

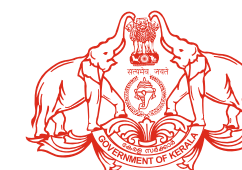
ONE HEALTH
Kerala Antimicrobial Resistance
Strategic Action Plan
Implementation Report 2019



KARSAP - Implementation Report



Department of Health and Family Welfare
Government of Kerala



Department Of Health And Family Welfare
Government Of Kerala
Annexe II, Secretariat
Thiruvananthapuram
Kerala-695001
Kerala HEALTH

January 2020

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PINARAYI VIJAYAN
CHIEF MINISTER



Secretariat
Thiruvananthapuram-695 001

No.140/Press/CMO/2020.

25th January, 2020.

MESSAGE

I am happy to note that the first year activities of Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) jointly developed by the Departments of Agriculture, Animal Husbandry, Fisheries, Environment, Health & Family Welfare of the Government of Kerala in partnership with many other stake holders, have made significant progress in all the strategic priorities.

KARSAP is the first State Level Action Plan to be conceptualized and implemented in India. It recognizes the linkages between different sectors captured in the "One Health" policy announced by World Health Organization. I am happy that all the concerned departments under the Government of Kerala have come together in the true spirit of "One Health" and worked sincerely to achieve the one year targets set under KARSAP. I hope that it will become an inspiration and guidance for other states to develop and implement similar Action Plans.

Antimicrobial resistance (AMR) is a global issue and actions are needed at every level to combat it. But action at the State, District, Sub-district and Institution level will be critical. The Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) outlines the strategic priorities and activities to achieve the objectives, outputs and outcomes, right from awareness and knowledge, surveillance, optimizing antimicrobial use including antimicrobial stewardship, research to infection prevention and control.

Establishment of KARS-NET will help in understanding the ground level antimicrobial resistance in the state, which will definitely help in the fight against AMR. The sustainability of KARSAP depends on the attitude of all the stakeholders in the programme and the extent to which it gets implemented. I am sure, our State will become a model to the entire nation to develop and implement their own strategic against this global issue. AMR crisis is as complex as climate change. KARSAP can be viewed as the State's first and decisive step in the fight against AMR.

I wish all success to stakeholders in their endeavour to make Kerala an antibiotic literate state by 2021.

Pinarayi Vijayan



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Message from Health Minister

Reviewing the first year activities of Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) gives me immense pride and pleasure. KARSAP is the flagship project of the state in its fight against the growing threat of AMR.. Antimicrobial Resistance (AMR) is a serious global public health threat which can be tackled only by a “One Health” approach.. Major drivers of AMR include inappropriate use of antimicrobials in healthcare as well as in animal husbandry, especially those used for non-therapeutic purpose like growth promotion in agriculture and fisheries. AMR being a very complex issue, can be addressed only by a collaborative and comprehensive approach. KARSAP is an embodiment of such a multi-sectoral and multi-stakeholder approach.



The KARSAP has been developed involving multiple sectors and it addresses a wide range of activities required to tackle AMR problem effectively. I am glad to acknowledge the support provided by the World Health Organisation Country Office for India in the development and implementation of KARSAP, which requires commitment and complementary efforts from all related sectors including health professionals – which include doctors, nurses, microbiologists, pharmacologists, researchers – veterinarians, farmers those involved in fisheries and all other related stakeholders. Establishment of KARS-NET is a feather in the cap of KARSAP. Programme of removal of unused drugs [PROUD] campaign, which is a joint initiative by State drugs control department and All Kerala Chemists and Druggists Association, is a major step taken under KARSAP to bring down the environmental impact due to improperly disposed antibiotics.

Kerala has set its target on becoming an Antibiotic literate state by 2021. In order to achieve this aim, educational campaigns in AMR addressing all levels of Society was rolled out along with WHO World Antibiotic Awareness Week Activities in 2019. I would like to applaud all the parties involved either directly or indirectly in developing and upraising this action plan including national government and partners like WHO Country Office for India.

I hope that this Annual report of KARSAP One Health activities will provide guidance towards responsible use of antimicrobial agents in the efforts to combat AMR and preserve the efficiency of these precious drugs for the present and the future generation.

K.K. Shailaja Teacher

Hon'ble Minister for Health & Family Welfare

Message from WHO Representative to India



Antimicrobial resistance (AMR) is a serious threat to global public health. Combating AMR requires proactive action across all government sectors and the society. An effective response requires coordinated action at the global, regional, national and sub-national levels. The Global Action Plan on AMR (GAP-AMR) was endorsed by the World Health Assembly in 2015. AMR is a flagship priority of WHO Regional Office for South-East Asia and a key priority under WHO-India Country Cooperation Strategy 2019-2023. WHO supported the development of India's National Action Plan on Antimicrobial Resistance and the Delhi Declaration on Antimicrobial Resistance, that were endorsed in April 2017.

Kerala was the first state to develop the Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP), which was launched by the Hon'ble Chief Minister of Kerala, Mr Pinarayi Vijayan and the Hon'ble Health Minister, Ms K K Shailaja Teacher on 25 October 2018 in Thiruvananthapuram. I was a witness to this proud moment for the State Government. WHO is honoured to have facilitated the development and implementation of Kerala Antimicrobial Resistance Strategic Action Plan, which emphasise antimicrobial resistance (AMR) as a strategic priority of the state government of Kerala. WHO is also supporting the strengthening and expansion of the Kerala Antimicrobial Resistance Surveillance Network (KARS-NET) in the state.

I congratulate the Hon'ble Chief Minister and the Hon'ble Health Minister for overseeing AMR containment in Kerala through KARSAP, by engaging stakeholders from human health, animal husbandry, fisheries, food and environment sectors, in a One Health approach. I also congratulate the Principal Secretary Health, Dr Rajan Khobragade for operationalizing KARSAP.

Kerala is the first state to review its state action plan at the Regional Workshop on AMR being organised from 31 January to 1 February 2020 in Kochi, jointly organized by the Kerala Government, Ministry of Health & Family Welfare and WHO. This workshop will showcase Kerala's experience of AMR containment to six states and one union territory as an example of how to develop and implement State Action Plans for Containment of AMR.

I also commend the Kerala Government's initiative to raise awareness about AMR it's

through antibiotic literacy campaign. Infection Prevention and Control is a critical cross-cutting area to reduce infections and antibiotic use. The National Guidelines for Infection Prevention and Control in Healthcare Facilities, developed jointly by the Ministry of Health & Family Welfare, Government of India and WHO, which can guide the strengthening of IPC practices in all states. Undoubtedly, Kerala is a pioneer and has taken a leadership role in AMR containment in India.

DR HENK BEKEDAM

Foreword

Kerala health with a long-term strategy is undertaking various initiatives in a life cycle approach. For each phase in life, there are structured interventions planned and under implementation. One can see the outcomes in the form of achieving SDG goals and levels of achievements of the respective indicators. The noticeable aspect of the overall strategy of the Health Department is that there are other complementary initiatives such as a large cohort studies, antimicrobial resistance strategic action plan, focus on primary health care through Aardram Mission and developing electronic health records system, public health approaches for controlling Non Communicable diseases to name a few strategic interventions.

The health initiatives in Kerala can be described as a continuous Public action. Any program is structured with the participation of the stakeholders. The program later gets rolled out in a specific way with the capacity building of all the stakeholders, involvement of the structures i.e Family Health Centers, Community Health Centers, General Hospitals, District Hospitals to the Medical Colleges including private sector health institutions and functionaries. The awareness building among population is done through involvement of people's representatives at the ward member of Gram Panchayath to MLAs in their respective constituencies, which is further guided by proactive involvement of the Hon Chief Minister and Hon Health Minister. The strong Panchayathi Raj System provides a platform to take various initiatives in the Health sector and the sectors related to social determinants of the health.

The Antimicrobial Resistance containment is not possible only through the Health Department. It needs collaborative efforts from all the line departments. The line departments like Animal Husbandry, Fisheries, Agriculture and other departments are partners of the program. They have been taking various activities as per the KARSAP.

Antimicrobial Resistance containment challenges are plenty, antibiotic misuse in both humans and animals, management of waste from hospitals, farms, pharmaceutical industry and households to unregulated access to antimicrobials. This requires a multipronged approach such as regulatory framework and capacities to deal with varied situations. It is felt that the most fundamental intervention is educating the masses. Our continuous efforts in bringing in systems and processes in the institutional settings of various departments including health will continue but we will have to bring primary focus on educating each and every individual with respect to ANTI MICROBIAL RESISTANCE.

The state started taking action under guidance of Hon Chief Minister and Hon Health Minister from October 2017 and in October 2018 the Kerala Antimicrobial Resistance Strategic

Action Plan was launched. After the launch, a series of meetings and workshops were conducted involving all the stakeholders.

WHO has been supporting the initiative right from the start. As the program implementation is meticulously followed up and got introduced in the State, the nodal officer WHO requested to conduct a Regional Workshop inviting the Southern States for experience sharing and facilitating the preparation of framework for their respective States. Hon Health Minister readily agreed to the suggestion and asked the State team to facilitate the organization of the workshop. The Health & Family Welfare Department along with the WHO is organizing a Regional workshop on 31st January and 1st February 2020 at Kochi.

The TEAM- Kerala health, including Directorate of Health Services, National Health Mission, Directorate of Medical Education, Directorate of AYUSH, Drug Controller, KMSCL have been spearheading the KARSAP implementation. The Local Self Governments, Department of Animal Husbandry, Agriculture, Fisheries are coordinating activities through their respective departments and organizations.

I express my sincere gratitude to Dr Sarada Devi, Head of Department, Microbiology, MCH Thiruvananthapuram who as a State Nodal Officer along with her colleague Dr Aravind are following up the implementation of KARSAP in the State. The State Team members and all the Directors of the line departments and their wholehearted involvement has ensured consolidation of the KARSAP.

I also acknowledge continuous technical support extended by the nodal officer Dr Anuj Sharma, WHO right from development of strategic action plan, roll out, capacity building and now for taking next steps in this fight against antimicrobial resistance.

I also appreciate the efforts of all the line departments, organizations and the foot soldiers, working untiringly at the field to take various activities as per the Strategic Action Plan. By 2020 we will strive for making Kerala fully literate regarding the Antimicrobial resistance under the guidance of Hon Chief Minister Shri Pinarayi Vijayan and Hon Health Minister Smt K K Shailaja Teacher.

Dr Rajan Khobragade
Principal Secretary
Health & Family Welfare
AYUSH

As the State Nodal officer for AMR , it is indeed heartening to note that Kerala was the first state in India to develop KARSAP, which is the State's decisive action plan to tackle the scourge of AMR. Government of Kerala had identified AMR as a public health threat and had committed to take suitable action to address AMR by involving all stakeholders under One Health approach and this multipronged approach is well articulated in KARSAP . The Conceptualization and genesis of KARSAP was possible only with the whole hearted co-operation of multiple stakeholders from multiple sectors who toiled tirelessly in unison under One Health Umbrella with the blessings of Honourable Chief Minister and Health Minister of Kerala. The support and valuable advice provided by Principal Secretary of Health went a long way to encourage all stakeholders to strive hard towards the realisation of their collective dream—KARSAP.

Under One Health umbrella the stakeholders from The Department of Agriculture, Animal Husbandry, Fisheries, Environment , Health and Family Welfare of the Government of Kerala have worked together to achieve the one year target as per the monitoring and evaluation framework of KARSAP. The sincerity, perseverance and co-operation of all the stakeholders is what drives KARSAP forward in its journey to address the issue of AMR in the State. The long-term sustainability and success of KARSAP depends solely on this One health approach, where are all stakeholders work together as One family in the fight against AMR. The role played by private sector and public participation are important determinants in the long-term success of KARSAP.

Strengthening laboratory capacity and AMR surveillance systems are essential for assessing baseline AMR burden and providing evidence based information for action. Kerala has not only initiated AMR surveillance programme in Government hospitals, but also has extended to seventeen private laboratories. Establishment of KARS-NET is a major achievement under KARSAP. Since food of animal origin also represents the major route of human exposure to food borne

pathogens, AMR surveillance in animals and fisheries is as critical as it is in human health, which is done in four NABL accredited laboratories of the Animal Husbandry Department and fisheries Department in the state.

As the world is running out of effective antibiotics to fight even simple infections, alternate strategies and new molecules are the need of the hour, Research is also underway to establish the role of phytochemicals and natural antimicrobial substance as a means to fight AMR. CSE played a very important role in drafting the monitoring frame work for surveillance in environment sector.

The support and involvement of WHO Country office for India has been pivotal both in the conceptualization and implementation of KARSAP.

Its still early days for KARSAP—the road ahead is less travelled by, and we have miles to go before we sleep.

Dr Sarada Devi
HoD Microbiology
Sate Nodal Officer KARSAP
MCH Thiruvananthapuram

Antimicrobial Resistance - The Kerala scenario

Antimicrobial resistance is an emerging global public health threat. Antibiotics which are being used across the world to treat a wide variety of conditions, including life threatening infections are increasingly becoming ineffective because of their misuse in both humans and animals. Poor management of waste from hospitals, farms, pharmaceutical industry and households adds to the problem. A primary contributing factor to the rise in resistance includes unregulated access to antimicrobials. There is also a significant drop in the number of newer antibiotics available. Research and development of antibiotics pose a significant challenge to the health industry in both time and resources. Lack of profitability has forced pharmaceutical industries to move on to newer research domains.

Kerala scenario

Experts say around 70% of the total antibiotic use happens in animal husbandry. Use of antibiotics as growth promoters in farm animals needs to be curbed to prevent the emergence of AMR. Use of animal manure in soil, inadequate treatment of antibiotic containing effluents from the pharmaceutical industry, farms & health care facilities, inadequate wastewater management and contamination of water sources has contributed much to this issue. Kerala, being a state with high treatment seeking behaviour, antibiotics are consumed irrationally without following proper protocols. At present, there is no Antibiotic policy at the national level or a national policy to contain the antimicrobial resistance in India. The policy published in 2011 has not been implemented in any state completely. There is no restriction on Over the Counter (OTC) dispensing of antibiotics. Any antibiotic, even including the newer generation ones; can be purchased without a prescription.

Indian hospitals have reported very high Gram-negative resistance rates, Extended Spectrum Beta Lactamases producers and carbapenem resistance rates resulting in increased usage of colistin, currently the last line of defence, with a potential for colistin-resistant and Pan drug-resistant bacterial infections.

There are major international efforts to tackle the challenge of antimicrobial resistance.

