use (AMU). Accurate and comprehensive set of data also aid in monitoring the effectiveness of the measures taken. An integrated approach to surveillance between the human and animal/food sectors is necessary for source trace-back and to aid with prevention measures.

Prevention: Preventing infections in human and animal populations is a vital way to achieve decreases in antimicrobial consumption. Preventive measures such as improved food and personal hygiene practices, utilising vaccines against common diseases, and optimised on-farm management, hygiene and husbandry, and biosecurity are essential.

Appropriate use of antimicrobials: If antimicrobials (namely antibiotics) are to be used, they must be administered with caution in order to minimise the development of resistance. This relies heavily on a high level of expertise among the individuals prescribing or using antibiotics, both within human and animal medicine. Binding rules and restrictions where appropriate, are also necessary, and must be applied consistently throughout the country. All settings affected and involved should be systematically monitored so that information surrounding the sale and use of antimicrobials and the development and spread of resistance is obtained readily and consistently.

Cooperation and Governance: Interdisciplinary and inter-sector coordination is essential in the effort to control antimicrobial resistance. Technical and strategic synergies should be used, and political, scientific, and economic cooperation among the sectors and entities involved must be actively encouraged. The national action plan on AMR must be treated as a live document, with regular review, and its activities and initiatives should be governed by the AMR national action plan development working group (NAPDWG) for the Cayman Islands.

Implementation: Full implementation of the action plan will begin once it has been adopted by the government in May 2017. As they were in its creation, key stakeholders will be involved in implementing the AMR national action plan. This process will require regular collaboration and discussion by the NAPDWG, and will also draw upon external technical experts for consultation and involvement where required and appropriate. Thorough analyses of the AMR burdens and drivers within each sector, as well as preparation of a suitable budget to conduct AMR activities and initiatives will be crucial to the implementation process. It may be necessary for particular regulations and policies to be created, laws to be passed, or ordinances to be amended so that the measures referred to in the national action plan can be implemented. Stakeholders will be involved in accordance with the established consultation processes when changes to legislation or ordinances are being drafted and discussed.

Background

Introduction

The phenomenon of antimicrobial resistance (AMR) has been a topical public health issue for many years. When microbes become resistant to medicines, options for treating the diseases they cause are significantly reduced. The resistance of antimicrobial agents is rapidly increasing on a global scale, and hence causes a serious threat to human health, animal health, and environmental health. In reality, AMR threatens to take us back to the pre-antibiotic era, and in doing so, would almost eradicate the medical gains made in the last century.

Antimicrobial resistance develops when bacteria and other microorganisms adapt/mutate, and are subsequently able to survive and grow in the presence of the medicines which would normally kill them (e.g. antibiotics). The development to resistance is strongly linked to the frequency with which antimicrobials are used. Because (e.g. in the case of antibiotics) many antimicrobials belong to the same class/family of medicines, resistance to one specific agent can lead to resistance to an entire class. Resistance developing in one location or organism can also spread rapidly and unpredictably though, e.g. the exchange of generic material between the two organisms, which can negatively affect the efficacy of antimicrobial agents for a range of infections and diseases.

Since antibiotics are the most widely used (and abused) of the antimicrobials, much of this action plan covers strategies to mitigate resistance to these drugs. However, many of the actions proposed in this plan are equally applicable to antifungal, antiviral, and antiparasitic resistance, and hence resistance in those other microorganisms (fungi, viruses, and parasites). As antimicrobial resistance (and particularly antibiotic resistance) spreads, we are faced with the reality that very few prospects for the development of new classes of antibiotics exist in the short term. The pipeline of antibiotic development has been rather dry for the past ten years, with only a handful of new drugs on the market, most of which have a limited spectrum of activity. There are several challenges involved in the creation of new antibiotics. Firstly, the highly-effective defense mechanisms and rapidly evolving complex structure of bacteria make it difficult for the development of medicines which can penetrate and kill them. Secondly, the process of testing new medicines can be exceptionally lengthy, and involves finding patients with specialised infections already resistant to the medicines that are typically prescribed. The research and development cost is large, with investors rarely recovering their expenditure.

The consequences of resistant microorganisms include longer illnesses, longer hospital stays, increased absenteeism from work, increased mortality rates, decreased protection during surgery and other medical procedures such as chemotherapy, and increased costs for insurance companies, hospitals, and

families. Doctors are increasingly using 'last-resort' medications, which are usually more costly and may have more side effects. Some cases of tuberculosis, malaria, and gonorrhea are now resistant even to these 'last resort' antimicrobials. Antimicrobial resistance affects all areas of health, involves a range of sectors, and has an impact on the whole of society.

The development of the global action plan on antimicrobial resistance requested by the World Health Assembly (WHA) in May 2014 and the adoption of this global action plan by governments at WHA in May 2015 reflect that there is a global consensus on the severity of AMR. Subsequently, each member country has been tasked with submitting a national action plan on AMR in line with the global plan. To achieve this goal, action plans identify five strategic objectives: (1) to improve awareness and understanding of antimicrobial resistance; (2) to strengthen knowledge through surveillance and research; (3) to reduce the incidence of infection; (4) to optimise the use of antimicrobial agents; and (5) to ensure sustainable investment in countering antimicrobial resistance. A 'One Health' approach must be taken to meet these objectives and successfully combat AMR, realising that coherent, comprehensive, and integrated actions involving different sectors (namely human and veterinary medicine, agriculture, finance, environment, and consumers) are necessary and need to be implemented synergistically.

This national action plan on AMR in The Cayman Islands sets out key activities and initiatives which will be executed and implemented over the next 5-10 years to combat antimicrobial resistance. The overall action plan will be reviewed at a minimum of every three years. These actions are structured around the five strategic objectives set out in the previous paragraphs, and are tailored to economic and cultural considerations for the country.

Situational analysis

Country situational analysis on antimicrobial resistance (AMR)

Following a regional training workshop in October 2016 on AMR the development of a national action plan on AMR, a detailed analysis of the situation in The Cayman Islands was conducted initially between public health officials and veterinary services. This was done in order to provide baseline information on factors affecting and driving AMR in The Cayman Islands, focusing on achievements, as well as gaps and challenges which exist for each objective to be met in mitigating AMR. Further ratification took place among the wider working group for AMR, and the findings of the analysis are outlined below.

Human Health

Awareness and understanding of antimicrobial resistance risks and response in human health	
Achievements:	
	<ul style="list-style-type: none">• Observance of International Infection Prevention Week October 16-22 2016 by government hospital staff (continuing medical education presentations on hand hygiene, vaccination benefits, antimicrobial stewardship, and the national antibiogram)• Observance of World Antibiotic Awareness Week November 14-20 2016 (radio appearance by AMR action plan development working group members, AMR Fact sheet publication in major local newspaper)• AMR awareness and antibiotic use survey created for the general public in January 2017
Gaps:	<ul style="list-style-type: none">• Varying levels of AMR awareness among the general public

Training and professional education on AMR in the human health sector	
Achievements:	
	<ul style="list-style-type: none">• Government hospital staff attended a regional training workshop on AMR and AMR national action plan development hosted by PAHO/WHO in October 2016• The AMR national action plan development working group hosted the first One Health Symposium in Cayman Islands in April 2017. The target audience was human, animal, and environmental healthcare professionals, as well as students pursuing training in these areas
Gaps:	<ul style="list-style-type: none">• Lack of continued professional development (CPD) opportunities for human healthcare workers specifically related to AMR• Lack of an official AMR handbook for healthcare establishments• Lack of information regarding AMR education in curriculum for medical and nursing schools

National monitoring system for consumption and rational use of antimicrobials in human health	
Achievements:	
	<ul style="list-style-type: none">• There is a national drug regulatory authority for The Cayman Islands• An antibiogram is produced every six months by the government hospital laboratory, with subsequent dissemination to all local physicians
Gaps:	<ul style="list-style-type: none">• Lack of a system of data collection, reporting, and monitoring on antimicrobial sales or consumption nationally• Lack of a system of data collection, reporting, and monitoring of antibiotic prescribing and appropriate use in a sample of private and public healthcare facilities

National surveillance system for antimicrobial resistance in humans

Achievements:

- The government hospital laboratory is Joint Commission International (JCI) accredited, with strong testing capacity and state-of-the-art machinery
- There is a Vitek system present at the government hospital laboratory for microbiology and AMR surveillance
- An antibiogram is produced every six months by the government hospital laboratory, with subsequent dissemination to all local physicians

Gaps:

- Limited AMR surveillance is being done across sectors/healthcare facilities
- Limited collaboration takes place between existing laboratories on island
- There is a need to regularly contribute AMR data to the global AMR Surveillance System (GLASS)

Infection prevention and control (IPC) in human health care

Achievements:

- Observance of International Infection Prevention Week October 16-22 2016 by government hospital staff (continuing medical education presentations on hand hygiene, vaccination benefits, antimicrobial stewardship, and the national antibiogram)
- There is a national IPC policy/plan available for the Cayman Islands
- All relevant infection control measures are implemented at the government hospital and associated district clinics
- IPC policies, SOPs, guidelines, and protocols at the government hospital and associated district clinics are monitored annually
- Presently there are exceptional national percentage values (>92%) for third-level immunisation coverage with pneumococcus vaccine and the Haemophilus influenza type b(Hib) vaccine
- Annual submissions are made to PAHO with respect to immunisation coverage as per the vaccination schedule from birth to 18 years of age

Gaps:

- Lack of internal publishing of information on compliance and effectiveness of IPC practices at the government hospital and associated district clinics on an annual basis
- Lack of information regarding the IPC policies, SOPs, guidelines, and protocols in use at major private hospitals and patient care centers
- Lack of information on IPC policies, SOPs, guidelines, and protocols in congregate settings (e.g. nursing/retirement homes, medical and veterinary student dorms, prisons, immigration detention centers, children's homes, etc.)

Antimicrobial stewardship and regulation in human health

Achievements:

- Observance of International Infection Prevention Week October 16-22 2016 by government hospital staff (continuing medical education presentations on hand hygiene, vaccination benefits, antimicrobial stewardship, and the national antibiogram)
- There is a national drug regulatory authority for The Cayman Islands
- An institutional essentials medicines list exists at the government hospital
- There are standard treatment guidelines at the government hospital for use of antimicrobial agents in humans
- Healthcare provider survey created and disseminated in March 2017 to medical doctors, dentists, and veterinarians to ascertain most commonly-prescribed/used antimicrobials, and decision-making for antimicrobial choice

Gaps:

- The government hospital lacks a formal multidisciplinary antimicrobial stewardship team to oversee the prescribing practices and use/administration of antimicrobials, monitor resistance patterns, and take steps to mitigate the spread of resistance microorganisms
- Lack of a national policy with associated regulations that addresses appropriate use, availability, and

- quality of antimicrobials in the community and in health care settings
- Lack of an official AMR handbook for healthcare establishments
- Lack of coordination between monitoring and surveillance results in order to inform action and update treatment guidelines and essential medicines lists
- Lack of legislation and regulations which govern importation, marketing authorisation/sales, and access to antibiotics for human use
- For the government hospital, at present there is no review of appropriateness of antimicrobial agents 48-72 hours after administration, i.e. post-prescription review

Legislation components related to AMR in human health

Gaps:

- Lack of legislation and regulations which govern importation, marketing authorisation/sales, and access to antibiotics for human use

Food and Animal Health

Awareness and understanding of antimicrobial resistance risks and response in animal health and food production

Achievements:

- Observance of International Infection Prevention Week October 16-22 2016 by government hospital staff (continuing medical education presentations on hand hygiene, vaccination benefits, antimicrobial stewardship, and the national antibiogram)
- Observance of World Antibiotic Awareness Week November 14-20 2016 (radio appearance by AMR action plan development working group members, AMR Fact sheet publication in major local newspaper)
- AMR awareness and antibiotic use survey created for the general public in January 2017

Gaps:

- Limited knowledge of the animal-related contributions to AMR among livestock and pet owners

Training and professional education on AMR in the veterinary sector

Achievements:

- Government Veterinary Services attended a regional training workshop on AMR and AMR national action plan development hosted by PAHO/WHO in October 2016
- The AMR national action plan development working group hosted the first One Health Symposium in Cayman Islands in April 2017. The target audience was human, animal, and environmental healthcare professionals, as well as students pursuing training in these areas

Gaps:

- Lack of continuing professional development (CPD) opportunities for veterinarians and veterinary paraprofessionals on AMR
- Lack of an AMR handbook for all veterinary establishments
- Lack of information regarding AMR education in the local veterinary school curriculum

National monitoring system for antimicrobial use in animals

Achievements:

- The Ministry of Agriculture/Department of Agriculture is the sole importer of commercial livestock feed on island
- Since 2006, there has been a policy in favour of the importation of livestock animal feeds which are hormone and antibiotic-free
- 98% of antimicrobial use is under veterinary supervision
- There are no over-the-counter sales of antibiotics to farmers or pet owners
- An OIE-initiated survey on antibiotic use in animals for the year 2014 was completed in February 2017

Gaps:

- There is a small percentage (potentially less than 2%) of illegal importation of antimicrobials from USA and Latin America; i.e., without a veterinary prescription
- Lack of current and consistent information related to antimicrobial use/sales in animal species in the Cayman Islands
- Need for a system of data collection, reporting, and monitoring on antimicrobial sales or consumption nationally for livestock animals
- Need for a system of data collection, reporting, and monitoring of antibiotic prescribing and appropriate use in a sample of private and public veterinary healthcare facilities (e.g. a national animal drug regulatory authority)

National surveillance system for antimicrobial resistance in animals and foods

Gaps:

- Lack of laboratory capacity for AMR screening
- No AMR testing programme in animals or foods of animal origin
- No information is available on priority pathogens for animals as it relates to AMR
- No information is available on priority food pathogens as it relates to AMR

Infection prevention and control in animal health

Achievements:

- A Veterinary biosecurity SOP document exists for government veterinary services field staff
- There is strong, continuous promotion of good hygiene practices along the food chain
- There is continuous promotion of on-farm biosecurity and hygiene practices to minimise infection and the need for antimicrobial use in livestock animals

Gaps:

- There is a need for greater ‘buy-in’ among livestock farmers as it relates to adequate farm hygiene, biosecurity, appropriate vaccination, and appropriate handling of sick animals to prevent transmission of resistant bacteria to other animals and humans

Antimicrobial stewardship and regulation in animal health

Achievements:

- Healthcare provider survey created and disseminated in March 2017 to medical doctors, dentists, and veterinarians to ascertain most commonly-prescribed/used antimicrobials, and decision-making for antimicrobial choice

Gaps:

- To develop and implement a national policy with associated regulations for antimicrobial stewardship that addresses appropriate use, availability, and quality of antimicrobials for animals
- There is need for a national AMR handbook for veterinarians and veterinary para-professionals
- Lack of monitoring and surveillance of AMR to guide updating of an essentials medicines list for animals
- There is a need for standard treatment guidelines for the use of antimicrobial agents and standard treatment recommendations in animals

- Lack of legislation and regulations governing importation, marketing authorisation/sales, access to, and prudent use of quality medicinal products for animal use based on international standards (e.g., the OIE)

Legislation components related to AMR and animal health

Gaps:

- The national slaughter regulations are outdated and have yet to be passed by cabinet
- The current Animals Law is in need of updating and subsequent approval by cabinet
- There is little enforcement of the Animals Law and a lack of cohesion between the police force and the Department of Agriculture
- Lack of legislation and regulations which govern importation, marketing authorisation/sales, access to, and prudent use of quality medicinal products for animal use based on international standards (e.g., the OIE)

Plant and crop production and health

Awareness and understanding of AMR in plants and crops

Achievements:

- Observance of World Antibiotic Awareness Week November 14-20 2016 (radio appearance by AMR action plan development working group members, AMR Fact sheet publication in major local newspaper)
- The Cayman Islands, along with other Caribbean countries, through the Caribbean Group of Pesticide Boards (CGPC), observes Pesticide Awareness Week annually during the week containing the 27th September

Gaps:

- There is still much uncertainty surrounding the impact of plant/crop farming on AMR in The Cayman Islands (it is currently thought that the impact is minimal, given product use regulations and the small crop farming sector)

Training and professional education on AMR in the plant sector

Achievements:

- The AMR national action plan development working group hosted the first One Health Symposium in Cayman Islands in April 2017. The target audience was human, animal, and environmental healthcare professionals, as well as students pursuing training in these areas
- Safe use and handling of pesticide products workshop held annually and is attended by participants from government and privately-owned nurseries, pest control companies, farm hands, landscapers, and the mosquito research and control unit

Gaps:

- There currently is no committee which allows interaction between plant and crop stakeholders (e.g. landscapers, nursery owners, hardware store owners, etc.)
- It is estimated that there are varying levels of AMR and IPC knowledge/awareness among staff at plant and crop establishments

National monitoring system for and rational use of antimicrobials within the plant sector

Achievements:

- Presently, imported fertilisers (via the Department of Agriculture) do not contain antimicrobials
- Presently, there is no importation (via the Department of Agriculture) of antibiotics for use on plants

Gaps:

- There is still much uncertainty surrounding the impact of plant/crop farming on AMR in The Cayman Islands (it is currently thought that the impact is minimal, given product use regulations and the small crop farming sector)

National surveillance system for antimicrobial resistance in plants

Gaps:

- No AMR testing programme in crops and plants currently exists
- There is still much uncertainty surrounding the impact of plant/crop farming on AMR in The Cayman Islands (it is currently thought that the impact is minimal, given product use regulations and the small crop farming sector)

Infection prevention and control in the plant sector

Gaps:

- Lack of a national plant IPC policy/SOP
- Lack of a monitoring system for IPC policies, SOPs, guidelines, and protocols at nurseries and farms on island

Antimicrobial stewardship and regulation for plant health

Achievements:

- Presently, imported fertilisers (via the Department of Agriculture) do not contain antimicrobials
- Presently, there is no importation (via the Department of Agriculture) of antibiotics for use on plants

Gaps:

- There is still much uncertainty surrounding the impact of plant/crop farming on AMR in The Cayman Islands (It is currently thought that the impact is minimal, given product use regulations and the small crop farming sector)

Environmental health

Awareness and understanding of AMR and its effects on the environment

Gaps:

- There is limited knowledge surrounding the levels of antibiotics, biocides (disinfectants, antiseptics, preservatives), and heavy metals (particularly silver, copper, and zinc) in the soil, sediment, and coastal waters in The Cayman Islands
- There is need for further investigation as to the impact of AMR on the environment of The Cayman Islands

Training and professional education on AMR in the environment sector

Achievements:

- The AMR national action plan development working group hosted the first One Health Symposium in Cayman Islands in April 2017. The target audience was human, animal, and environmental healthcare professionals, as well as students pursuing training in these areas

Gaps:

- There is a lack of specialised AMR training and education for persons working in the environment sector

National surveillance system for antimicrobial resistance in the environment

Gaps:

- Surveillance of antimicrobial resistance and consumption of antibiotics is virtually non-existent as it relates to environmental health
- There is a need to identify relevant environmental pathogens and monitor AMR data, particularly as it relates to municipal wastewater, hospital waste effluent, and soil

Antimicrobial stewardship and regulation for environmental health

Achievements:

- There is some protection of ground water as it relates to sewage and industrial effluent disposal via planning regulations, trade and business license governance, the Department of Environmental Health's functions, and the functions of the local Water Authority.
-

Gaps:

- There is need to develop regulations which limit discharge of antimicrobial residues into the environment (including pharmaceutical waste)
- There is a need for national policies/SOPs (for the general public, as well as healthcare facilities) for the disposal of pharmaceutical waste
- There is need to develop a regulatory compliance system that includes compliance with regulations on antimicrobial residues

Overview and analysis of surveillance data

While the impact of AMR in The Cayman Islands has not yet been quantified, antibiogram data for the government hospital shows that resistance is present. This data is produced every six months, focusing on major organisms cultured from a range of samples. Since 2012, antibiogram data has been disseminated to all public and private medical physicians, and subsequently, decreases in resistance patterns have been evident for most major organisms within this time period. Summary data is as follows: (refer to Appendix 4 for Antibiogram data for the 2012-2016 period).