The Kerala medical community is seriously concerned about the high antimicrobial resistance rate in the state and would like to tackle the issue by joining the global fight against Antimicrobial Resistance. Implementing Antimicrobial Stewardship Programs (ASPs) in the hospital setting will help curb inappropriate antibiotic use. Currently, ASPs are rare in India but are gaining momentum. The Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) was launched on October 25th, 2018 with the objective of implementing the ASPs in the state. Though it is organized by the Department of Health and Family Welfare, it includes Stakeholders from Animal Husbandry, Agriculture, Fisheries, Food, Environment, Drug Regulator, Research and the civil society. Antibiotic Stewardship Program (ASP) intends to ensure that the right drug gets prescribed at the right time, in the right dose, for the right duration and for the right patient, at health care institutions in Kerala starting from the tertiary care institutions. With the challenges and increased physical visibility and high antibiotic use in the community, the program has gained good momentum due to the implementable road map set. I wish the program all success.

Dr Rathan Kelkar
Secretary & SMD NHM

AMR

The Health service department has actively taken up issues of Antibiotic resistance, AMR surveillance, Infection control measures and Rational use of antibiotics.

Since Culture sensitivity reports play a vital role in Antibiotic prescription and developing Antibiograms, funds to set up Microbiology labs were included in Plan 2018-19, 19-20 and in NHM PIP. Institutions included during 2018-2019 are GH Thiruvananthapuram, GH Alappuzha, GH Eranakulam, DH Palakkad, GH Kottayam, GH Kozhikode. Microbiologists have been posted to these six institutions on a working arrangement.

Institutions included for 2019-2020 are DH Kollam, GH Kanjagad, DH Kannur, GH Mananthawady, GH Thirur, GH Pathanamthitta. The installation of equipment to set up microbiology labs is in progress at these institutions.

GH Eranakulam is running a programme called Sepsis management project for the last three years and this project is playing a crucial role in early diagnosis and management of sepsis, rational use of antibiotics, developing Antibiogram and in building up confidence of Physicians to escalate and deescalate Antibiotics according to culture and sensitivity reports. Prescription audit is also being done in the Institution. Recently the project has isolated, identified and confirmed the presence of Colistin resistant Klebsiella pneumoniae by microbroth dilution method which is the gold standard test with support from Rajiv Gandhi Centre for Biotechnology. This is the first such report in the state.

The project has a good outcome since GH Eranakulam has developed an antibiogram and an antibiotic policy. Organisms responsible for sepsis are identified early and correct antibiotics can be given. This has brought down mortality and morbidity and duration of hospital stay. In the SNCU the duration of hospital stay has been reduced from 7.2 days to 5.4 days.

GH Eranakulam gets 30-40 cultures per day and around 400 positive cultures per month. Reports are forwarded by WHONET to Dept of Microbiology Medical College Thiruvananthapuram. A Hub and Spoke method has been initiated by including six peripheral institutions in the project. Training programmes have been conducted. The Department has taken steps to include all Taluk Hospitals in the project. The institutions included now are GH

Moovattupuzha, DH Aluva, TH Thripunithara, TH Karuvelipady, TH Perumbavoor, W&C Mattanchery. The Guidelines for infection control practice have been circulated to all the districts. Infection control practices are being followed in institutions and there are infection control committees in all the major institutions. Directions have been given to DMOs to constitute prescription committees and convene audits.

The Department conducts Antibiotic awareness week every year. The Department is taking all efforts with a multipronged approach to tackle infection control effectively in all the Health Institutions in the State.

Dr Saritha R L
Director Health Service

DME

Antimicrobial Resistance [AMR] is often referred to as a silent tsunami, which if left unaddressed can lead to one crore deaths across the globe in 2050. The set back to the world economy by 2050 is predicted to be to the tune of 100 trillion dollars.

The AMR situation in Kerala is also alarming with more and more cases of infections due to XDR and PDR bacteria being reported from tertiary care centers across the State.

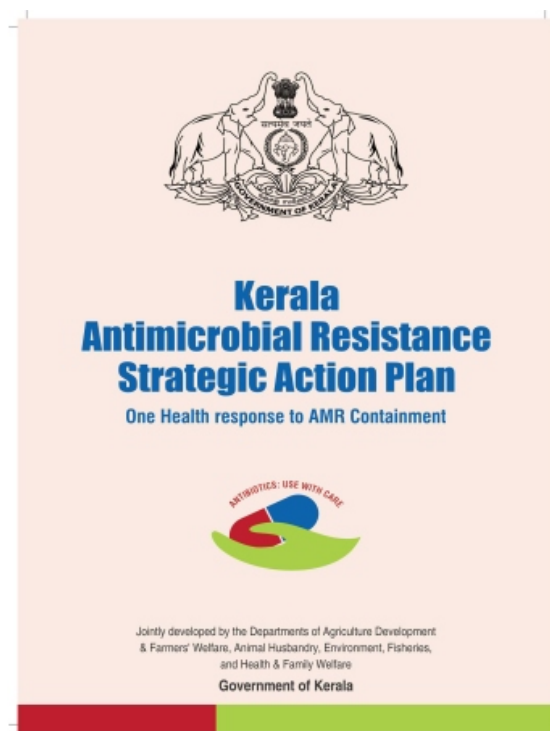
KARSAP is Kerala states decisive action plan to tackle the scourge of AMR. It is really heartening to note that almost all the targets envisaged to be achieved by first year in all strategic priorities of KARSAP have been achieved. Establishment of KARS-NET [Kerala antimicrobial resistance surveillance network] is a major achievement under KARSAP. Strengthening and streamlining of IPC and ASP activities across the state is a major output of KARSAP. Link nurse system and small group learning sessions have been major game changers in IPC scenario in Medical Colleges.

The participation and involvement of public will decide the long-term success of KARSAP. Medical colleges will take the leadership role in AMR containment. The focus will be on the students so as to inculcate the principles of prescribing and managing the cases as per the standard treatment guidelines and antibiotic policies. Such collective actions will enable the State to achieve the stated objectives of the Kerala Antimicrobial Resistance Strategic Action Plan.

Dr. Remla Beevi.A
Director of Medical Education

Acronyms and abbreviations

AMR	Antimicrobial Resistance
API	Association of Physicians of India
ASP	Antimicrobial Stewardship Program
DHS	Director Health Services
DME	Director Medical Education
GMCT	Government Medical College Thiruvananthapuram
HAI	healthcare associated infection
IAP	Indian Academy of Pediatrics
ICU	Intensive care unit
IMA	Indian Medical Association
IPC	Infection prevention and contro
KAP	Knowledge attitude and practice
KARSAP	Kerala Antimicrobial Resistance Strategic Action Plan
KVASU	Kerala Veterinary and Animal Sciences University
NABH	National Accreditation Board for Hospitals and Health care Providers
NABL	National Accreditation Board for Testing and Calibration Laboratories
NAP-AMR	National Action Plan on Antimicrobial Resistance
OTC	Over-the-counter
RGCB	Rajiv Gandhi Centre for Biotechnology
SOP	Standard operating procedures
WHO	World Health Organization



KARSAP-A STATE'S FIGHT AGAINST AMR

Antimicrobial Resistance (AMR) is a global public health problem that has been identified as a priority by the World Health Organization. The United Nations identified it as a global development and economic issue at the high-level meeting on antimicrobial resistance at the United Nations General Assembly in September 2016. It is estimated that approximately 7 lakh people die every year due to antimicrobial resistant infections worldwide. If remedial measures are not implemented to control the scourge of AMR, it is estimated that by 2050, one crore (10 million) people will die every year due to antimicrobial resistant infections worldwide. This number will be the single largest cause of death worldwide, and will be more than the number of deaths due to cancer and road traffic accidents. Global economy also will be set back to the tune of 100 trillion US dollars if steps are not initiated to control AMR.

At the National level, there was a NAP- AMR workshop in late 2016 followed by the inter- Ministerial consultation on AMR in April 2017 at which NAP-AMR was launched along with endorsement of Delhi Declaration on Antimicrobial resistance. India being a federal country with a large population in 28 states and 9 Union territories, and health being a state subject, action against AMR requires strong ownership by the states and UTs, involving other relevant sectors. Therefore, State action plans for AMR containment are critical for effective action against AMR. As a part of National Consultation to Operationalise Action against Antimicrobial Resistance organized in New Delhi in August 2017, Kerala was one of the five States invited to initiate development of their State action plan on AMR.

Kerala is considered as a consumer State for pharmaceuticals. The total consumption of drugs in the state is around 20,000 crores per annum, with antibiotics making up 20% of the total drugs consumed annually in the state. Poultry farmers in Kerala also use a variety of antibiotics either as growth promoters or for controlling infections. The presence of fisheries, aquaculture, network of water bodies and integrated farming practices make the AMR scenario in Kerala complex. Many prescription medications used for human and animal health ultimately find their way into the environment and can affect the health and behaviour of animals

Even though there are many drivers of antibiotic resistance, the most dangerous trends contributing to rising AMR apart from the inappropriate use of antibiotics in humans include antibiotic use for growth promotion and disease prevention in animals, horticulture and fisheries. The use of animal manure in soil and inadequate treatment of effluents containing antibiotic residues from pharmaceutical industry, healthcare facilities and farms also contributes to the problem of increasing AMR. This highlights the importance of having a “One Health” approach to tackle AMR.

The “One Health” approach requires all stakeholders in various sectors and different ministries to work together collaboratively. The Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) has been developed jointly with the help of Departments of Agriculture, Animal Husbandry, Fisheries, Environment, Health and Family Welfare in partnership with many other stakeholders. WHO Country Office for India has been keenly supporting this initiative right from its inception.

Inter-sectoral collaboration and One Health approach are crucial and integrated in the government's response. The Government of Kerala has involved all stakeholders in the Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP), which is aligned with the Global and National Action Plans on Antimicrobial Resistance (GAP-AMR and NAP-AMR). NAP-AMR was launched on 19 April 2017 at the Inter-ministerial Consultation on AMR. The development and implementation of KARSAP was led by the Government of Kerala involving all stakeholders, including the private sector.

KARSAP was launched on 25 October 2018 by Honourable Kerala Chief Minister in the presence of State Health Minister, Additional Chief Secretary Health, WHO Representative and policy makers and senior officials from Departments of Agriculture Development & Farmers' Welfare, Animal Husbandry, Environment, Health & Family Welfare, and Fisheries

The Government of Kerala identified antimicrobial resistance (AMR) as a priority few years back. Since then Kerala has been working on its containment through the State AMR committee. The Department of Health and Family Welfare organized numerous meetings and workshops over the last one year in which stakeholders from all relevant sectors came together and jointly developed the KARSAP. Uniqueness of KARSAP is that it is the first state level action plan to be released in India and probably in entire South East Asia

A number of activities have been organized for AMR containment in the state including awareness generation, AMR surveillance through laboratories, infection prevention and control and facilitating pilot research projects for AMR containment. .

The Department of Health and Family Welfare is closely monitoring the AMR situation in collaboration with all stakeholders. Focal points for key focus areas have been identified for overall coordination and surveillance, research, infection prevention and control, antimicrobial stewardship and private sector.

The State also formally engaged with the civil society through a successful call for expression of interest leading to a memorandum of understanding in collaborating with the Government of Kerala for AMR containment in the state. More institutions have also joined the AMR surveillance network and become partners in regular surveillance and reporting.

Regular meetings of the State AMR committee are being organized to monitor the AMR situation and the activities undertaken for AMR containment in the state.

MAJOR ACHIEVEMENTS UNDER KARSAP

1. Kerala was the first state in India to have a state action plan.
2. Establishment of (Kerala Antimicrobial Resistance Surveillance Net work) KARSNET—introduction of automated and point of care rapid diagnostic kits helped in antibiotic stewardship and thereby helped in reduction of misuse of antibiotics.
3. Link nurse system and small group learning sessions in infection prevention and control which helped the state to combat Nipah effectively.
4. Establishment of App based antibiotic stewardship modules.
5. One health approach with equal importance to animal husbandry, aquaculture, food and environment.
6. PROUD [program for removal of unused drugs]—it's a program to take back unused or antibiotics past expiry.
7. Campaign to make Kerala an Antibiotic Literate State by 2021.
8. Launching of Kerala chicken-antibiotic residue free chicken.
9. Kerala is going to host the first Regional WHO workshop in January 2020 to help seven neighbouring states for developing state action plans for containment of AMR

KARSAP strategic priorities & focus areas

This document has been brought out with the aim of capturing the genesis of KARSAP as well as all the activities done in the state under the One Health Umbrella, since the Official release of KARSAP.

Conceptualization of KARSAP

Some of the key initiatives taken towards tackling the issue by Kerala State are listed below

Reiterating commitment to addressing AMR and spreading awareness

India- AMR has increasingly been talked about on global platforms, even by

Indian leaders, and been recognized as one of the biggest global health issues. More recently, Indian Prime Minister during his visit to Japan reiterated the need for a joint global focus on AMR. Prime Minister Modi also brought up the issue in a recent episode of his monthly Mann ki Baat radio programme, where he urged the general public to consume antibiotics with caution and only when necessary.

24–25 Aug 2017, New Delhi

National Consultation to operationalize action plan for AMR containment.

Since the states have differing levels of infrastructure and preparedness for AMR containment, to begin with 5 states from various regions across India (Andhra Pradesh, Assam, Himachal Pradesh, Kerala and Uttar Pradesh) were invited for the consultation. The key stakeholders from these five states including Senior administrator from the State Department of Health, Senior official/expert from Department of Animal Husbandry and Fisheries, state level clinical expert on AMR from a nodal institution attended the meeting. These states shall be supported to develop their State Action Plans on AMR, and after this consultation workshop, regional workshops at state headquarters in these 5 states will be conducted to develop their Action Plans on AMR.

11 Oct 2017, TVM

To tackle AMR Honourable Chief Minister On 11/10/17 had conducted a Review meeting on AMR with Honourable Health Minister, Principal Secretary H&FWD, Secretary Animal Husbandry, Add Chief Secretary Fisheries Dept, DME, DHS, Director of Fisheries, Scientists from RGCB, Director Veterinary Dept, doctors from Health services & Medical Education. The government is putting in efforts to combat the threat posed by AMR. However, there is a pressing need to bring coherence and confluence in such efforts, and to work in coordination with other departments and stakeholders for clearer direction and to ensure better. In this meeting on AMR chaired by Honourable Chief Minister of Kerala in which he emphasized the need for developing and time-bound implementation of Kerala Antimicrobial Resistance Strategic Action Plan. The meeting served as the focal point for all further activities planned with regard to drafting and implementation of KARSAP.