Enterococcus faecalis: The highest levels of resistance seen from 2012-2016 were to Ciprofloxacin and Levofloxacin, with approximately 30% of samples submitted exhibiting resistance to both antibiotics

Haemophilus influenzae: Moderately-high levels of resistance (>40%) to Ampicillin was seen in 2012. Resistance levels in subsequent years have exhibited an undulating pattern. Moderately-low resistance patterns (<25%) have been seen with Azithromycin and Augmentin

Klebsiella Pneumoniae: Extremely-high resistance levels (68%-82%) to Nitrofurantoin have been consistent between 2012 and 2016. The organism has repeatedly shown low resistance levels (<20%) to all other major antibiotics

Proteus mirabilis: The highest resistance levels exist for Ampicillin (approximately 20%), with moderately-low resistance levels to Augmentin and Trimethoprim/Sulfamethoxazole

Staphylococcus aureus: Extreme levels of resistance to Erythromycin (>50%), and high resistance to Ciprofloxacin, Oxacillin, and Clindamycin have been consistent over the four year period

Pseudomonas aeruginosa: Highest resistance levels exist for Ciprofloxacin, however, the levels have steadily decreased between 2012 and 2016

Escherichia coli: Extremely high and consistent resistance levels exhibited for Ampicillin throughout the four-year period, with moderate resistance figures for Ciprofloxacin and Trimethoprim/Sulfamethoxazole

Country Response

Governance

National strategies, policies, and action plans have higher implementation success rates when their development is inclusive of all relevant stakeholders. Transparent governance and oversight are also essential at all stages of the preparation and sustainable implementation of such plans. Early on in the planning process for development of a national action plan for AMR in The Cayman Islands, it was decided that a core working group consisting of the three government representatives who attended regional training on AMR would exist, as well as a wider working group consisting of representatives from relevant sectors and departments within human, animal, and environmental health. A list of technical experts to consult was also created, which included tertiary medical institutions, private sector entities, voluntary organisations, and wider governmental departments such as customs, immigration, commerce, and the judiciary. In order to establish and maintain sound governance of the action plan, it was decided that the plan would:

- be officially approved by the government and published with open access to the general public
- have a dedicated budget for implementing the outlined activities with long-term investment to ensure sustainability
- align itself to a national health plan and other human, animal, plant, and environmental health strategies and food safety strategies
- have incremental targets, ensuring implementation in a stepwise manner to meet both local needs and global priorities
- be updated regularly, at a minimum of every 5 years, and be accompanied by a national AMR progress report regarding its implementation
- meet intergovernmental standards where relevant (e.g. Codex, OIE Code)

National AMR working group

In January 2017, a national, multi-sectoral working group was created to develop the action plan for antimicrobial resistance. Members of the government-led working group include representation from Ministry of Health, relevant departments of the government hospital (public health, infection control, microbiology, and pharmacy), as well as the Department of Agriculture and the Department of Environmental Health. The goals of the working group have been to ensure that a ‘one health’ approach is taken to AMR, as well as to oversee AMR strategic interventions and lobby for implementation of the national action plan. Technical advisement of the committee has mainly been provided by regional PAHO/WHO representatives. Following submission of the national action plan on AMR (May 2017), the working group aims to meet quarterly (or more frequently if required) to discuss AMR activities, goals, project deadlines, and other related business.

Strategic Plan

The overall goal of the action plan is to ensure the continuity of the ability to treat and prevent infectious diseases through the effective and safe use of quality-assured medicines, used in a responsible way by those who need them. To this end, the five strategic objectives (SOs) as outlined by the WHO are as follows:

1. Improve awareness and understanding of antimicrobial resistance through effective communication, education, and training
2. Strengthen the knowledge and evidence base through surveillance and research
3. Reduce the incidence of infection through effective sanitation, hygiene, and infection prevention measures
4. Optimise the use of antimicrobial medicines in human and animal health
5. Develop the economic case for sustainable investments that takes account of needs of all countries, and increase investment of new medicines, diagnostic tools, vaccines, and other interventions

What follows is a detailed outline of strategic interventions and activities which will be implemented and executed over the next three years. Bearing in mind the priority of AMR drivers/contributors, the largest focus has been placed on human and animal health, with moderate focus placed on environmental health, and minimal focus placed on the plant/crop sector.

Strategic Objective One: Improve awareness and understanding of antimicrobial resistance through effective communication, education, and training

Objectives:

- Identify clear terminology on AMR which can be used and understood by all
- Conduct regular nationwide awareness campaigns on AMR with the aim of changing general practices, behaviours, and perceptions as it relates to antimicrobials and their use by consumers, as well as those directly involved in human health, animal health, and agriculture
- Use the media, government websites, and social networking sites to promote and increase national awareness of AMR and to deliver messages to train the agents of change
- Include antimicrobial resistance in undergraduate curricula for medical doctors, veterinarians, and nurses
- Include antimicrobial resistance as part of continuing professional development for all sectors and professionals in human health, animal health, agriculture, and environmental health
- Include AMR and hygiene/biosecurity presentations in annual livestock farmer seminars

Specific interventions and activities with proposed deadlines:

- Participate in and promote AMR through World Antibiotic Awareness Week on an annual basis
- Assess AMR education as part of curriculum for the local medical school, veterinary school, and nursing school. Provide appropriate recommendations to the Ministry of Education and to each institution regarding necessary implementations
 - *Milestone: July 2017*
- Create a detailed report on the knowledge and use surrounding antimicrobials and antimicrobial resistance, using data collected from general public and healthcare practitioners' surveys conducted in early 2017
 - *Milestone: October 2017*
- Host a One Health Symposium on an annual basis, which features AMR and other relevant public health topics for the education and sensitisation of the general public, as well as professionals in One Health arenas
- Determine AMR education at private nurseries and landscaping companies. Provide appropriate recommendations to each institution regarding necessary implementations
 - *Milestone: October 2017*
- Develop an AMR handbook for use within human healthcare establishments which includes information on antimicrobial treatment guidelines
 - *Milestone: December 2017*
- Develop an AMR handbook for use by veterinarians and veterinary para-professionals which includes information on antimicrobial treatment guidelines
 - *Milestone: December 2017*
- Create a One Health website for the Cayman Islands which features information on AMR
 - *Milestone: January 2018*
- Create a committee which allows interaction between national plant and crop stakeholders, and where AMR and other relevant topics can be discussed
 - *Milestone: March 2018*

Strategic Objective Two: Strengthen the knowledge and evidence base through surveillance and research

Objectives:

- Fill gaps in knowledge as it relates to the incidence, prevalence, and drivers of AMR in human and animal populations, as well as in the environment
- Ensure key players understand how resistance develops and spreads, and how it can circulate within and between humans and animals, as well as through food, water, and the environment

- Define national objectives and standards across all sectors for the surveillance of antimicrobial resistance and a list of priority pathogenic, zoonotic, commensal, and indicator organisms
- Ensure harmonisation between human and animal laboratory testing methods and surveillance sampling methods
- Strengthen AMR data collection across all sectors, applying an integrated surveillance approach between human clinical samples, animal samples, and foods of animal origin.
- Ensure national surveillance and diagnostic tools and methods remain current across all sectors
- Maintain JCI accreditation for the government hospital laboratory
- Conduct and publish results from basic research to support AMR objectives
- Conduct and publish results from research identifying alternatives to nontherapeutic use of antimicrobials in agriculture
- Conduct and publish economic research which assesses the cost/impact of antimicrobial resistance, as well as the costs and benefits of implementing the outlined national action plan

Specific interventions and activities with proposed deadlines:

- Share information on national antimicrobial resistance research at the annual One Health Symposium
- Contribute AMR data to the Global Antimicrobial Resistance Surveillance System (GLASS) on an annual basis
- Build on the current government hospital laboratory's antibiogram to include antibiotics not conventionally reported
 - *Milestone: October 2017*
- Identify two priority animal health pathogens and collect, report, and monitor AMR data on an annual basis
 - *Milestone: December 2017*
- Submit samples of key organisms to CARPHA on a quarterly basis for antimicrobial sensitivity testing, and to assist with ascertaining the level of resistance present within the region
 - *Milestone: January 2018*
- Through the national communicable disease surveillance group, establish a national disease surveillance technical group with terms of reference to develop a national One Health surveillance system to include routine surveillance, sentinel surveillance, and surveys
 - *Milestone: January 2018*
- Update national slaughter regulations and submit to cabinet for approval
 - *March 2018*

- With a focus on municipal wastewater, hospital waste effluent, and soil, identify relevant environmental pathogens and collect, report, and monitor AMR data on an annual basis
 - Milestone: June 2018*
- Identify relevant food pathogens and collect, report, and monitor AMR data on an annual basis
 - Milestone: June 2018*
- Invest resources in studies for wastewater sites and their effect on the spread of AMR microorganisms
 - Milestone: October 2018*
- Establish a national reference laboratory where foodborne and animal pathogens can be analysed, and where antimicrobial resistance research and antimicrobial sensitivity testing can take place
 - Milestone: January 2019*

Strategic Objective Three: Reduce the incidence of infection through effective sanitation, hygiene, and infection prevention measures

Objectives:

- Continue to promote strong hygiene practices and infection prevention measures such as hand washing
- Continue to promote and educate the general public regarding food preparation and water safety
- Strengthen, and continue to advocate for and encourage the use of appropriate vaccination as an infection prevention measure
- Maintain current national percentage values, and seek to improve values for immunisations as per the PAHO immunisation schedule/guidelines
- Continue to promote sustainable animal husbandry practices, strong on-farm hygiene and biosecurity, as well as stress-free handling of animals
- Promote safe sexual practices to prevent infections transmitted through bodily fluids
- Promote good dietary nutrition and healthy lifestyle practices as a means to prevent infections and the need for antimicrobials

Specific interventions and activities with proposed deadlines:

- Participate in and promote International Infection Prevention Week activities on an annual basis
- Internally publish information on compliance and effectiveness of IPC practices at the government hospital and associated district clinics on an annual basis
- Assess IPC education as part of curriculum for the local medical school, veterinary school, and nursing school. Provide appropriate recommendations to each institution regarding necessary implementations and review every two years
 - Milestone: July 2017*

- Review IPC policies/SOPs/guidelines/protocols for major private hospitals and healthcare facilities. Provide recommendations/templates where necessary and review every two years
 - *Milestone: October 2017*
- Review IPC policies/SOPs/guidelines/protocols for congregate settings. Provide recommendations/templates where necessary and review documentation every two years
 - *Milestone: October 2017*
- Update 'Standards of Care' documents for all animal species, and create regulations surrounding best practice for animal rearing for submission to cabinet
 - *March 2018*

Strategic Objective Four: Optimise the use of antimicrobial medicines in human and animal health

Objectives:

- Educate clinicians, veterinarians, and pharmacists in order to eliminate unnecessary dispensing of antimicrobial, and hence increase their longevity
- Continue to place restrictions on non-therapeutic use of antibiotics within agriculture
- Maintain high levels of inspection vigilance at borders for the illegal/non-judicious importation of antimicrobial medicines/ products
- Increase regulation related to antibiotic distribution, quality, and use to aid in preserving effectiveness of antibiotics
- Encourage relevant stakeholders to regularly consult OIE resources on antimicrobial agents of veterinary importance
- Encourage relevant stakeholders to regularly consult WHO resources on essential medicines of human health importance

Specific interventions and activities with proposed deadlines:

- Collect data on antibiotic use in animals on an annual basis in order to develop a national database on antibiotic use in animals and report to the OIE as necessary
- Create a national policy which speaks to the general public, as well as to healthcare providers as it relates to the safe disposal of medicines and pharmaceutical waste
 - *Milestone: October 2017*
- Establish an antimicrobial stewardship team for the government hospital consisting primarily of microbiology, infection control, public health, and pharmaceutical personnel
 - *Milestone: December 2017*

- Implement a system of data collection, reporting, and monitoring on antimicrobial sales or consumption nationally for human healthcare establishments and pharmacies
 - *Milestone: January 2018*
- Implement a system of data collection, reporting, and monitoring of antibiotic prescribing and appropriate use in a sample of private and public healthcare facilities
 - *Milestone: January 2018*
- Establish a national stewardship programme for the animal sector
 - *Milestone: March 2018*
- Create Veterinary drug legislation for submission to cabinet
 - *Milestone: March 2018*

Strategic Objective Five: Develop the economic case for sustainable investment that takes into account the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines, and other interventions

Objectives:

- Via the AMR national action plan development working group (NAPDWG), continue to implement, execute, coordinate, and lobby for antimicrobial resistance activities
- Link the national antimicrobial resistance action plan to existing strategic plans from all sectors
- Ensure a dedicated secretariat and budget exist for the AMR working group
- Continue to identify specific sector issues related to antimicrobial resistance and national action plan implementation
- Continue to consult with national, regional, and international technical experts and stakeholders as it relates to the strategical operational plan on antimicrobial resistance
- Ensure international technical collaboration and information sharing on all aspects of antimicrobial resistance
- Participate in regional and international collaborative research to support the development of new medicines, diagnostic tools, and vaccines
- Develop agreements/regulatory measures to evaluate new vaccines, diagnostic methods, and antimicrobial drugs and include these in country health agendas

Specific interventions and activities with proposed deadlines:

- Conduct a comprehensive impact analysis on antimicrobial resistance in The Cayman Islands
 - *Milestone: October 2017*
- Create a realistic AMR activity and initiatives budget after assessing investment needs, funding sources, and relevant partners to engage
 - *Milestone: December 2017*
- Review the OIE Veterinary performance tool as it relates to human resources, staff education, laboratory capacity, and compliance with OIE standards for Veterinary Services
 - *Milestone: April 2018*
- Expand the existing public health department to include a ‘One Health’ representative who will be primarily responsible for One Health initiatives and activities for the Cayman Islands
 - *Milestone: January 2019*
- Ensure regular meetings of the AMR NAP development working group; at least quarterly
- Provide annual financial contribution to regional or international diagnostic tools or research related to AMR
- Review the antimicrobial resistance action plan for the Cayman Islands every three years, or more frequently if necessary

Operational plan and budget

Several AMR activities have been executed and implemented, and can be identified in the situational analysis section of this action plan. The AMR working group has been deliberate with identifying which individuals, sectors, or institutions will be responsible for which activities, and the proposed deadlines by which these should be achieved. These activities will be continuously reviewed during quarterly working group meetings. Further discussion is necessary regarding the specific calculated budget for implementing each activity, as well as the indicator(s), milestones, and targets that will be used to monitor the execution/implementation of each activity.

The budget for AMR activities will originate from the Ministry of Health, Ministry of Agriculture, and other relevant government and private sectors. External funding will be coordinated by the national AMR working group. Appropriate finance/accounting expertise will be sought and engaged in preparing the NAP budget, particularly with regards to procurement, supply, and costing. Information to be clearly indicated in the budget includes: source and funding for each intervention, government contributions, the expected funding gap, ideas to fill the funding gap, and the activities and strategic interventions required to achieve NAP objectives that are not funded. National action plan development toolkit references and resources from international bodies such as the WHO will also be consulted. The AMR budget will be reviewed every three years in alignment with the overview of the national action plan.

Monitoring and evaluation plan

Monitoring and evaluation (M&E) are essential managerial and governance functions in health plans. Indicators, targets, baselines, data collection methods, and responsible entities have been and will continue to be identified in order to provide a comprehensive framework for the progress made in implementing planned AMR activities (monitoring), as well as the progress made in achieving intended AMR goals and objectives (evaluation).

Locally appropriate outcome indicators will be feasible, tangible, easy to measure, and will highlight positive momentum, or obstacles in the implementation process. The national action plan on AMR will remain a live document, and a process of review and revisiting while activities and initiatives are being implemented will take place via the AMR NAPDWG. As part of SO5, a national AMR progress report will be published within five years after adoption of this action plan. This report will allow any required changes to the implementation process to be made, and will intend to answer the following questions in particular:

- Have the targets been achieved? Can they be achieved?
- Were the timeframes/milestones realistic?
- Were the correct implementation steps taken?
- Are the instruments and measures effective and efficient?
- What consequences can be drawn and what recommendations can be made in respect to the results/outcome of each implementation?

Key resources for M&E will include the following documents:

- Monitoring, evaluation and review of national health strategies. A country-led platform for information and accountability. Geneva: International Health Partnership, WHO; 2011
- Sample conceptual monitoring and evaluation framework for national action plans on antimicrobial resistance
- WHO M&E framework for AMR, which will include output, outcome, and impact indicators

References

1. A framework for national health policies, strategies and plans. Geneva: WHO; 2010 (http://www.who.int/nationalpolicies/FrameworkNHPSP_final_en.pdf).
2. Antimicrobial Resistance: A manual for developing national action plans (FAO, OIE, WHO 2016)
3. Antibiotic Resistance: Handle Antibiotics with care, WHO/PAHO Infographic, www.who.int/drugresistance
4. [Antibiotic resistance: Q&A for WHO spokespeople, November 2016](#)
5. Antimicrobial Resistance and Use in Canada: A Federal framework for action
6. Antimicrobial Resistance: What you need to know, Dorman, S. November 2016
7. Barriere, S.L., PharmD (2015) Clinical, economic and societal impact of antibiotic resistance, Expert Opinion on Pharmacotherapy, 16:2, 151-153
<http://www.tandfonline.com/doi/pdf/10.1517/14656566.2015.983077?needAccess=true>
8. Causes of Antibiotic Resistance, WHO/PAHO Infographic
9. Economic Aspects of Antibiotic Resistance: A Factsheet from ReAct-Acion on Antibiotic Resistance, May 2008, www.reactgroup.org
10. Global action plan for antimicrobial resistance (World Health Assembly document A68/20, 27 March 2015) (http://www.who.int/drugresistance/global_action_plan/en/).
11. OIE: (<http://www.oie.int/en/for-the-media/amr/>)
12. O'Neill review on Antimicrobial Resistance, 2014, www.amr-review.org
13. Poppy, G., Antimicrobial resistance in the food supply chain, Chief Scientific Adviser's Science Report, Food Standards Agency, UK <https://www.food.gov.uk/sites/default/files/csa-amr-report.pdf>
14. Rousseau, O., FAO to cut antimicrobial resistance in food supply chain, Global Meats news.com, September 2016 http://mobile.globalmeatnews.com/Industry-Markets/FAO-to-cut-antimicrobial-resistance-in-food-supply-chain?utm_source=RSS_text_news&utm_medium=RSS_feed&utm_campaign=RSS_Text_News
15. Sample conceptual M&E framework for national action plans on antimicrobial resistance. WHO; 2015. (<http://www.who.int/drugresistance/action-plans/en/>)
16. Strategy on Antibiotic Resistance Switzerland, November 18 2015
17. Template for a national action plan on antimicrobial resistance. WHO; 2015.
(<http://www.who.int/drugresistance/action-plans/en/>)
18. The Government of Fiji: Fiji National Antimicrobial Resistance Action Plan 2015
19. The World Bank, By 2050, drug-resistance infections could cause global economic damage on par with 2008 financial crisis, September 2016 <http://www.worldbank.org/en/news/press-release/2016/09/18/by-2050-drug-resistant-infections-could-cause-global-economic-damage-on-par-with-2008-financial-crisis>