17 Oct 2017 - State Workshop on AMR

The Intersectoral Workshop ie One health approach held on 17/10/17 addressed the key elements for combating AMR : a comprehensive State plan aligned with the principles outlined in the NAP-AMR, laboratory capacity to undertake surveillance for resistant microorganisms, access to safe, effective antimicrobial medicines, control of the misuse of antimicrobial medicines, awareness and understanding among the general public and effective IPC programs. Tackling AMR requires a multi-sectoral approach, encompassing all areas— human and animal use of antibiotics, as well as agriculture and the environment. Owing to the complexities posed by the issue, in addition to the nodal ministries - Ministry of Health and Family Welfare, Ministry of Environment, Veterinary Dept, and Department of Pharmaceuticals – other government departments like Dairy development, Department of Biotechnology, Department of Fisheries, Dept of Agriculture, State Drug Controller, Manager KMSCL, Dean Research KUHS, Doctors from Private & Govt Medical Colleges, IMA, IAP, were brought together. Effective policies require equally effective implementation and monitoring. Therefore, active participation from implementation bodies such as state pollution control boards, primary healthcare centres, sub-health centres and offices, health workers .

To tackle the problem of low-quality and/or counterfeit medicines state level regulatory authority should be empowered. Recognizing the global threat posed by AMR, the Kerala State Govt has shown commitment to prevent, limit, and control the emergence and spread of AMR. Convergence across Ministries & Depts is necessary for a comprehensive strategy against AMR hence all stakeholders were brought together in this Workshop.

The proceedings were initiated by Shri Rajeev Sadanandan, Additional Chief Secretary, Department of Health and Family Welfare, Government of Kerala, with support from Dr Sarada Devi KL, Professor Microbiology, Government Medical College, Thiruvananthapuram.

The workshop consisted of two sessions: in the first half, participants were

shared information on current gravity of antimicrobial resistance, along with various initiatives that have been taken for its containment at the global, national and state level. Key officials and professionals made presentations on AMR in Kerala and their initiatives for containment of AMR in the state, with active participation and discussion.

The second half of the workshop aimed at seeking suggestions from participants for developing a State Action Plan on AMR, in alignment to the Nation Action Plan on AMR, while taking cognizance of the state needs and priorities. The participants were congregated in 5 groups based on their area of expertise, to reflect key strategic priorities for collaborative containment of AMR, based on the global action plan on AMR. The five groups were (i) awareness and understanding – communications and trainings; (ii) surveillance and laboratory; (iii) infection prevention and control; (iv) optimizing use of antibiotics; and (v) research and innovations.

The group representatives (rapporteur) shared the group work and deliberations on key focus areas for each strategic priority along with broad activities required to achieve specific objectives.

The workshop concluded with Mr Rajeev Sadanandan summarizing the key takeaway messages and follow-up action points:

- Rajiv Gandhi Centre for Biotechnology (RGCB), Trivandrum volunteered to host a meeting to define the research priorities under Kerala's State Action Plan on AMR, and lead development of research proposals by November 2017
- Prioritization of AMR surveillance activities
- Private colleges and NABL-accredited labs to feed their AMR data into state level
- WHONET to be used for data entry on AMR across human health, veterinary sector and food labs
- Hospital Infection Control programs to be mainstreamed at all levels.
- Review need for microbiology lab automation to guide clinical use of antibiotics.

- A multi-disciplinary working group to be formed for AMR containment in Kerala with representatives from health department, animal husbandry, fisheries, pollution control board, drug regulator, food safety, science & technology, AYUSH, research institutes, private sector, etc.)
- Regulatory bodies to control use of antibiotics
 - State Drug Controller to suggest a mechanism
 - Review use of electronic prescriptions (similar to NHS)
- WHO Country Office for India requested to provide technical support for development and implementation of State Action Plan on AMR in Kerala

Creation of an operational team (core working group or secretariat) was proposed to carry out routine day to day operational activities towards development and successful implementation of SAP-AMR in Kerala.

State Workshop on AMR 17.10.2017



State Level Meeting

A state level meeting was held which was convened by the Additional Chief Secretary. The Directors of Medical Education, Health services, Public health lab, Additional Director (Medical) and the Head of the department of Microbiology, GMC, TVPM participated in the meeting. The focus of the discussion was on Antibiotic awareness week (Nov. 13th – 19th). The administrators were directed to highlight and educate all the medical and

paramedical staff regarding Hospital infection control during the observance of the antibiotic awareness week. They were also asked to ensure the proper functioning of the infection control team in all hospitals.

Future Agenda

The awareness regarding antibiotic resistance does not end with this observance. It has to be continued for ever to combat the threat of increasing antibiotic resistance developing among microbes. The department of Microbiology, GMC, Tvpm has it's own agenda for future.

- Ongoing training programmes for all health care providers and students as and when required.
- HAI surveillance data would be strictly monitored. Active participation of the infection control nurse will be ensured.
- AMR surveillance data will be sent to NCDC in every quarter.
- Adherence of the clinicians to the Antibiotic Policy will be monitored.
- Effective antibiotic stewardship program will be implemented.

15 Dec 2017

Review meeting in Medical College

- Report on AMR awareness/training activities in Kerala during the WAAW
After this meeting, a high level meeting comprising of all the stakeholders was organized on 15 December 2017. The State AMR Core Committee with identified members was formed as a governance mechanism for AMR in Kerala. At the review meeting, the State AMR Core Committee finalized the draft KARSAP and submitted it to the Government for approval. **To formulate State Action Plan (SAP) on AMR aligned to NAP-AMR** - A core working group (Multi disciplinary group) shall be constituted with the following members -Health, Fisheries, Veterinary, Dairy development Dept, Environment, Commissioner of food safety, Science and Technology, KUHS, RGCB, Fisheries University, CFRI, Swatch Bharath, Ayush (Ayurveda), Homeopathy and they are entrusted to continue to discuss this issue on a periodic basis to rationalize the use of

antimicrobials and to bring out the SAP-AMR . We should have a comprehensive State action plan based on a multisectoral approach and aligned to National action plan on AMR .The national action plans will provide a necessary framework for action and must be supported by good governance, multisectoral collaboration, and ongoing monitoring.

4 Jan 2018, RGCB

The importance of research and innovations cannot be over emphasized. As the world is running out of effective antibiotics to fight even simple infections, alternate strategies and new molecules need to be discovered at the earliest. Research is underway to establish the role of phytochemicals and natural antimicrobial substances as a means to fight antibacterial resistance. Rajiv Gandhi Centre for Biotechnology (RGCB), Trivandrum, Kerala, a premier national research institute, is the research partner for Kerala Antimicrobial Resistance Strategic Action Plan. On 4 January 2018, a workshop to discuss the strategies to control bacterial pathogens affecting humans, animal and environment was conducted at RGCB. The workshop facilitated an understanding of the work being done at different institutions and also discussed the development of research projects. Research proposals on AMR from various stakeholders were presented and discussed in detail during the workshop. It was decided to have review meeting after six months to assess progress of research works.

22–24 Jan 2018, CSE:

Asia-Africa workshop on NAP-AMR implementation

The State Nodal officer for AMR attended the Africa-Asia workshop on Implementation of National Action Plan on AMR at Tijara, Rajasthan from 22–24 January 2018, focusing on animal and environmental aspects of AMR.

The workshop had representatives from 15 African & Asian countries such as Kenya, Ethiopia, South Africa, Nigeria, Ghana, Tanzania, Uganda, Zimbabwe, Indonesia, Vietnam, Malaysia, Philippines, Bangladesh, Sri Lanka, Thailand as well as representatives from different stakeholders of various states in India including Kerala. Global veterinary and environment experts, and experts from

the WHO-FAO-OIE tripartite were also present to facilitate discussions and exchange of information on NAP implementation across areas of education and awareness, surveillance, optimized antimicrobial use, infection prevention and control etc. During the workshop the challenges and issues in NAP implementation at the ground level and also the opportunities to understand how other countries and states were planning implementation.

18 April 2018:

Workshop on role of NGO stake holders for AMR containment in Kerala.

The private and non-governmental sector are integral parts of AMR containment activities in all countries including India. A meeting was organized on April 18, 2018 to engage the private sector and NGO stakeholders for AMR containment in Kerala. After analyzing the basic information on AMR activities/initiatives undertaken by various private sector and NGOs, a shortlist was prepared. From private sector Beckman Coulter, Becton Dickinson, bioMerieux, DSM Sinochem Pharmaceuticals and MSD Pharmaceuticals were shortlisted. Centre for Science and Environment [CSE], a highly respected NGO, which is a public interest research and advocacy organisation that promotes environmentally sound and equitable development strategies was also shortlisted. Expression of interest was sought from these shortlisted stakeholders. The aim of the meeting with these shortlisted stakeholders was to identify areas of co-operation and collaboration without compromising the interests of the state in areas like environmental aspects of AMR, integrated AMR surveillance, Health Systems Strengthening, digital applications and development of antibiotic stewardship protocols and laboratory automation for AMR. The meeting of private sector and non-government stakeholders for AMR containment in Kerala was organized on 18 April 2018. Areas of collaboration and future co-operation with the private and NGO stakeholders were identified and a plan of action was charted based on the deliberations.

10 Jul 2018,

SHSRC: IPC activities reviewed

Application of good infection prevention and control (IPC) measures across human

health, animal health and agriculture helps to prevent infections and limit the use of antibiotics. Steps were taken to tackle AMR at all government medical colleges in Kerala , which included scaling up of infection control program to prevent spread of antibiotic resistant organisms. Link nurses were identified in all medical colleges and were given intensive training in infection control. A proposal was submitted to train a core group of nurses in infection control at Amrita Institute of Medical Sciences. Application of good IPC measures in animal husbandry is also important to reduce AMR burden and antimicrobial residues in the environment. Kerala State Pollution Control Board recommends adherence to good farm management practices for infection control among flock, issuance of improved biosecurity guidelines by Central Poultry Development Organization for farm implementation and promotion of antibiotic alternatives (such as vaccination).

27th Sep. 2018

Workshop on Integrated surveillance for AMR

The Centre for Science and Environment (CSE) organized a Workshop on Integrated Surveillance Framework for Antimicrobial Resistance (AMR) for Kerala, with support from the Department of Health, Kerala and the Kerala State Pollution Control Board (KSPCB). The aim of the workshop was to develop an integrated AMR surveillance plan for the state, including surveillance in livestock, fisheries and the environment. The workshop was held at the Regional office of the KSPCB in Ernakulam.

The workshop was attended by 35 participants, including representatives from the state departments of Health, Animal Husbandry (including SLMAP), Fisheries, Drug Control, KSPCB, Kerala University of Fisheries and Ocean Studies, Kerala University, All Kerala Chemist and Druggist Association, Central Institute of Fisheries Technology, DSM Sinochem Pharmaceuticals, Meat Products of India, Government Medical College (Ernakulam and Trivandrum) and Aster Med city. There was significant representation of environmental engineers and environmental scientists from the KSPCB.

- It was decided that CSE will now work on the group-work outputs to

compile and develop a draft integrated AMR surveillance framework for Kerala. CSE will also reach out to concerned stakeholders for their inputs in case greater clarity or technical inputs are needed. The framework will then be shared among all contributing stakeholders for review and inputs, following which it will be finalized and shared with the Dept. of Health, Kerala (the nodal agency on AMR activities in Kerala) and relevant other stakeholders in the state.

28th Sep. 2018

Workshop on Waste Water Treatment to Combat Antimicrobial Resistance

The workshop was started at 10 AM on 28th September 2018. Shri Sajeewan K., Chairman of the Kerala State Pollution Control Board in his opening speech highlighted the seriousness of the issue of AMR. The priority given by the Government for combating Antimicrobial resistance was mentioned in his speech. Dr. Aravind, Head of Department of Infectious Diseases, Government Medical College, introduced the subject and the expectations from the workshop. Dr. Anuj Sharma, Technical Officer, World Health Organization in his speech talked about the initiatives taken by the World Health Organization in combating antimicrobial resistance all over the world and about their efforts in India. . Dr. Rajeshwari, Deputy Programme Manager, Food and Safety Programme, Centre for Science and Environment, explained the environmental inter linkages with AMR. Ms. Suman Sharma, Director - Sustainable Antibiotics and Brand Communication, DSM Sinochem Pharmaceuticals (DSP) explained the need for industry action on AMR and DSP's position and efforts for combating AMR.. Mr. Ashok Nanda, Senior Manager, Water Treatment Plant of DSP shared his experience in combating AMR. The problem OF amr was discussed in detail by the two working groups which had participation of representatives from all sectors namely pharmaceutical units, hospitals, meat processing plants, slaughter houses, and Drugs Controller, Kerala State Pollution Control Board. WHO official, Dr.Anuj Sharma, and DSP officials Dr.Suman Sharma and Mr. Ashok guided the working groups. **Kerala State-**

Effective implementation of norms at State and local level: With health being a state subject, state government need to build capacity and awareness on misuse, unnecessary use and over the counter sale of Antibiotics

Red Line Campaign

Recognizing the threat posed by irrational use of medicines, state has also led the way towards 'Red Line Campaign' that aims to put a red line on antibiotic packages to curb their over-the-counter sale.

- **Creating awareness about AMR among stakeholders, including government, industry, the medical fraternity and citizens:** The first step to combating a problem is to recognize it as one. It is important to educate people about what AMR is, its various causes and what they can do to curb it. Creating awareness among government stakeholders, the industry and the medical community is also important as they can initiate a top-down channel to communicate the message to the public at large. The communication material pertaining to guidelines also needs to be administered in simple, clear language, so that it can be understood not just by the policy formulation officials, but also by the on-ground implementers such as the front-line health care workers.
- **Regulating sales of antibiotics:** Pharmaceutical companies should refrain from offering compensation to doctors in exchange for prescribing their products. There is also a need to restrict over-the-counter sale of antibiotics without proper prescriptions, however, this needs to be balanced against the need to ensure adequate access to medicines especially in areas where there is a lack of doctors.
- **Better management of hospital waste:** With an increase in the rate of hospital related sepsis, it is clear that hospital waste is still not effectively managed. Stringent standards must be set for cleanliness protocols in hospitals and treatment centers.
- **Phasing out use of antibiotics as growth promoters for livestock and agriculture:** As a major chunk of antibiotic consumption is for non-

medical use in agriculture and livestock, it is important to regulate sale and use in these sectors. Pharmaceutical companies should limit supply to livestock industry and organizations sourcing meat and farm produce should insist on naturally grown produce.

- **Appropriate surveillance mechanisms in the health and veterinary sectors:** It is pertinent to generate reliable epidemiological information, baseline data, trends on antimicrobial resistance, utilization of antimicrobial agents and impact on the economy and health through designated national and regional reference centres.
- **Development of minimum standards to reduce release of antibiotic manufacturing waste and active pharmaceutical ingredients (APIs) into the environment:** Currently, there are no norms for monitoring and limiting the discharge of antibiotic waste in the effluents released by pharmaceutical manufacturers. Monitoring various kinds of effluent discharges especially AMR specific waste effluent, that is pharmaceutical waste, liquid hospital waste, etc Sweden has recently notified minimum standards for the same, and that could be used as a benchmark.
- **Improved surveillance and monitoring of environmental regulations for pharmaceutical industry:** On-ground surveillance needs to be strengthened to ensure that manufacturing units follow environmental regulations. Setting up of CCTV cameras around manufacturing setups and monitoring these at the local Pollution Control Board offices is one of the ways of achieving this. Strict penalties should also be imposed on those found flouting these norms and discharging untreated or inadequately treated effluents into the environment.
- **Incentivize use of Good Manufacturing Practices:** The government can offer subsidies on new equipment that reduces the level of APIs in pharmaceutical waste, and also incentivize operational cost and exports for pharmaceutical players that follow Good Manufacturing

Practices.

- **Incentives or subsidies for development of alternative antimicrobials:** With the existing antibiotics slowly becoming ineffective due to growing resistance to them, it is important for the government to encourage development of new antibiotics. An Innovation Fund can be set up to support R&D in this field.
- **Encouraging 'clean procurement':** Global players that import APIs from India should be urged to set Buyer Procurement Standards, wherein the Indian exporters need to certify that they adhere to the best manufacturing standards and have a negligible environmental footprint
- **To get community data for AMR surveillance-** Project proposal between State public Health Lab and RGCB has been sanctioned to assess the AMR status in PHCs and CHCs. Limited data from the community- Strengthening of Labs in the PHCs and CHCs
- To set up antibiotic stewardship committees in all hospitals in the state with the aim of optimizing antimicrobial use in hospitals. Step wise implementation of pre-authorization and/or prospective audit and feedback in all hospitals in the state. Initially persuasive antibiotic stewardship strategies to be pursued for first six months followed by implementation of restrictive strategies.
- Pharmacologists in states to be trained as clinical pharmacologists for the purpose of antibiotic use auditing by either defined daily dose or days on therapy calculation.
- Periodic training for all the registered pharmacists in the state by drugs controller.

· 25th October 2018 – Official Launch of KARSAP by Hon'ble Chief Minister

Government of Kerala in collaboration with WHO Country Office for India organized a State consultation to review and disseminate Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) on 25 October 2018 at KTDC Mascot Hotel, Thiruvananthapuram.

The National Action Plan on Antimicrobial Resistance (NAP-AMR) was launched on 19 April 2017 at the Inter-ministerial Consultation on AMR. Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) was developed in alignment with NAP-AMR and was launched on 25 October 2018 by Kerala Chief Minister in the presence of State Health Minister, Additional Chief Secretary Health, WHO Representative and AMR stakeholders from Kerala.

The specific objectives of the consultation were

1. Share information on the development of Kerala's state action plan on AMR,
2. Officially launch the KARSAP, and
3. Review the progress made in various sectors for AMR containment in Kerala.

All relevant stakeholders from various sectors – human health, animal health, agriculture, aquaculture, environment and research, incorporating the “One Health” approach were present for the official launch.

21st Feb. 2019

Meeting of Kerala Antimicrobial Resistance Surveillance Network (KARS-NET)

The State government of Kerala had initially networked eight government medical colleges, General Hospital Ernakulam & State Public Health Laboratory into a State AMR surveillance network, co-ordinated by Government Medical College Thiruvananthapuram (GMCT), with data sharing on monthly basis using WHONET. Currently only public sector institutions are part of the AMR surveillance network in Kerala, which may not be enough to portray the true picture of AMR across the state. Therefore the number of surveillance sites needs to be augmented including the private sector, for a more comprehensive and representative surveillance of AMR that better captures the AMR burden across the state.

World Health Organization (WHO) and Government Medical College Thiruvananthapuram (GMCT) collaborated to strengthen and expand the AMR surveillance network in Kerala and termed it the Kerala Antimicrobial Resistance Surveillance Network (KARS-NET).

In the first phase of expansion, 10 more institutions were inducted into KARS-NET, including NABL/NABH accredited institutions in Kerala, based on their capacity for AMR testing and surveillance that was assessed using a standard assessment tool.

KARS-NET objectives

- Foster standardization, strengthening and expansion of AMR surveillance in Kerala;
- Analyse and report KARS-NET data to State Government and NCDC on regular basis;
- Contribute towards the estimation of extent, burden and monitoring of AMR in Kerala; and
- Detect emerging resistance and its spread in Kerala

The initial focus of surveillance in KARS-NET is bacterial drug resistance. Key staff from participating institutions was trained for standardized antimicrobial susceptibility testing, data management and development of antibiograms.

The collated KARS-NET data shall be shared with state government and NCDC, which is coordinating the National AMR containment programme and also the designated national coordinating centre for AMR surveillance in India.

The meeting on public private partnership for KARSNET was held at Principals conference room, Government Medical College, Thiruvananthapuram on 21/02/2019. Sri.Rajeev Sadanandan, Additional Chief Secretary Health, Govt. of Kerala addressed the audience. He said that the data from existing KARSNET shows an alarming rise of antimicrobial resistance requiring the use of newer costly antibiotics making treatment expensive for common man. Hence to take action against these, a data representative of the state is required and it needs the participation of private medical colleges and stand alone labs across the state apart from the existing members. Dr Rajan Khobragade , Principal Secretary Health was also present. Dr Anuj Sharma, Technical Officer AMR, WHO country office India spoke about the objectives of the meeting. Later on Dr Sarada Devi, talked about the present situation of KARS NET and briefed the strategies of KARSAP and the activities in this regard so far. Dr Anuj

explained the WHO perspective and introduced the participants to various tools and guidelines of WHO.

The 14 participants representing 16 labs presented the capacity, activity and standards of their lab/ institution. Dr Nanditha, Amrita institute of Medical Sciences, Kochi, Dr Vishnu representing Aswini Diagnostics and MVR cancer centre, Kozhikode, Dr Reena, Believers Church Medical College, Dr Gowri A representing Dane Diagnostics and Thangam Hospital, Palakkad, Dr Samitha, DDRC, Dr Soumya of Dr Girija's scans and laboratories, Attingal, Mr. Raj of Dr Gopinathans laboratories, Trivandrum, Dr Binoy Kurien of Jubilee Mission Medical college, Thrissur, Dr Sabitha Baby of Karuna medical college, Palakkad, Dr Aneeta of Pushpagiri Medical College, Thiruvalla, Dr Radhakrishnan from RGCB, Poojappura, Dr Kavita Raja from SCTIMST, Dr Ashish Jitendranath from SGMCRI, Venjarammoodu and Dr Kenny Dsouza of Metropolis scans briefed about their laboratories.

Group activity started at 2 PM. The participants were divided into 2 groups A and B. Each group was given a few points to discuss and present. Dr Gowri from Group A presented the group suggestions regarding SOP, quality control, EQAS etc. The group agreed on sticking to NCDC, CLSI and other standard guidelines. Dr Ashish from Group B expressed their concern of sharing the raw data of their institution and the frequency of sharing. At 4.15 pm Sri Rajeev Sadanandan, ACS made the closing remarks and way forward.

It was decided to send a formal letter from ACS to all the participating institution's management to give the consent and nominate a person for this activity. It was also decided to arrange a workshop for training the participating laboratories on standardized antimicrobial susceptibility testing, using WHONET for AMR surveillance and on modalities and format of data sharing. A formal MoU between the partners to protect the confidentiality of the data and to provide credit for the data shared was proposed. Dr Anuj Sharma concluded the meeting at 4.30pm by requesting the participants to convince their managements to join KARSNET.

10 to 11-06- 2019

National Workshop on Development and implementation of SAP on AMR jointly organized by CSE and H&FW Kerala.

The Centre for Science and Environment (CSE) is a non-profit public interest research and advocacy organization, working on issues of public health, environment and development in India and global south. CSE has been collaborating with the Department of Health and Family Welfare, Kerala to support implementation of the KARSAP.

As part of the collaboration, a Workshop on Development and Implementation of State Action Plan on Antimicrobial Resistance (AMR) was organized in Thiruvananthapuram on June 10-11, 2019. The workshop aimed at developing a better understanding on how to develop and implement a State's action plan on AMR through cross learning and inputs from Kerala's SAP-AMR development process. The workshop had two objectives:

- Development of recommendations for State Action Plans on Antimicrobial Resistance
- Development of a roadmap for Kerala to phase-out non-therapeutic antibiotic use (growth promotion and disease prevention) and reduce use of critically important antibiotics (CIAs) for humans in poultry sector

Day 1 of the workshop focused on SAP-AMR development and implementation. There were representations from across ten states of India namely Uttar Pradesh, Madhya Pradesh, Maharashtra, Telangana, Tamil Nadu, Karnataka, Odisha, Andhra Pradesh, Delhi and Kerala. Participants included AMR focal points or senior level representatives from multiple departments such as health, animal husbandry, fisheries, food, drug, agriculture, and environment. In addition, experts from National Centre for Disease Control (NCDC), Indian Veterinary Research Institute (IVRI), ReAct, Pharmacy Council of India (PCI) and Indian Medical Association (IMA) also attended the workshop. The discussions apprised the participants about the AMR problem and related global and national policies to address it. Across three sectors (human health, food

animals and crops, and waste and environment), key issues that were selected from Indian NAP-AMR for discussions are as follows:

Human health sector

- Over-the-counter sale of antibiotics
- Prescription practices
- Hospital infection prevention and control (IPC) practices
- Antimicrobial use (AMU) and AMR surveillance

Food animal and crop sector

- Non-therapeutic antibiotic use in food animals (growth promotion, disease prevention)
- Use of CIAs in food animals and crops
- Animal husbandry and biosecurity
- Surveillance of AMU, AMR and antibiotic residues in food

Waste and environment

- Waste management from different sources
- Environmental monitoring of AMR
- Siting guidelines and biosecurity
- Disposal of expired/unused drugs

Experts from states deliberated on above issues through presentations and open group discussions to develop practical guidance that could help achieve effective NAP implementation at the local level. Experts identified key policies, systems, tools, training and capacity building efforts needed for AMR containment across all sectors.

Day 2 of the workshop focused on developing a roadmap for Kerala to phase-out non-therapeutic antibiotic use and to reduce use of critically important antibiotics (for humans) in poultry sector. Participants were largely from Kerala with few from other states. From Kerala, experts from Animal Husbandry Department, veterinarians, poultry consultants as well as doctors and fishery professionals engaged in discussions to agree on a roadmap under which antibiotics used for growth promotion and disease prevention were planned to

be phased-out in 3-5 years. It was unanimously agreed to stop use of antibiotics in feed and ban last-resort antibiotics like colistin immediately.

The key recommendations from the workshop [see Annexure] were compiled.

17-09-09-2019-WHONET training workshop at Amritha Kochi

14-11-2019 –KARSAP technical committee meeting chaired by Hon'ble Health Minister.

The meeting brought together Stake holders from Human Health, Animal Health, Aquaculture & Fisheries, RGCB, Kerala State pollution Control Board, Drugs Control Dept, Indian System of Medicine, Homeopathy to review the activities undertaken after initiation of KARSAP on AMR.

Hon'ble Health Minister had convened this meeting to review the progress of KARSAP along with the scientific advisor to hon'ble Chief Minister. The proceedings were initiated by Dr. Rajan Khobragade, Principal Secretary, H & FWD, Govt. of Kerala. An update on the activities of KARSAP in all the 6 strategic priorities in human health was presented by Dr. Sarada Devi.K.L, Professor, Department of Microbiology, Govt. Medical Thiruvananthapuram

The meeting concluded with Hon'ble Health Minister summarizing the keytake away messages and follow up action points:

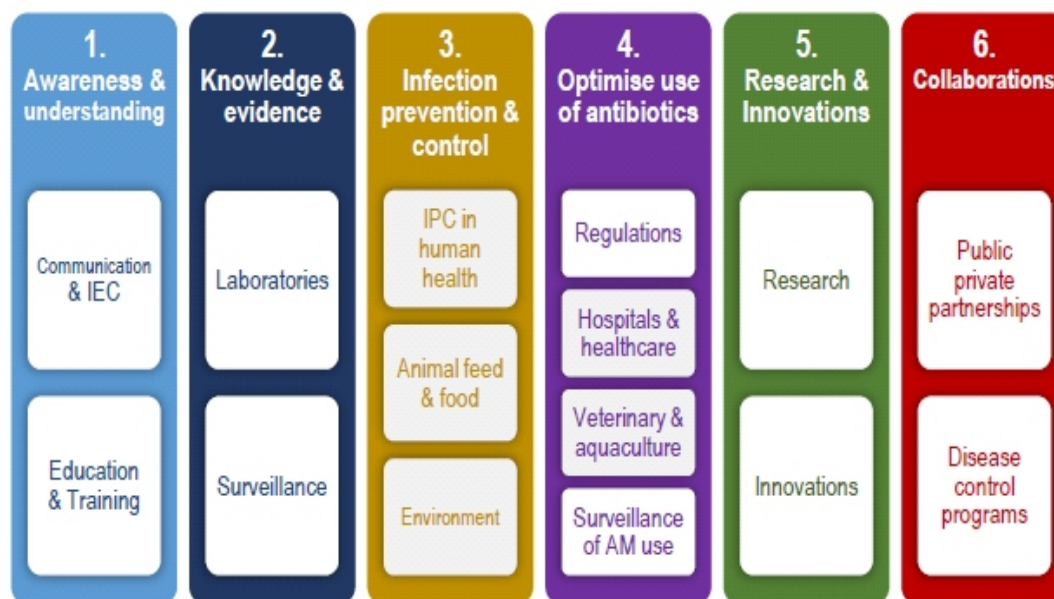
- To include containment of AMR as an objective of Mission Aardram and to focus on public awareness creation with regard to AMR.
- Since there was no participation from IMA, IAP, API & from private partner, Amrita Institute of Medical Sciences, Kochi Hon'ble Health minister insisted on participation from private hospitals also in the containment of AMR & public awareness creation with regard to AMR.
- Focus to make Kerala - an antibiotic literate/ Aware State by 2020 – 21.
- To draw up a time bound action plan to make Kerala an antibiotic literate state by 2021.
- Permission was granted for conducting a workshop in January 2020 by WHO for evaluating the progress and to showcase KARSAP to other seven neighbouring states/union territories and prepare a

roadmap to develop their state action plans.

- It was decided to focus on public engagement in AMR containment as the focus of world antibiotic awareness week activities from Nov 18 to 24, 2019.

To follow up with law department regarding the request to monitor poultry and cattle feed for antibiotics which had been sent by Animal Husbandry department

The following are the focus areas of the strategic priorities under KARSAP:



Current work flow

Priority indicator 1

Awareness and understanding - AMR awareness campaigns are being conducted in all Govt. Medical Colleges and Major hospitals in the state targeting students, interns, Residents, Faculty members, Nurses and other Paramedical workers. Routine AMR demonstrations are organized in various

OPDs to sensitize the patients and bystanders regarding the optimal use of antibiotics. In collaboration with K-DISC (Kerala development and Innovation strategic council), the Antibiotic policy of various Medical Colleges are being converted in to App format. With the help of K-DISC, Antibiotic Stewardship modules are also being developed to help the physicians in selecting the right antibiotic at the right time, right dose, right duration for the right patient. A structured questionnaire based survey is conducted in the OPD to assess the AMR awareness among patients & bystanders attending the OPD. Measures are being taken to assess the KAP of health workers & vets on AMR using a standard online survey.