20. UK Five Year Antimicrobial Resistance Strategy 2013-2018
21. Union of Concerned Scientists, Prescription for Trouble: Using Antibiotics to fatten Livestock, n.d
http://www.ucsusa.org/food_and_agriculture/our-failing-food-system/industrial-agriculture/prescription-for-trouble.html#.WCs0RrlrKUk .
22. WHO: (<http://www.who.int/drugresistance/en/>)

Appendices

- 1. List of technical experts to consult for the development and implementation of AMR activities for The Cayman Islands**
 - Human health
 - Ministry of Health
 - Public Health Department
 - St. Matthews University School of Medicine
 - Cayman Islands Medical and Dental Society
 - Health Practice Commission
 - Animal health, welfare, and production including fisheries
 - Ministry of Agriculture (PLAHI)
 - Department of Agriculture
 - St. Matthews University School of Veterinary Medicine
 - Cayman Islands Agriculture Society
 - Cayman Animal Hospital
 - Island Veterinary Services
 - The Veterinary Clinic and specialty pet boarding
 - Cayman Islands Veterinary Medical Association
 - Food safety and security, including food production and processing
 - Cayman Islands Customs
 - Department of Agriculture
 - Department of Environmental Health
 - Plants and agriculture
 - Ministry of Agriculture (PLAHI)
 - Department of Agriculture
 - Cayman Islands Agriculture Society
 - Nurseries/Landscaping companies

- Environment, including water and sewage
 - Department of Environment
 - Department of Environmental Health
 - Water Authority Cayman
 - Cayman Water Company
 - Mosquito Research and Control Unit
- Technical disciplines
 - Public Health
 - Public and Private pharmacies
 - Public and private laboratories
 - Infection control coordinator
- Others
 - Ministry of Tourism/Department of Tourism
 - Department of Education
 - Ministry of Finance/Commerce
 - Department of Immigration
 - Legal sector/judiciary
 - CINICO and other insurance companies
 - Other Universities (e.g. UCCI, ICCI)
 - Appropriate voluntary organisations
 - Regulatory authorities (medicines, agricultural products)

2. Survey: Antibiotics and Antimicrobial Resistance in the Cayman Islands

What follows is a survey that was conducted over a two-week period in February 2017. The target audience was the general public of the Cayman Islands, and the objectives of the survey were to gain an understanding of how safely and accurately antibiotics are used on the island, as well as how aware members of the public were regarding antimicrobial resistance (AMR) as a topic, its causes, and how the spread of AMR takes place. Along with a survey targeting healthcare professionals (Appendix 3), this survey will be used to generate a report on antibiotic use and antimicrobial resistance for the Cayman Islands.

Antibiotics and Antimicrobial Resistance in The Cayman Islands

1. Are you male or female?

- Male
- Female

2. What is your age?

- 20 or younger
- 21-30
- 31-40
- 41-50
- 51-60
- 61 and older

3. In which district do you reside?

- West Bay
- George Town
- Bodden Town
- North Side
- East End
- Cayman Brac
- Little Cayman

4. What is the highest level of education that you have completed?

- No schooling completed
- High school or less, no diploma/qualifications
- High school graduate with diploma/qualifications
- Some college credits, no degree
- Technical/Vocational training OR Associates degree
- Bachelor's degree
- Masters/Professional degree
- Doctorate degree

5. When did you last take antibiotics?

- In the last month
- In the last 6 months
- In the last year
- More than a year ago
- Never
- Can't remember

6. On that occasion, did you get the antibiotics or a prescription for them from a doctor?

- Yes
- No
- Not applicable

7. Do you think this statement is true or false? - 'It's okay to use antibiotics that were given to a friend or family member, as long as they were used to treat the same illness'

- True
- False

8. Which of the following conditions can be treated with antibiotics? Select all that apply.

- HIV/AIDS
- Gonorrhea
- Bladder infection or urinary tract infection (UTI)
- Diarrhoea
- Flu virus
- Fever
- Malaria
- Skin or wound infection
- Sore throat
- Body aches
- Headaches
- Zika virus

9. Which of the following terms are you familiar with/have you heard before? Select all that apply.

- Antibiotic resistance
- Superbugs
- Antimicrobial resistance
- AMR
- Drug resistance
- Antibiotic-resistant bacteria
- MRSA
- Multi-drug resistance

10. For the terms selected above, where did you hear about them? Select all that apply.

- Doctor or nurse
- Pharmacist
- Other healthcare professional
- Family member or friend (including on social media)
- Media (newspaper, TV, radio, social media)
- Specific campaign
- Can't remember
- Other (please specify)

11. Please indicate which of the following statements you believe to be true. Select all that apply.

- Antibiotic resistance occurs when your body becomes resistant to antibiotics and they no longer work well
- Many infections are becoming increasingly resistant to treatment by antibiotics
- If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause
- Antibiotic resistance is an issue that could affect me or my family
- Antibiotic resistance is an issue in other countries but not in The Cayman Islands
- Antibiotic resistance is only a problem for people who take antibiotics regularly
- Bacteria which are resistant to antibiotics can be spread from person to person
- Antibiotic-resistant infections could make medical procedures like surgery, organ transplants, and cancer treatment much more dangerous
- Antibiotic-resistant infections can be contracted from interaction with or exposure to animals or animal products (including pets, livestock)

12. On a scale of 1-5 (1{extreme left}= disagree strongly, 2= disagree slightly, 3= neither agree nor disagree, 4= agree slightly, 5 {extreme right} = agree strongly), indicate how much you agree that the following actions would help address the problem of antimicrobial resistance. **Note that questions relate to the global problem of antimicrobial resistance, and not just the situation in The Cayman Islands**

	1	2	3	4	5
People should use antibiotics only when they are prescribed by a doctor	<input type="radio"/>				
Farmers and Veterinarians should give fewer antibiotics to food-producing animals	<input type="radio"/>				
People should not keep antibiotics and use them later for other illnesses	<input type="radio"/>				
Parents should make sure that all their children's vaccinations are up-to-date	<input type="radio"/>				
People should wash their hands regularly	<input type="radio"/>				
People should wash fruits and vegetables before consumption	<input type="radio"/>				
People should cook meat thoroughly	<input type="radio"/>				
Doctors should only prescribe antibiotics when they are needed	<input type="radio"/>				
Governments should reward the development of new antibiotics and vaccines	<input type="radio"/>				
Pharmaceutical companies should develop new antibiotics and vaccines	<input type="radio"/>				

13. On a scale of 1-5 (1{extreme left} = disagree strongly, 2= disagree slightly, 3= neither agree nor disagree, 4= agree slightly, 5 {extreme right} = agree strongly), indicate how much you agree with the following statements.

	1	2	3	4	5
Antibiotic resistance is one of the biggest problems the world faces	<input type="radio"/>				
Medical experts will solve the problem of antibiotic resistance before it becomes too serious	<input type="radio"/>				
Everyone needs to take responsibility for using antibiotics responsibly	<input type="radio"/>				
There is not much that people like me can do to stop antibiotic resistance	<input type="radio"/>				
I am worried about the impact that antibiotic resistance will have on my health, and that of my family	<input type="radio"/>				
I am not at risk of getting an antibiotic-resistant infection, as long as I take my antibiotics correctly	<input type="radio"/>				

14. Do you think that antibiotics are widely used in the rearing of food-producing animals in The Cayman Islands?

- Yes
- No
- Don't know

15. Do you think that antibiotics are widely used in the farming of fruits and vegetables in The Cayman Islands?

- Yes
- No
- Don't know

16. Do you think that antibiotics are widely used in animal products being imported into your country?

- Yes
- No
- Don't know

17. Do you think that antibiotics are widely used in fruits and vegetables imported into your country?

- Yes
- No
- Don't know

3. Survey: Antimicrobials and Healthcare Professionals in the Cayman Islands

What follows is a survey that was conducted over an eight week period in March 2017. The target audience was medical doctors, dentists, and veterinarians; i.e., those who prescribe antimicrobials in the Cayman Islands. The objectives of the survey were to gather information regarding which antimicrobials are commonly prescribed in human and animal health, as well as the awareness of the antibiogram data which is conducted on a six-monthly basis and disseminated to all human health physicians. As of December 2016, the data is also shared with local veterinarians. Along with a survey targeting the general public (Appendix 2), this survey will be used to generate a report on antibiotic use and antimicrobial resistance for the Cayman Islands.

Antimicrobials and Healthcare Professionals in The Cayman Islands

1. Are you male or female?

 Male Female

2. What is your age?

 20 or younger 21-30 31-40 41-50 51-60 61 and older

3. What is your profession?

 Medical doctor Dentist Veterinarian

4. How would you best describe the environment in which you work?

 Public practice Private practice

Other (please specify)

5. How many years of work experience have you had since graduation?

- Less than 1 year
- 1-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21 years or more

If you are a Veterinarian, please go directly to question 9 (omit questions 6-8)

6. For the following situations, select the antibiotic which you would prescribe prophylactically to an adult patient with no allergies.

	I don't prescribe antibiotics	Penicillin VK	Cloxacillin	Amoxicillin	Amoxicillin with clavulanic acid	Other antibiotic	Not applicable
Always before every root canal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Only before endodontic surgery	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HIV positive patients	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HBs positive patients	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-controlled diabetic patients	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Congenital heart disease (AV shunt and cardiac valve replacement)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mitral valve prolapse	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prosthetic joint in past 2 years	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
History of cancer and/or radiotherapy	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. For the following conditions, select the antibiotic you would prescribe to an adult patient with no allergies.

	I don't prescribe antibiotics	Penicillin VK	Cloxacillin	Amoxicillin	Amoxicillin with clavulanic acid	Other antibiotic	Not applicable
Symptomatic irreversible pulpitis	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Symptomatic apical periodontitis	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	I don't prescribe antibiotics	Penicillin VK	Claudiomycin	Amoxicillin	Amoxicillin with clavulanic acid	Other antibiotic	Not applicable
Acute apical abscesses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chronic apical abscesses with sinus tract	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chronic apical periodontitis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
After all root canal treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In a patient with fever and malaise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In a patient with diffuse swelling within the oral cavity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In a patient with swelling and difficulty swallowing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In a two-visit root canal treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In re-treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If the patient insists	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In a prolonged root canal treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. For each of the following conditions and diseases, select which antimicrobial agent you would be most likely to use.

	I don't prescribe antimicrobials	Augmentin	Cefuroxime	Ciprofloxacin	Metroxicazole	Trimeth/Sulph	Doxycycline	Other antimicrobial drug	Not applicable
Surgical prophylaxis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Chronic Obstructive Pulmonary Disease (COPD): infective exacerbation	◀	◀	◀	◀	◀	◀	◀	◀	◀
Cholecystitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Community-acquired pneumonia	◀	◀	◀	◀	◀	◀	◀	◀	◀
Urinary tract infection (UTI)	◀	◀	◀	◀	◀	◀	◀	◀	◀
Cellulitis/erysipelas	◀	◀	◀	◀	◀	◀	◀	◀	◀
Appendicitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Wound infection: surgical	◀	◀	◀	◀	◀	◀	◀	◀	◀
Pneumonia: aspiration	◀	◀	◀	◀	◀	◀	◀	◀	◀
Pneumonia: hospital-acquired	◀	◀	◀	◀	◀	◀	◀	◀	◀
Abscess	◀	◀	◀	◀	◀	◀	◀	◀	◀
Sepsis: empirical therapy	◀	◀	◀	◀	◀	◀	◀	◀	◀
Diverticulitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Osteomyelitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Sepsis: gram-negative bacteraemia	◀	◀	◀	◀	◀	◀	◀	◀	◀
Diabetic infection (including foot)	◀	◀	◀	◀	◀	◀	◀	◀	◀
Sepsis: gram-positive bacteraemia	◀	◀	◀	◀	◀	◀	◀	◀	◀

	I don't prescribe antimicrobials	Penicillin	Metronidazole	Amoxiclav	Cephalexin	Trimeth/Sulpha	Tetracycline	Other antimicrobial drug	Not applicable
Retained foetal membranes	◀	◀	◀	◀	◀	◀	◀	◀	◀
Rumen acidosis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Pancreatitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Fever	◀	◀	◀	◀	◀	◀	◀	◀	◀
Coccidiosis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Gingivitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Meatitis/Pyometra	◀	◀	◀	◀	◀	◀	◀	◀	◀
Bladder infection/Urinary tract infection (UTI)	◀	◀	◀	◀	◀	◀	◀	◀	◀
Abscess	◀	◀	◀	◀	◀	◀	◀	◀	◀
Upper respiratory tract infection	◀	◀	◀	◀	◀	◀	◀	◀	◀
Cascous lymphadenitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Pertonitis	◀	◀	◀	◀	◀	◀	◀	◀	◀
Diarrhoea: adult	◀	◀	◀	◀	◀	◀	◀	◀	◀
Diarrhoea: newborn	◀	◀	◀	◀	◀	◀	◀	◀	◀
Cat scratch disease	◀	◀	◀	◀	◀	◀	◀	◀	◀
Pneumonia	◀	◀	◀	◀	◀	◀	◀	◀	◀
Otis	◀	◀	◀	◀	◀	◀	◀	◀	◀

10. On a scale of 1-5, how important are the following factors in your decision-making regarding choice of antimicrobial therapy? (1= not at all important, 2=slightly important, 3= important, 4= very important, 5= extremely important)

	1	2	3	4	5
Availability of non-pharmacologic therapies	<input type="radio"/>				
Mode of action	<input type="radio"/>				
Drug efficacy	<input type="radio"/>				
Duration of action	<input type="radio"/>				
Typical response rate	<input type="radio"/>				
Spectrum of activity	<input type="radio"/>				
Culture and Sensitivity results	<input type="radio"/>				
Cost	<input type="radio"/>				
Resistance patterns for the antimicrobial in question	<input type="radio"/>				
Ease of availability	<input type="radio"/>				
Effect of antimicrobial agent on co-existing medications or allergies	<input type="radio"/>				
Ability to alter treatment plan/ remove antimicrobial agent from treatment plan based on microbiology results	<input type="radio"/>				
Current research related to the disease/condition in question	<input type="radio"/>				
Risk of adverse effects/events	<input type="radio"/>				
Patient's expressed need or desire for the prescription	<input type="radio"/>				
Antimicrobial prescribing audits	<input type="radio"/>				
Consequences of future resistance	<input type="radio"/>				
Consultation with therapeutic guidelines within your practice	<input type="radio"/>				
Related public health implications	<input type="radio"/>				

11. Are you familiar with the regularly-disseminated antibiogram produced by the Health Services Authority (HSA) Laboratory?