Priority indicator-2

Knowledge & evidence

State coordinating centre for AMR surveillance has been established at Dept of Microbiology GMCT which is a part of the national AMR surveillance containment program under NCDC. An operational plan for AMR surveillance has been developed covering the human health as well as AMR in animals, food & environment. Antibigrams are being generated every month from all the Govt Medical Colleges in the State. Steps have been taken to establish KARS-NET so as to get a more representative antibiogram reflecting the AMR trends in the community also. The Antibiotic policy formulated for the first time in 2013 is revised every year based on the institutional antibiograms. The antibiograms from different institutions are being collated at the nodal centre.

The antibiograms from district Hospital Ernakulam & State Public Health lab are also captured in to the system. In order to widen the AMR surveillance net work steps have been taken to post Microbiologists at six District Hospitals in the State. These district hospitals are empowered with Automated ID AST machines.

The WHONET training workshop for strengthening antimicrobial resistance (AMR) surveillance was organized at Amrita Institute of Medical Sciences, Kochi on 17–19 September 2019.

Priority indicator -3**Infection prevention & control**

Microbiology Dept of GMCT has been identified as the nodal centre for coordinating IPC activities in the state. All the Govt. Medical Colleges have functional IPC committee which meets at least once a month. Steps have been taken to institute IPC committees in all the hospitals under DHS also. The staff Nurses selected from the Govt. Medical Colleges were given a One week sensitization program on IPC , HAI surveillance & out break investigation in Nov 2017. A follow up TOT workshop for these nurses were conducted in Dec 2019 and master trainers for IPC were identified. These nurses were deployed as Link Nurses/ICN in various Medical Colleges. HAI surveillance data with respect to VAP, CLABSI , CAUTI & SSI are being captured in all the ICUs. In case of clustering of cases/ outbreak process surveillance measures are initiated focusing on the bundle compliance rates. HAI surveillance rates of different institutions will be shared with the nodal centre. Regular workshops/training programs on IPC are organized in all Medical Colleges as well as hospitals under DHS. Sensitizations programs are also conducted on World Hand Hygiene day and Global Hand washing day also. The HAI surveillance rates from various institutions are being compared with INICC rates & NHSN rates.

Steps have been taken to assess the number of commercial farms compliant with IPC guidelines & good practices. Steps have also been taken to ensure that AMMR issues have been incorporated in biosecurity guidance for farms & slaughter houses.

Priority indicator 4**Optimizing use of antibiotics**

ASP committees have been constituted in all the Govt. Medical Colleges & major hospitals under Health service. ASP committees are already functional in NABH accredited hospitals in the state. Directions have been issued to all hospitals in the State to set up their own ASP committees. Antibiotic policy of all GOVT Medical Colleges are being updated based on the resistance trends. ASP committee meets at monthly intervals & assess the compliance with

institutional Antibiotic policy. One Pharmacologist from all Govt. Medical Colleges were imparted training in Clinical Pharmacology by Dr Sujith Chandy at CMC Vellore. Further sensitization programs in Clinical Pharmacology are being planned. The DDDs & DOTs of WHO Watch & restricted antibiotics are being calculated in various ICUs in GMCT. The antibiotic utilization rates with respect to WHO access, watch, and restricted antibiotics are being calculated in GMCT OPD. The Clinical Pharmacist provided by NCDC plays an active role in calculating the antibiotic consumption rate in GMCT. In order to assess the compliance with low hanging fruit model for ASP, an Antimicrobial check list is going to be piloted in GMCT. Routine training to retail pharmacists is conducted regularly under the leadership of State Drug Controller. The total antibiotic consumption in the state is monitored & the quality of drugs is periodically checked by the State Drugs Controller. A safe drug disposal initiative termed has been started by by All Kerala Chemists & Druggists association (AKCD).

Priority indicator 5

Research & innovations

RGCB is the research partner of KARSAP. Research on AMR in Fisheries is being conducted & coordinated by CIFT, Kerala University of Fisheries and Ocean Sciences [KUFOS] & Dept of fisheries Kerala .Research on the environmental aspects of AMR is being co-ordinated by the State pollution control board and Department of environment sciences Kerala University. Research in AMR on livestock is being conducted by State Laboratory for livestock, marine, and agri-products .AMR in animal husbandary is being co-ordinated by KVASU and State Institute of Animal Diseases. Research in AMR in Human health is being conducted in all Government Medical Colleges in the State, as well as in GH Ernakulam in collaboration with Aster Med city.

Priority indicator 6

Collaboration

Integrated surveillance frame work for antibiotic resistance, residues & use in animal & environmental sector, has been formulated with the help of CSE. IPC sensitization activities across the State have been started by corporate

partners.

Activities undertaken by animal health sector under the framework of KARSAP

Monitoring of Antibiotic Residues in Kerala

AMR in Food and Food Animals (Meat, Milk, Poultry)

Awareness programs for Farmers/Vets

Distribution of antibiotic sensitivity kits to Veterinary Dispensaries/ Hospitals/Polyclinics under AHD by IH & VB, Palode (Aprox 5000 nos)

AHD dept. manual revised and reissued, this has recommended antibiotics for select disease & AMR expert committee of AHD was constituted

World Organization for Animal Health (OIE) Performance of Veterinary Services (PVD) assessment visit was conducted.

Mapping and geo tagging of all animal farms in Kerala has been done along with individual animal identification.

More than 4000 mobile computing device provided to all field staff of Veterinary Department (BHUMIKA app)

Already mapped around 2.5 lakhs farms across Kerala, probably first of its kind in India.

Update of activities done under each strategic priority of KARSAP

Strategic Priority One

Knowledge And Awareness Creation

1. During first year of KARSAP [2018 -2019] , activities were focused on knowledge and awareness creation regarding need for surveillance platforms, infection prevention and control [IPC] and antimicrobial stewardship. These activities were done under one health approach and included activities in human side, animal husbandry,aquaculture , fisheries, dairy and environment.
2. Awareness creation in human side was co- ordinated by antibiotic stewardship committees in all tertiary care centers, IAP,API and IMA. NGOs like REACT also were actively involved in awareness creation. A free mobile App, ID Consult was launched by a group of ID physicians

and Microbiologists in the state for knowledge and awareness creation in health care workers regarding antibiotic stewardship and IPC.

3. Classes on IPC and antibiotic stewardship has been included in MBBS curriculum right from foundation course of first year onwards.
4. All interns , post-graduates and faculty members are given periodic training in IPC and ASP.
5. To optimize prescription of antibiotics ASP modules in App format are being developed by K-DISC.
6. World antibiotic awareness week is observed in all hospitals in the state from Nov 18 to 24.
7. Focus in 2020-2021 is public engagement and awareness creation among public with regard to AMR and rational use of antibiotics. The activities for public engagement will start from 2019 world antibiotic awareness week onwards. Aim is to make Kerala an antibiotic literate /Aware state by 2021.

All the NABH accredited hospitals in the state are routinely conducting training programmes on antibiotic stewardship. One example is Aster Med City, Kochi. The list of activities conducted by them are as follows.

1. Surveillance and improvement for antibiotic consumption- point prevalence study of antibiotic consumption was done across Aster DM units in India and through stewardship interventions has brought down the consumption of reserve category of antibiotics by > 20% in all Aster. Units.
2. Education – Dr Anup R Warriar, ID consultant conducted sessions on AMS and AMR at Govt Medical Colleges of Allepey, Palakkad and Ernakulam and also for IMA at Aluva and Irinjalakuda. In collaboration with Dr Shareek an educative App named ID consult was launched . This is a free App for download , already used by more than 700 doctors. Mandatory training for recertification under the pharmacy council for more than 300 pharmacists at Aster Medcity was also conducted.
3. Capacity building – Dr Anup R Warriar and Dr Arun Wilson got trained

in implementation of antimicrobial stewardship at the Radboud University, Netherlands. Based on this, a training program on developing AMS Leads at the Believer's Church Hospital and Medical College was conducted this year. Further programs are planned across the state in 2020.

4. Publications and presentations – The work done in AMS and AMR at Aster Med city Kochi was presented both in the ECCMID and ID Week of 2019.

WAAW activities 13–19 Nov 2017 and Nov 2018



Report:-

Creating awareness on AMR among stakeholders across all sectors is important for AMR containment. Awareness classes were held at all government medical colleges in Kerala for faculty and students. The focus of these classes was to emphasize the importance of rational antibiotic use, infection control practices and need to follow institutional antibiotic policy. As part of World Antibiotic Awareness week (13–19 November 2017), a one week CME and workshop on good antibiotic prescription practices and infection control was organized in all Government Medical Colleges and GH Ernakulam. The antibiotic awareness week was observed from November 13th to 19th in all Govt. Medical Colleges in Kerala and GH Ernakulam.

GMCT also conducted a series of activities to create the awareness of the threat of antibiotic resistance among administrators, clinicians, Nurses, Medical and paramedical students, other health care providers and the community as a whole.

World Antibiotic Awareness Week [WAAW] Activities done in Kerala from Nov 18 to 24, 2019**In Medical Colleges**

1. This year the focus was on public Awareness creation about the use and misuse of antibiotics and about importance of infection prevention and control. In Medical colleges using Link Nurses, students etc awareness classes were conducted for public in OPD and wards. For this purpose the posters from WHO site were downloaded and printed.
2. AWaRe classification of antibiotics was disseminated to all doctors and students.
3. Using student activities like flash mob, role play, street play, awareness runs etc were conducted.
4. Set goal of cutting down unnecessary prescription in OPDs by 50% by 2020
5. Set goal of achieving 60% of total antibiotic prescription to be from

Access category by 2023 as envisaged by WHO.

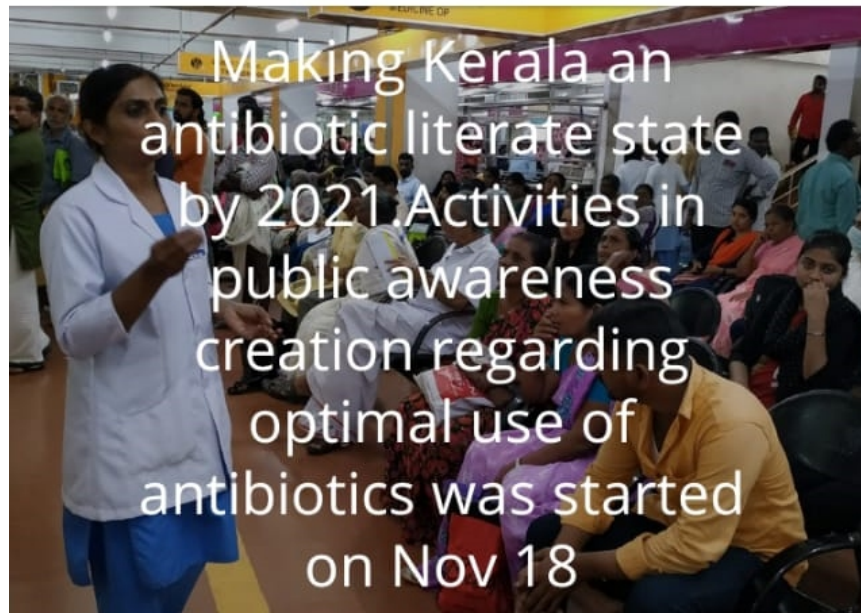
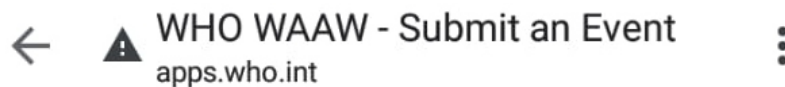
6. Enlisting all faculties, residents, interns and students for online MOOC on Antimicrobial stewardship and Diagnostic Stewardship by WHO

The theme- 'The future of antibiotics depends on all of us, world Antibiotics Awareness week / pledge was taken.

Public awareness creation was also done through

1. IMA, API, IAP
2. FM, Akashvani, TV, Newspapers etc

WHO WAAW Activities in Kerala 2019



DISCUSSION FORUM/SEMINAR | KERALA STATE | INDIA

WAAW Activities Done By Indian Systems Of Medicine November 2019





WAAW activities MCH, Trivandrum



Media Involvement In Antibiotic Literate Kerala Campaign



Awareness programme by KUFOS

- # Invited lectures on AMR were conducted at the University in 2018-19. Dr. Philip Mathew of ReAct Asia-Pacific and Dr. Robin Paul, Quality Manager, State Lab for Livestock Products, Ernakulam delivered lectures on AMR and one health approach for the benefit of the students and staff of the university.
- # **An expert consultation meeting on AMR in Aquaculture** was jointly organized by KUFOS and ReAct Asia-Pacific at Holiday Inn, Kochi on March 08, 2019, in which experts in the field of Aquaculture from various scientific institutions including CIBA, Chennai, MPEDA, KUFOS, State Fisheries Department officials, representatives from the shrimp farming and hatchery industry and students of KUFOS participated.
- # **Other Activities**
 - Dr. Devika Pillai attended and presented paper in the International Conference on 'Globalizing food campaigns: sharing strategies to combat antimicrobial resistance' at Bangkok from 12-14 December, 2018
 - Dr. Devika Pillai and team working on AMR attended two workshops

organized by ReAct Asia Pacific on 28-29 June, 2019 on 'Antibiotic Smart Communities: Agricultural dimensions of Antimicrobial Resistance' and 'Antibiotic Smart Communities: Environment dimensions of Antimicrobial Resistance

Strategic priority -2

Knowledge & Evidence

Kerala Antimicrobial Resistance Surveillance Network (KARS-Net)

Strengthening AMR surveillance is the focus of strategic priority 2 of KARSAP and NAP-AMR. Surveillance of AMR tracks changes in microbial populations, permits the early detection of resistant strains of public health importance, and supports the prompt notification and investigation of outbreaks. Surveillance findings are needed to inform clinical therapy decisions, to guide policy recommendations, and to assess the impact of resistance containment interventions.

Antimicrobial resistance (AMR) Surveillance

AMR surveillance is essential for assessing the AMR burden and for providing the information for action in support of local, national & global strategies. The patterns and driving forces for the emergence and spread of AMR vary from place to place. Monitoring local resistance patterns helps implement targeted measures to contain AMR and to treat infections effectively. Laboratories are important for quantifying the burden of AMR and resistance patterns, and it is vital that they follow standard protocols to generate quality data. Collating local data on AMR is essential to obtain a representative picture of national trends, plan and measure the effect of policies and interventions, and contribute to the understanding of AMR at a regional and global level.