Yes

No

12. If you are aware of the antibiogram, do you use it to make decisions related to drug/prescription choice?

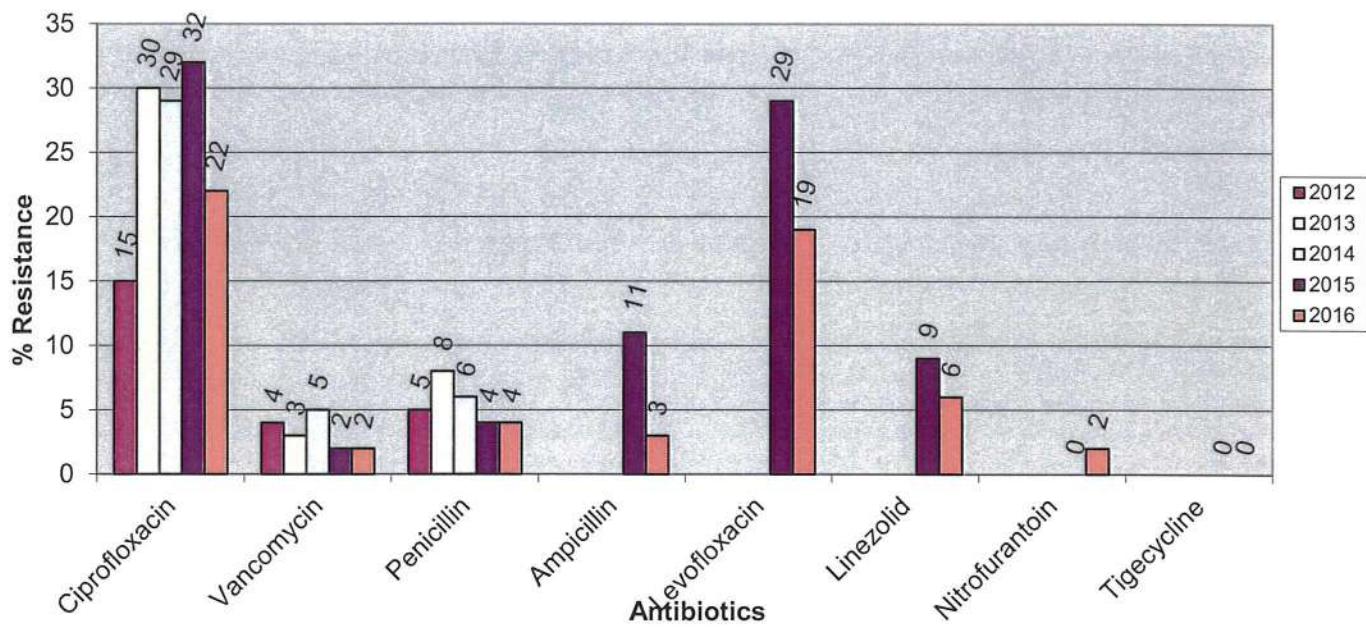
Yes

No

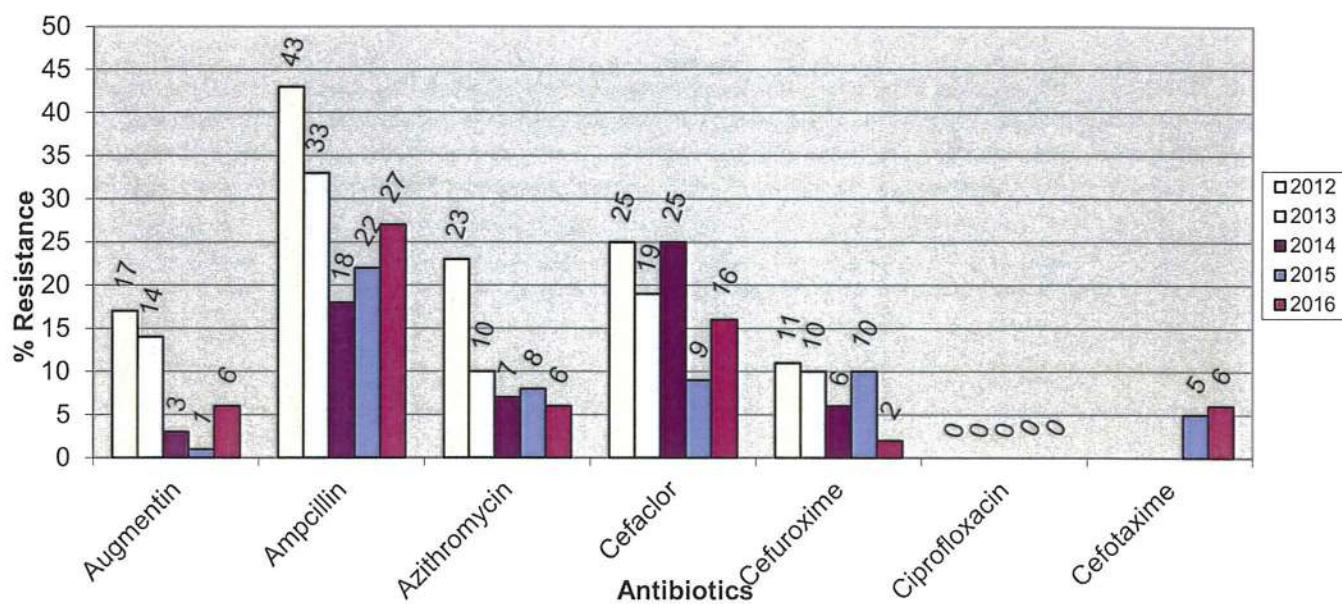
Not applicable

4. Cayman Islands Health Services Authority (H.S.A.) Antibiogram January 2012- December 2016

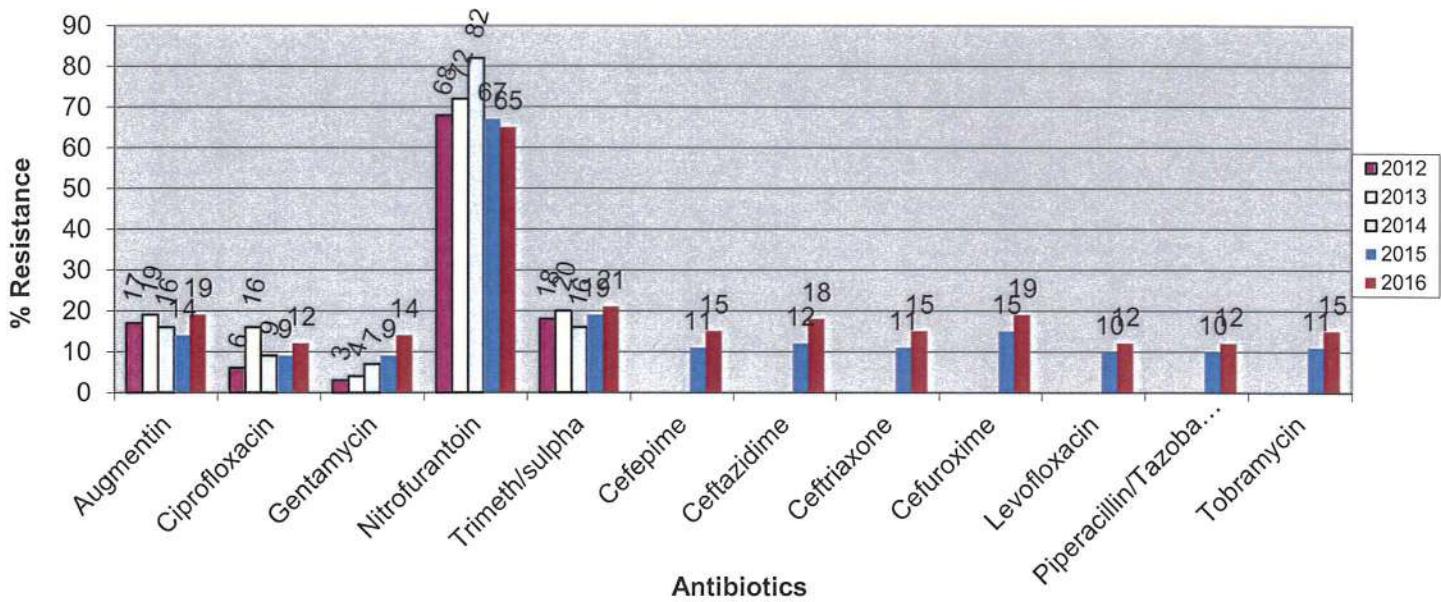
**CI Health Services Authority Pathology Laboratory Antibiotic Resistance
Enterococcus faecalis (Jan 2012 - Dec 2016)**



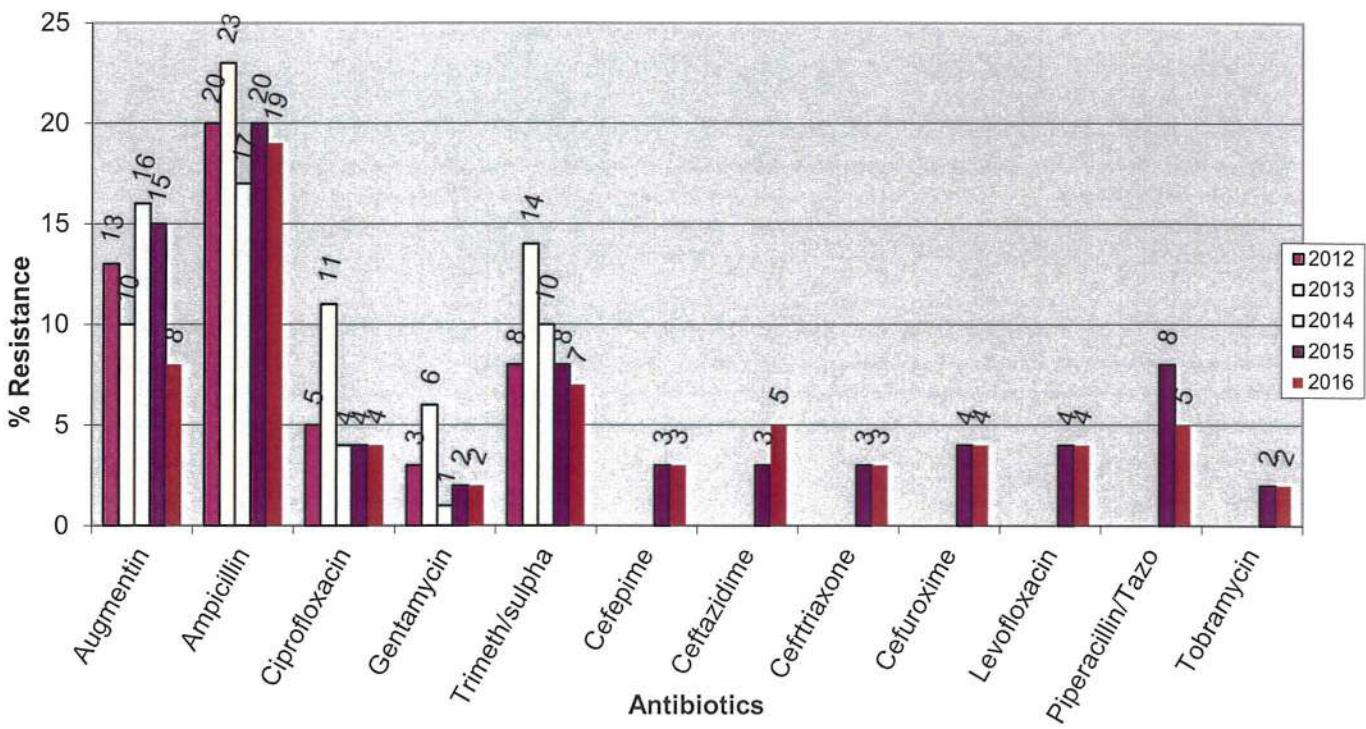
**CI Health Services Authority Antibiotic Resistance
Haemophilus influenzae (Jan 2012 - Dec 2016)**



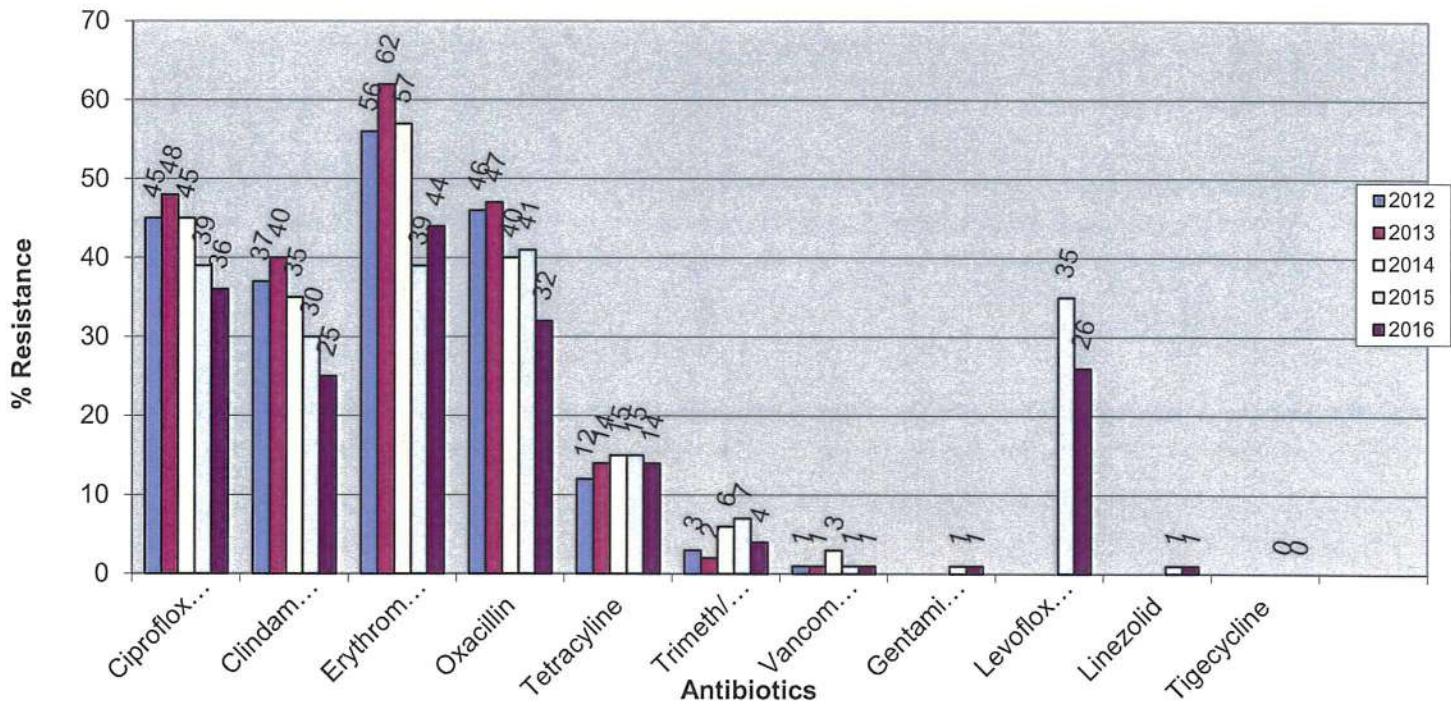
**CI Health Services Authority Pathology Laboratory Antibiotic Resistance
Klebsiella Pneumoniae (Jan 2012 - Dec 2016)**