Human health

Under the 'National Program on the Containment of AMR' with NCDC as a national focal point, the AMR surveillance is essential for assessing the AMR burden and for providing the information for action in support of local, national & global strategies.. Food of animal origin also represents the major route of human exposure to foodborne pathogens. AMR surveillance and monitoring of

drug resistant infections in animals is critical for control of AMR.

Human health

Under the 'National Program on Containment of AMR' with NCDC as a national focal point, the current National AMR surveillance network includes 10 laboratories and five more are proposed for inclusion in 2017-18. Government Medical College (GMC) Thiruvananthapuram, has been identified as one of the proposed laboratories, and has signed a memorandum of understanding with National Centre for Disease Control (NCDC). As part of the National AMR surveillance network, GMC Thiruvananthapuram will feed its laboratory results & clinical information using the latest version of WHONET and prepare antibiograms in accordance to the Clinical Laboratory Standards Institute guidelines (CLSI). This would help to monitor resistance trends, reveal emergence of potential novel resistance and aid clinicians in empiric treatment of infections. The laboratory would also share its internal quality control records for AST, send 1% of bacterial isolates on quarterly basis to NCDC for external quality control testing, conduct molecular characterization of Vancomycin, Carbapenem & Colistin resistant isolates, share HAIs surveillance data, share antimicrobial usage data of the hospital and preserve isolates for future need.

Currently, based on 'National Policy for Control of AMR 2011' & 'NAP-AMR 2017-21', GMC Thiruvananthapuram conducts surveillance for infections of public health importance namely blood stream infection (BSI), skin and soft tissue infection (SSTI), respiratory tract infection (RTI), and urinary tract infection (UTI) as well as tracks six pathogens of public health importance (*Acinetobacter* spp., *E. coli*, *Klebsiella* spp., *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Enterococcus* spp.). The participating institutions included in the surveillance initiative include:

- Government Medical College Thiruvananthapuram (coordinator)
- Government Medical College Kozhikode
- Government Medical College Thrissur
- Government Medical College Kottayam
- Government Medical College Alappuzha

- Government Medical College Ernakulum
- Government Medical College Manjeri
- State Public Health Lab
- Government Hospital Ernakulum

As a part of next steps, GMC Thiruvananthapuram plans to expand its AMR surveillance to district level in order to get more community data, and conduct a community based study (already been approved for health services institutions by State Public Health Lab), in partnership with Rajiv Gandhi Centre. Surveillance system would be developed in stages and incorporate a 'One Health' approach (currently the surveillance is limited to human health) in order to strengthen AMR surveillance across animals, food & environment.

Current National AMR surveillance network includes 10 laboratories and five more are proposed for inclusion in 2017-18. Government Medical College (GMC) Thiruvananthapuram, has been identified as one of the proposed laboratories, and has signed a memorandum of understanding with National Centre for Disease Control (NCDC). As part of the National AMR surveillance network, GMC Thiruvananthapuram will feed its laboratory results & clinical information using the latest version of WHONET and prepare antibiograms in accordance to the Clinical Laboratory Standards Institute guidelines (CLSI). This would help to monitor resistance trends, reveal emergence of potential novel resistance and aid clinicians in empiric treatment of infections. The laboratory would also share its internal quality control records for AST, send 1% of bacterial isolates on quarterly basis to NCDC for external quality control testing, conduct molecular characterization of vancomycin, carbapenem & colistin resistant isolates, share HAI surveillance data, share antimicrobial usage data of the hospital and preserve isolates for future need.

WHO has launched a Global Antimicrobial Resistance Surveillance System (GLASS) to standardise AMR surveillance. This system collects and reports data on AMR rates aggregated at national level and is expected to enable comparable and validated data to be shared between countries to drive local, national and regional action. Epidemiological and Microbiological information

will be combined to enhance understanding the extent and impact of AMR on populations, detect emerging resistance and monitor trends, and measure the effectiveness to control AMR. India has enrolled in GLASS in July 2017.

GMCT is the recognised nodal institution coordinating AMR containment efforts in Kerala. AMR containment is recognised as a WHO priority under WHO's Global Programme of Work (GPW) and is a flagship priority of the WHO Regional Office for South-East Asia and the WHO Country Cooperation Strategy (CCS) of WHO India office.

World Health Organization (WHO) and Government Medical College Thiruvananthapuram (GMCT) plan to collaborate to strengthen and expand the AMR surveillance network in Kerala and call it the Kerala Antimicrobial Resistance Surveillance Network (KARS-Net).

In the first phase of expansion, 10 more institutions shall be inducted into KARS-NET from the list of NABL/NABH accredited institutions in Kerala, based on their capacity for AMR testing and surveillance that shall be assessed using a standard assessment tool.

KARS-Net objectives

- Foster standardization, strengthening and expansion of AMR surveillance in Kerala;
- Analyse and report KARS-Net data to State Government and NCDC on regular basis;
- Contribute towards the estimation of extent, burden and monitoring of AMR in Kerala; and
- Detect emerging resistance and its spread in Kerala

The initial focus of surveillance in KARS-Net shall be bacterial drug resistance. Key staff from participating institutions shall be trained for standardized antimicrobial susceptibility testing, data management and development of antibiograms.

The KARS-Net shall be coordinated jointly by GMCT and WHO, and collated KARS-Net data shall be shared with state government and NCDC, which is coordinating the National AMR containment programme and is also the

designated national coordinating centre for AMR surveillance in India.

KARS-Net prerequisites

A. Essential

- 1) Regular documentation of internal quality control (IQC) for antimicrobial susceptibility testing using standard strains and media
- 2) Continuing participation in Microbiology external quality assessment scheme(EQAS) for at least last 2 years, with minimum 75% score in identification/susceptibility testing
- 3) Willingness to participate and share AMR data with KARS-Net

B. Desirable

- 1) Accreditation of laboratory or institute by National Accreditation Board for Testing and Calibration Laboratories (NABL) or National Accreditation Board for Hospitals & Healthcare Providers (NABH)
- 2) Regular generation of institutional antibiograms
- 3) Using WHONET or other laboratory software to capture AMR data electronically

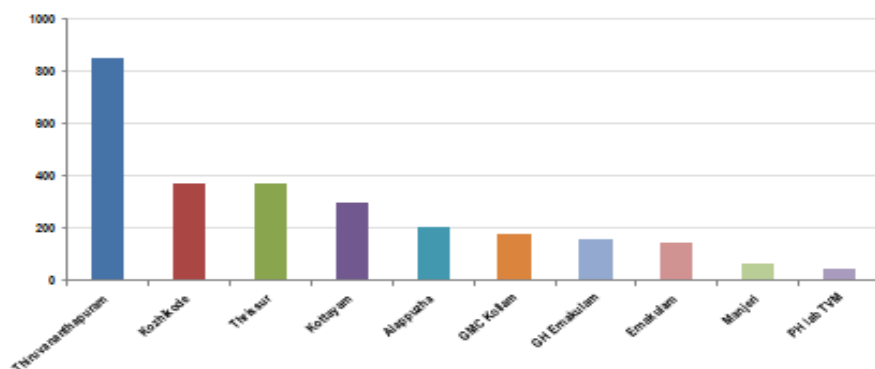
Private & Central Govt Institutions joined with GMCT- KARSNET – first phase of expansion

Currently only public sector institutions are part of the AMR surveillance network in Kerala, which may not be enough to represent the diversity across the state. Therefore the number of surveillance sites needs to be augmented including the private sector, for a more comprehensive and representative surveillance of AMR that better captures the AMR burden across the state. Thus KARS-NET was expanded by including the following sites also .

SCTIMST, Trivandrum	KSC	SCT
RCC, Trivandrum	KRC	RCC
Sree Gokulam Medical College, Venjaramoodu	KGO	SGM
Pushpagiri Institute of Medical Sciences, Tiruvalla	KPU	PIM
Believers Church Medical College, Tiruvalla	KBE	BCM
Jubilee Mission Medical College, Thrissur	KJU	JMM
Karuna Medical College, Palakkad	KKR	KMP
Thankam Hospital, Palakkad	KTH	THP
Dane Diagnostics, Palakkad	KDD	DDP
DDRC SRL	KSR	SRL
Gopinath Scans, Trivandrum	KGS	GOP
Baby Memorial hospital, Kozhikode	KBM	BMH
Ashwini Diagnostics, Kozhikode	KAD	ASW
MVR Cancer centre, Kozhikode	KMV	MVR
Amrita Institute of Medical Sciences, Kochi	KAI	AIM

Number of isolates

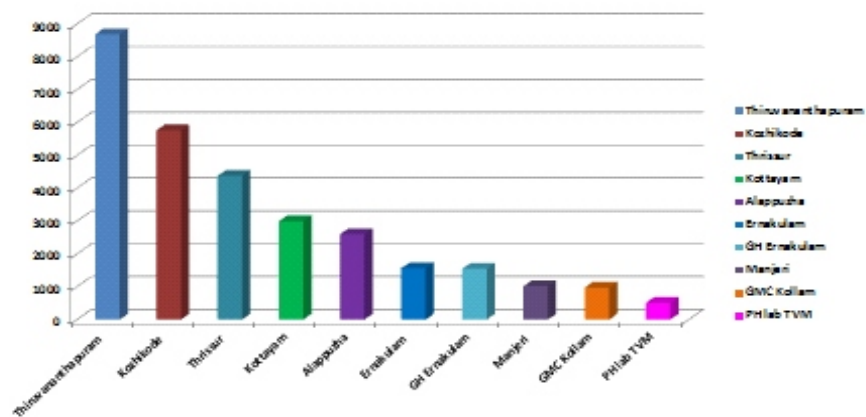
2017; Total 2691



Number of isolates

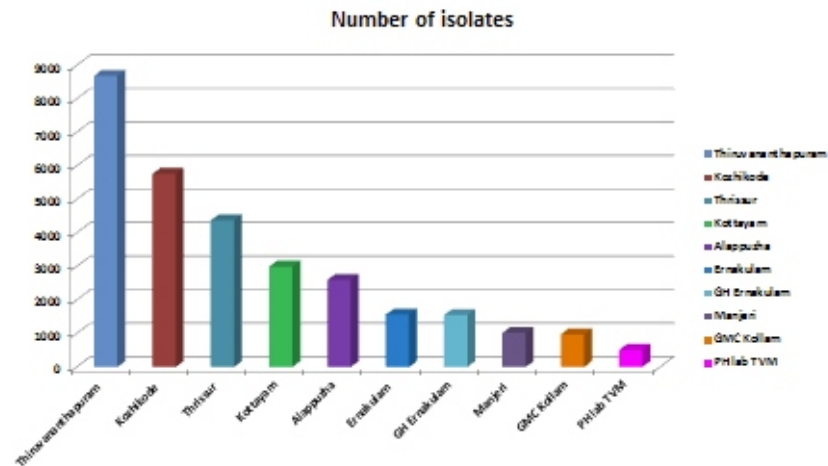
2018; Total 30,028

Number of isolates

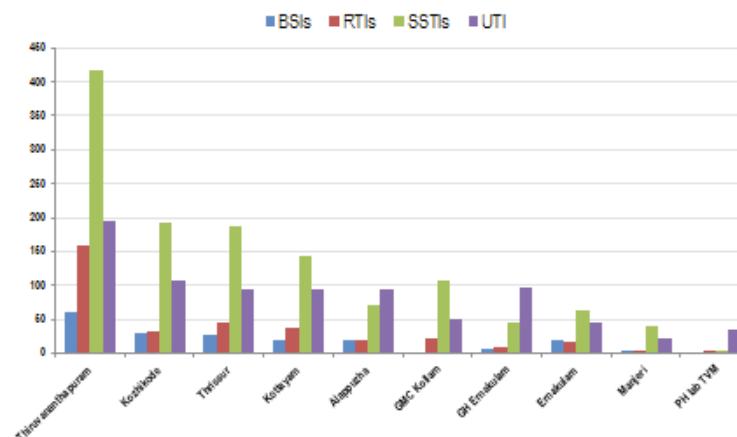


Number of isolates

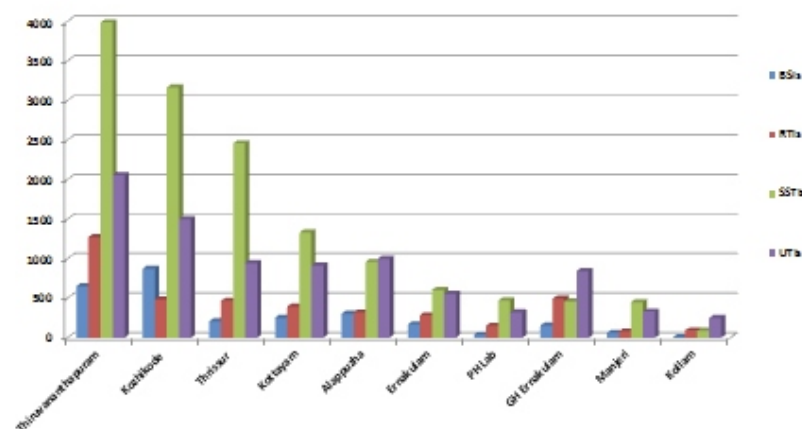
2018; Total 30,028



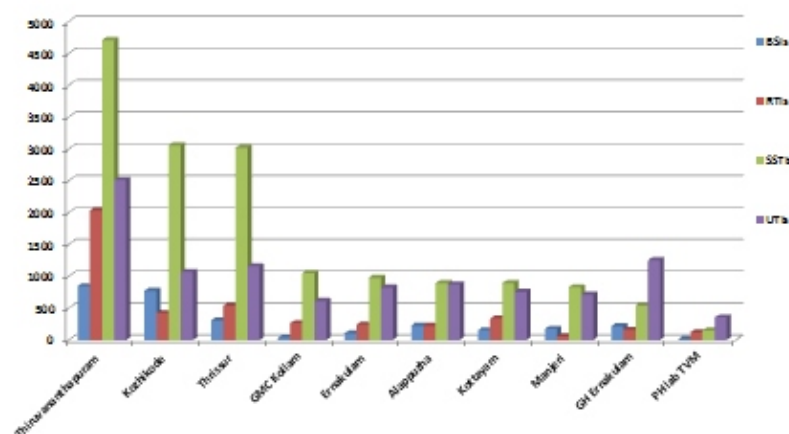
Infections of public health importance- 2017



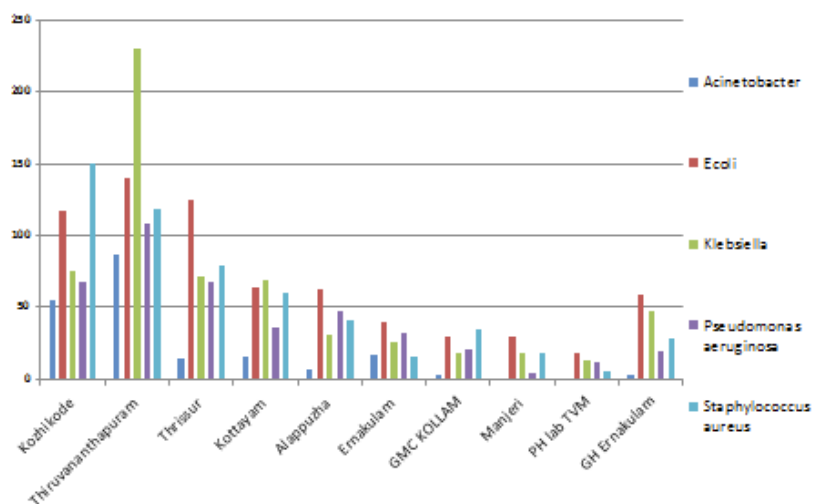
Infections of public health importance- 2018



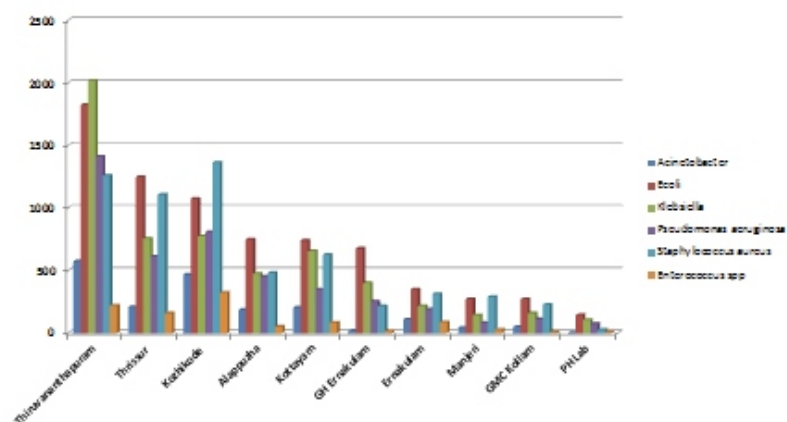
Infections of public health importance- 2019



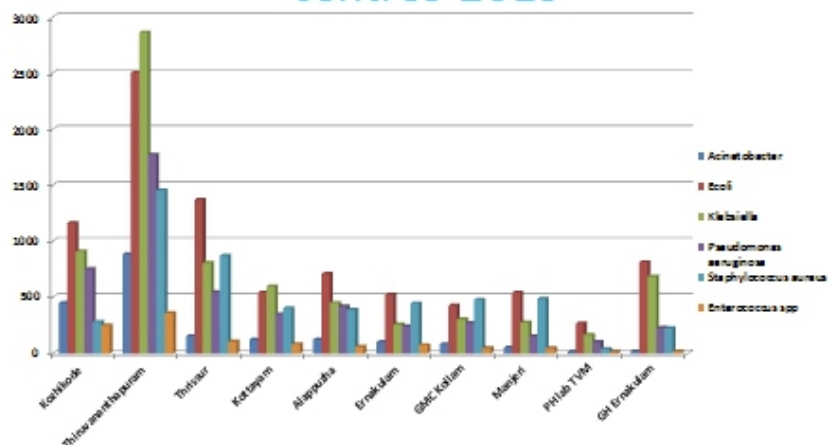
Distribution of isolates in various centres-2017



Distribution of isolates in various centres-2018



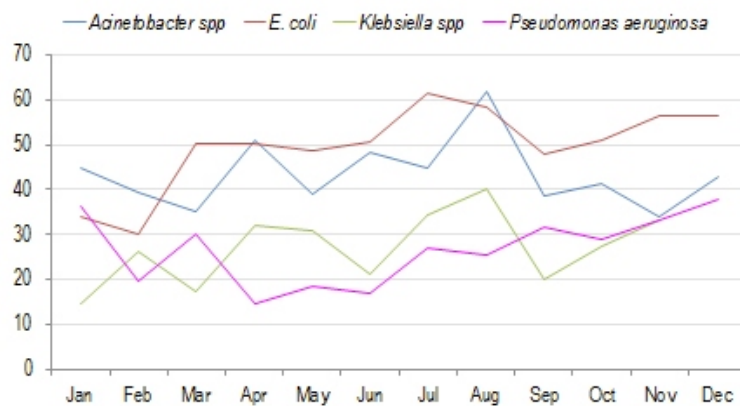
Distribution of isolates in various centres-2019



% of ESBL producers-2017

% of ESBL producers (India)

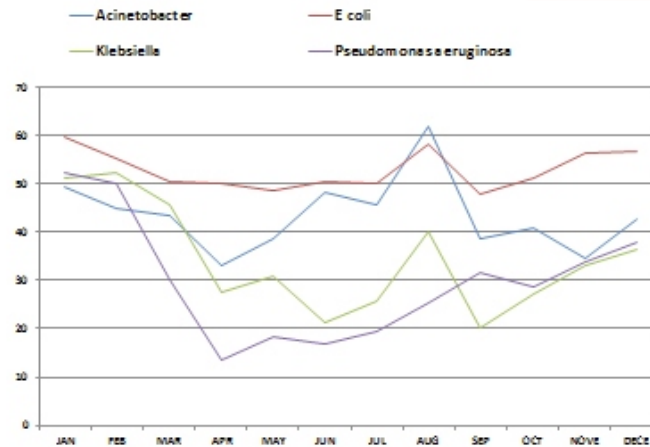
Acinetobacter spp	65
E. coli	61
Klebsiella spp	62
Pseud. aeruginosa	65



% of ESBL producers-2018

% of ESBL producers (India)

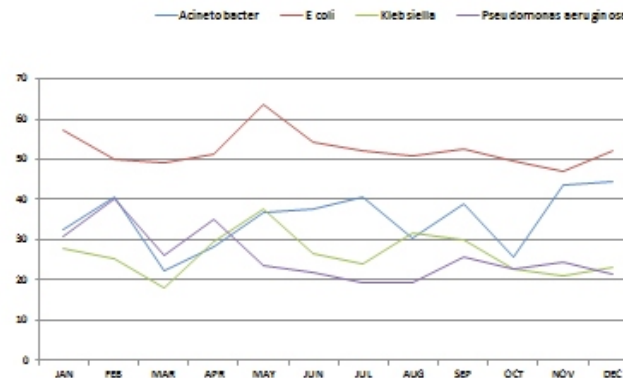
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% of ESBL producers-2019

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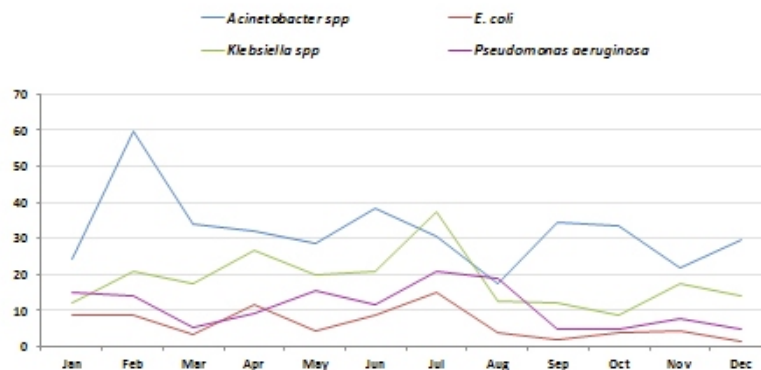
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Carbapenem resistance- 2017

Carbapenem resistance (India)

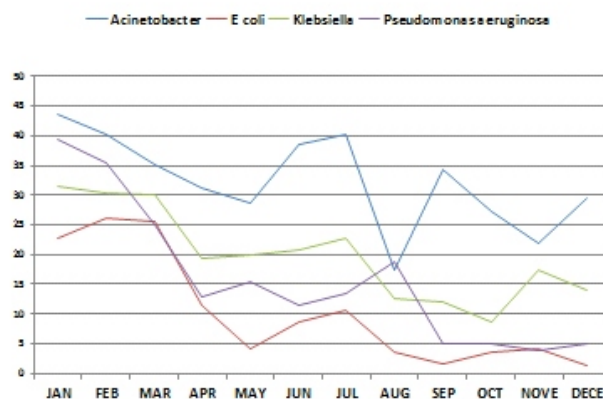
<i>Acinetobacter</i> spp	70
<i>E. coli</i>	12
<i>Klebsiella</i> spp	51
<i>Pseud. aeruginosa</i>	42



Carbapenem resistance- 2018

Carbapenem resistance (India)

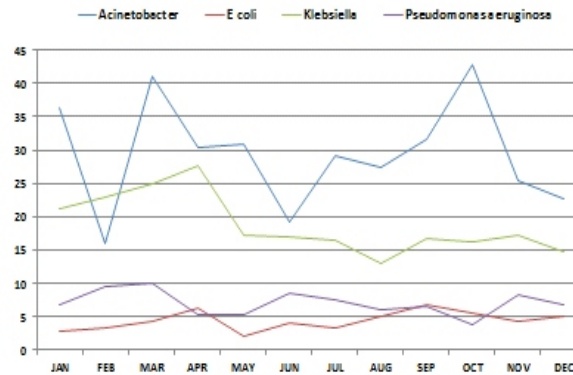
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Carbapenem resistance-2019

Carbapenem resistance (India)

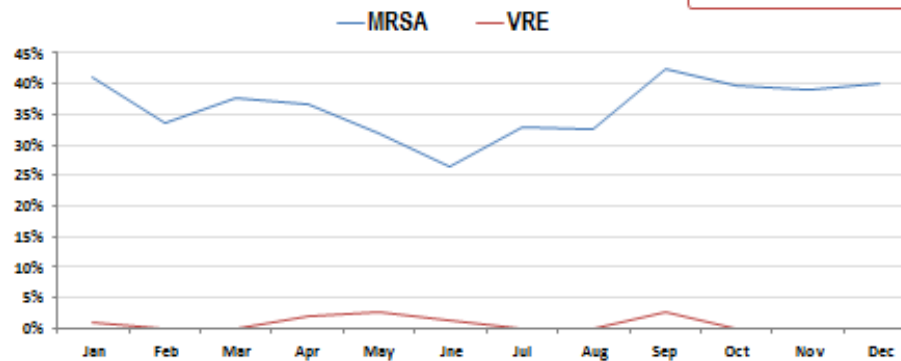
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<i>Pseud. aeruginosa</i>	42

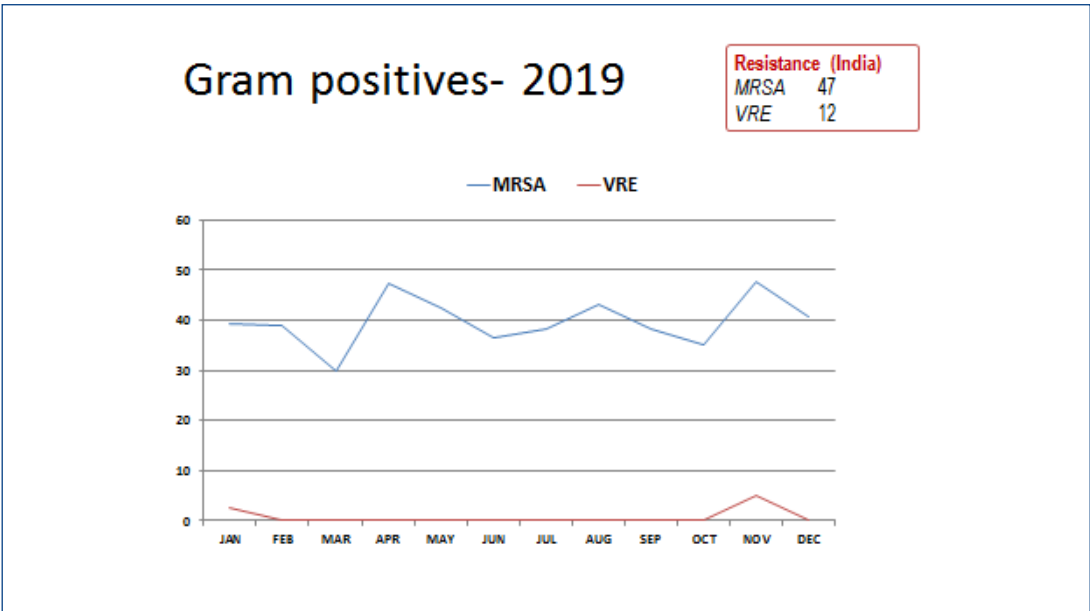
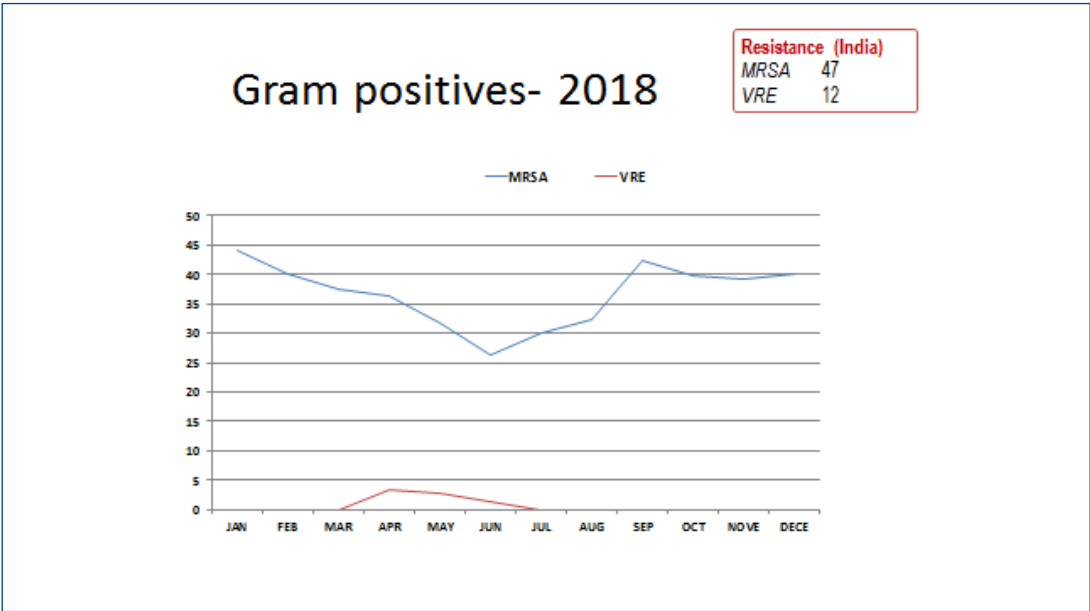