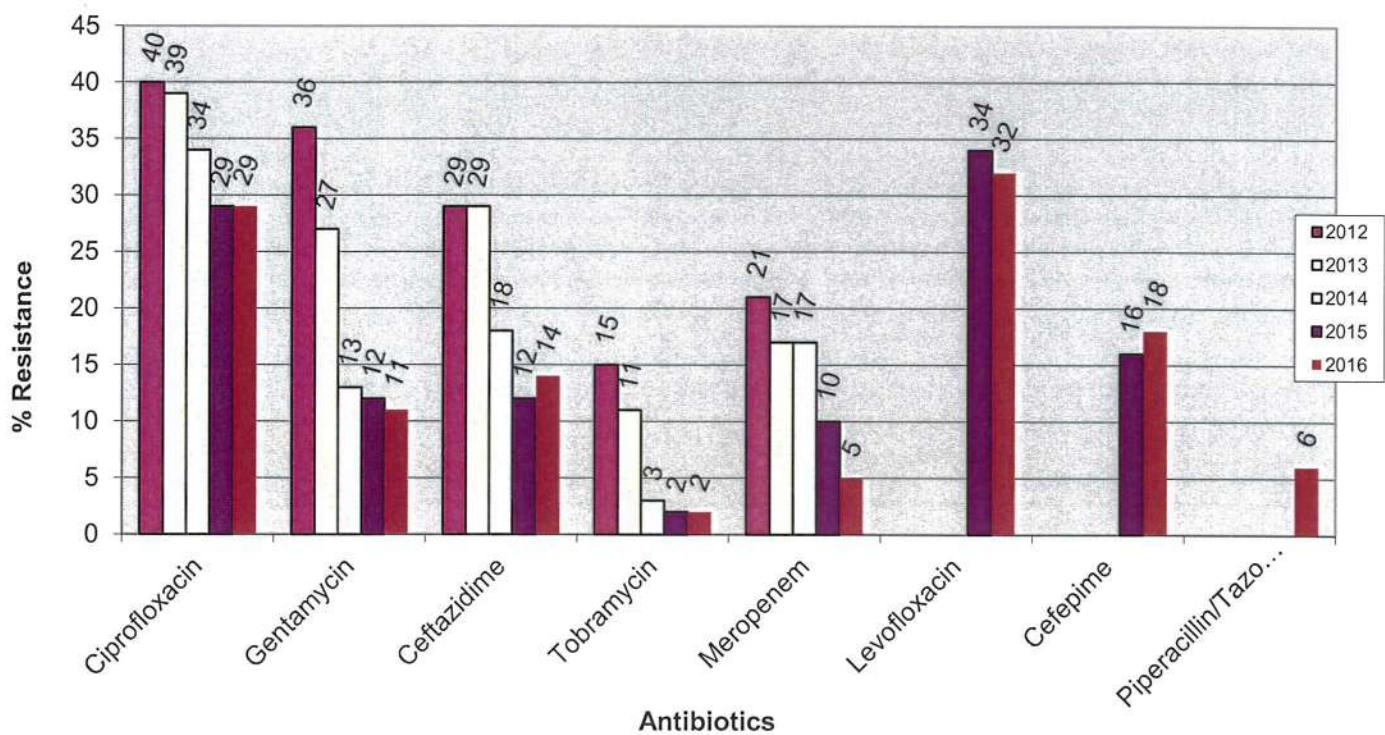
**CI Health Services Authority Pathology Lab Antibiotics Resistance
Proteus mirabilis (Jan 2012 - Dec 2016)**



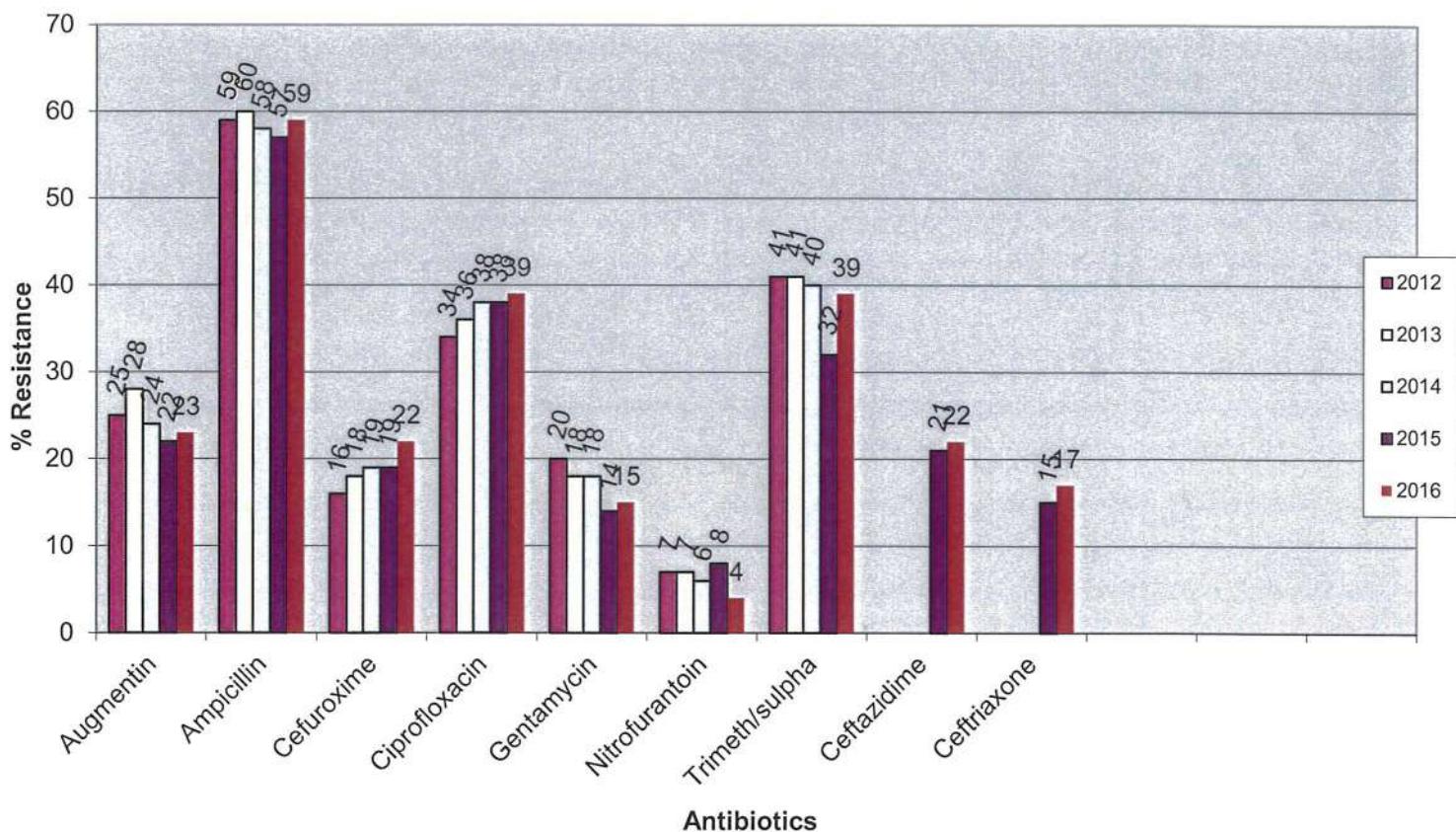
**CI Health Services Authority Pathology Laboratory Antibiotic Resistance
Staphylococcus aureus (Jan 2012 - Dec 2016)**



**CI Health Services Pathology Laboratory Antibiotic Resistance
Pseudomonas aeruginosa (Jan 2012 - Dec 2016)**



CI Health Services Authority Pathology Laboratory Antibiotic Resistance
E. coli (Jan 2012 - Dec 2016)



5. Photo of Antimicrobial Resistance National Action Plan Development Working Group for the Cayman Islands



L-R: Dale Chin, Microbiologist; Dana Scott, Infection Control Officer; Hazel Gordon-Fletcher, Infection Control Coordinator; Samantha Conolly, Pharmacist; Timothy McLaughlin-Munroe, Public Health Surveillance Officer/Deputy National Epidemiologist; Dr. Samantha Dorman, Veterinary Officer Department of Agriculture; Dr. Samuel Williams-Rodriquez, Medical Officer of Health. **Not pictured:** Dr. Eryka Simmons, General Practitioner; Antoinette Johnson, Laboratory Manager Department of Environmental Health; Colin Medford, Chief Pharmacist; Sarah Hetley-Frederick, Executive Secretary Public Health; Saleicia Samaroo, Public Health Intern