Gram positives 2017

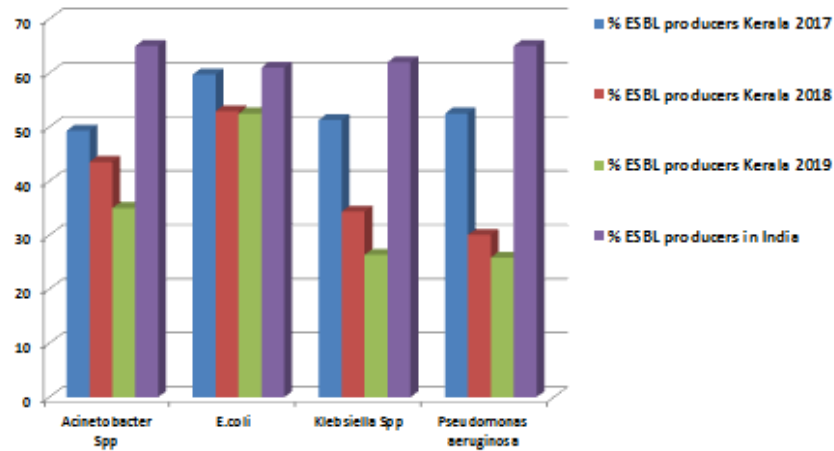
Resistance (India)

MRSA	47
VRE	12

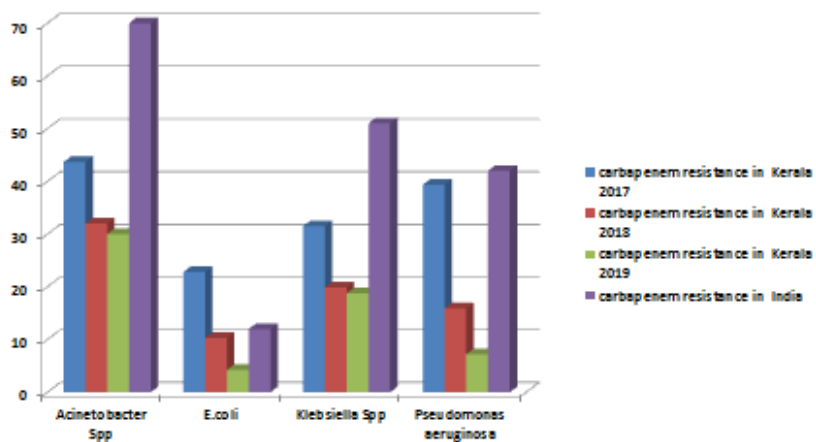


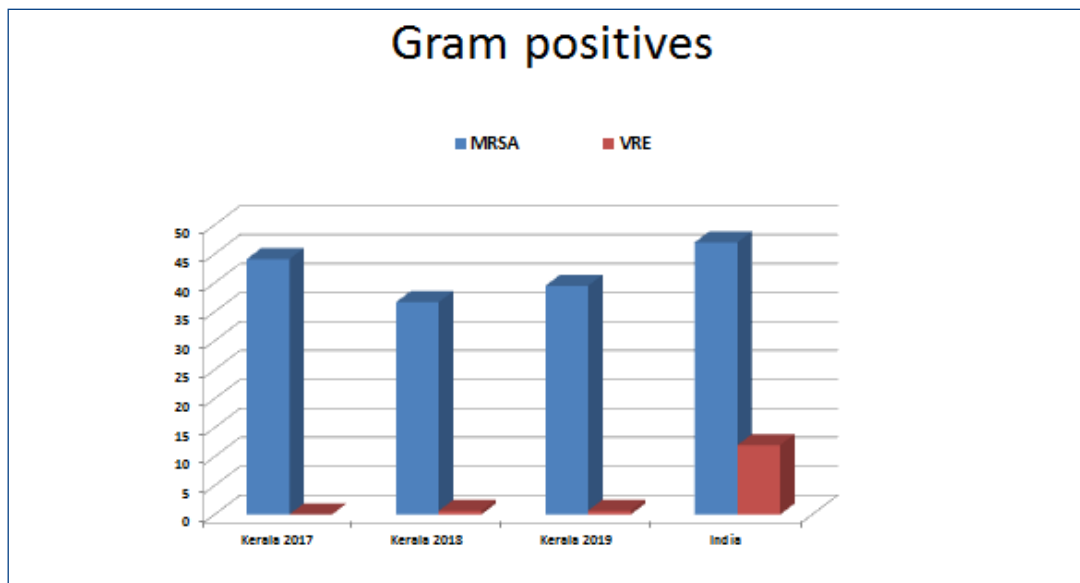


ESBL production



Carbapenem resistance





A Study On Antibacterial Resistance Pattern In Primary care centres in Thiruvananthapuram

September 2018- February 2019

Objectives

- 1) To process the specimens viz blood, urine, faeces, sputum, throat swab, pus collected from patients from hospital setting with signs and symptoms of acute infectious diseases that were received in the State PH lab to isolate the bacterial pathogens.
- 2) To identify the top priority bacterial pathogens circulating in Thiruvananthapuram.
- 3) Detection of antibiotic sensitivity and resistance pattern in the pathogen isolated.

Conclusion

- 1) Main bacteria causing wound infection are Staphylococcus aureus.
- 2) Staphylococcus aureus isolates were sensitive to antibiotic of choice Cloxacillin.

- 3) Resistance of *Staphylococcus aureus* isolates from patients not much treated with antibiotics are negligible. Only drugs like Penicillin and Erythromycin showed 100 % resistance.
- 4) Resistance of enterobactericeal isolates for first, second and last line drugs were lower.
- 5) All isolates of Enterobactericeae and all isolates of *Staphylococcus aureus* were sensitive to Cotrimoxazole. Reducing the unnecessary use or over use of an antibiotic may reduce the development of resistance. This is clear from the increased sensitivity shown to cotrimoxazole.
- 6) Since majority of isolates were sensitive to first line antibiotics, judicious use of first line antibiotics for infection at the primary and secondary care centers may cure the infection. At the same time prevent development of resistance to third line of antibiotics or last line antibiotics of current time.

Surveillance of Antimicrobial Resistance in public water bodies and aquaculture farms in the vicinity of hospitals of Kerala done by Kerala University of Fisheries and Ocean Studies (KUFOS).

Samples were collected from water bodies adjacent to prominent hospitals in four districts of Kerala viz; Kannur, Ernakulam, Alapuzha and Kollam; and from aquaculture farms in the vicinity of these hospitals, using the same water as inlet source. The following sites were selected for the study. In Kannur district (the water body near to Cooperative hospital, Thalassery), in Ernakulam district (adjacent to Lakeshore and Aster Medicity and shrimp farms near them), in Kollam district (water body adjacent to Govt. ESIC hospital) and in Alappuzha district (a water body near Vandaanam Medical College). Soil, water and fish/shrimp/clam samples were collected from the selected sites. For microbiological examination Trypticase soy agar was used. All the isolates were characterized by biochemical methods (Bergeys Manual of Systematic Bacteriology). Most of the isolates belonged to Gram negative

Enterobacteriaceae, Pseudomonas, Bacillus, Aeromonas, Acinetobacter, Staphylococcus, Streptococcus and Enterococcus. The antibacterial activity of the isolates was determined by antimicrobial susceptibility (AST) and MIC was done according to the Clinical and Laboratory Standards Institute guidelines (CLSI, 2013). Based on that, isolates were grouped into resistant/intermediate/sensitive. Thirty six antibiotics belonging to eight major classes of antibiotics screened included β -lactams, aminoglycosides, glycopeptides, macrolides, quinolone, fluoroquinolones, tetracyclines, cephalosporins and sulphonamides.

Isolates, particularly those from water bodies near older and busy hospitals showed very high resistance to most antibiotics. The isolates from water bodies adjacent to new hospitals were relatively sensitive. Maximum resistance was shown by *Staphylococcus* and Enterobacteriaceae group. Most of the Enterobacteriaceae group showed high MIC values for β -lactam, fluoroquinolones and cephalosporins, while *Staphylococcus* isolates showed extremely high MIC values for glycopeptides.

In an effort to understand the mechanisms of transfer of AMR, screening for antimicrobial resistance genes is in progress.

Karsap Strategic Priority Three

Infection Prevention And Control

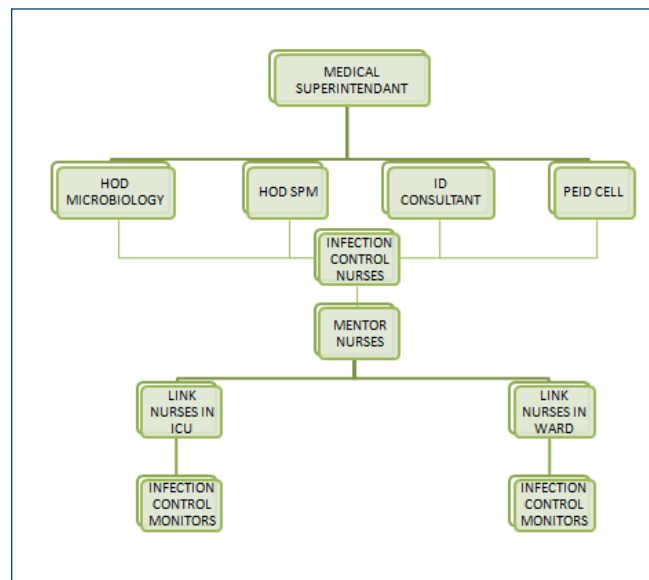
Under KARSAP, HICC was constituted in all Government Hospitals in the State. Periodic meetings of HICC was insisted upon. All private hospitals were directed to constitute HICC.

In all Government Medical colleges, to augment HCAI surveillance Link Nurse system was established. The selected Nurses from all MCH were given one week intensive training in IPC during a workshop organized by DME. These nurses were deployed as link nurses and ICNs in their respective institutes. These trained nurses in turn, conduct training for all other healthcare workers in their respective institutes. Using the link nurses, HCAI surveillance is being carried out in all ICUs. VAP, CLA-BSI, CA-UTI, SSI rates and hand hygiene compliance rates are calculated by Link nurses and ICNs. The rates are

presented and discussed in monthly ICT [Infection control team] meeting. If rates are above INICC benchmarks process monitoring is started in those ICUs. Bundles of care [VAP bundle, CLA-BSI bundle, CA-UTI bundle, SSI bundle, Blood collection bundle, Pressure sore prevention bundle] were introduced in all ICUs. Compliance to these HAI prevention bundles are monitored by link nurses. Regular training for all levels of staff is conducted by ICT. In order to foster dissemination of knowledge, small group learning [SGL] were introduced in all ICUs under leadership of Link Nurses. SGL sessions are done every week in ICUs. Last year in MCH TVM alone, 250 SGL sessions were conducted. Fifth of every month is observed as hand hygiene day in all ICUs and wards. SGL sessions have been extended to wards also. Bystander and public education in IPC measures like cough etiquette, hand hygiene etc are integral part of teaching sessions. Under PEID cell and ICT, World hand hygiene day [MAY 5] and Global Hand washing day were celebrated in all Medical colleges.

An Infection control tree was devised for Medical colleges and roles and responsibilities of each branch was defined after multi-stakeholder meeting.

Infection Control Tree



Responsibilities of the Infection Control Team

- Develop and implement Infection Control Guidelines for the hospital.
- Supervise and Monitor activities of Infection control Nurses and Link Nurses.
- HCAI surveillance –outcome and process surveillance.
- Analyze and take appropriate steps based on HCAI surveillance data.
- Training all levels of staff and students in infection prevention and control.
- Supervision and monitoring of general cleanliness and hygienic practices.
- Oversee sterilization and disinfection: and regular monitoring of quality of disinfectants used.
- Advise management of at-risk patients and supervision of isolation procedures.
- Conduct Outbreak investigations.
- Isolation and co-horting of patients.
- Advice regarding vaccination strategies and post exposure chemo prophylaxis.
- Biomedical waste management
- Training of all new students and staff on hospital infection control policy.
- Periodic auditing of infection control protocols, prevalence of MDROs, susceptibility patterns and antibiotic utilization rates.
- Monitoring health-care worker occupational safety.

Roles And Responsibilities Of Infection Control Core Team

- Deployment, supervision, control and periodic training of nursing and cleaning staff.
- Instruct and advise staffs on changes in policies, procedures or working standards.

- Check list based periodic sanitary rounds.
- Continuous monitoring of Infection control activities in casualty , wards and ICUs with the help of ICNs, Link Nurses and Monitor nurses.
- To identify the demand-supply mismatch with regard to disinfectants, Personal protective equipments and cleaning equipment
- Supervision of biomedical waste management and ensure proper segregation, transportation and disposal of biomedical waste by the staff.

Role Of Infection Control Nurses

1. Supervision

ICNs will have to supervise the IPC activities in wards, ICUs and casualty. ICNs will have to report to the Nursing superintendent in charge of Infection control on a periodic basis. ICNs will have to supervise the activities of the link nurses in wards and ICUs along with the mentor nurses.

2. Surveillance

ICNs will have to supervise and collate data with regard to HCAI Outcome surveillance measures [VAP rate, CLA-BSI rate, CA-UTI rate, SSI rate] and process surveillance measures like [Bundle compliance rates, hand hygiene compliance rate etc] should be collated by the ICNs .The data has to be presented monthly by ICN in infection control team meeting. HCAI rates have to be compared with NHSN and INICC rates by ICN. Standardised Infection ratio has to be calculated. If HCAI rates are above institutional benchmarks, process surveillance will have to be started in that particular ICU by ICNs.

3. Training

ICN and Mentor nurses will have to train link nurses periodically in IPC best practices and in HCAI Surveillance. ICN and Mentor nurses will have

to help link nurses in the selection of topics to be discussed in wards and ICUs during Small Group Learning sessions. ICN should take lead in IPC training activities for all health care staffs and students. Proper way of donning and doffing PPE should be demonstrated to all health care workers by ICNs. Random process monitoring surveillance based on checklists should be done by ICNs. ICNs should periodically observe the functions and surveillance forms filling methods by link nurses. ICN should take an active role in the periodic update and dissemination of infection control guidelines.

4. Outbreak Investigation

ICN will have to take a lead in flagging, investigating, reporting and implanting IPC measures for HCAI outbreaks.

5. Occupational health and hazard reporting.

ICN will have to maintain a register of vaccination status of all staff and students with regard to Vaccine preventable diseases.

ICN will have to maintain a register to document anti Hbs titres of all staff and students.

Needle stick injuries and other work place hazards should be duly entered in a register. ICN should refer them to seek chemoprophylaxis.

6. BMW management.

ICN should support ICT in BMW management.

Functions Of Mentor Nurses

Mentor nurses in addition to their responsibilities in ICU/Ward should guide link nurses in all IPC activities.

Mentor nurses should co-ordinate small group learning activities.

Mentor nurses should render academic support to link nurses for teaching sessions.

Apart from these, mentor nurses should perform all activities of Link nurses.

Functions Of Link Nurses

Link nurses in addition to their responsibilities in ICU/Ward should act as a liason between their clinical care area and ICT.

Responsibilities of link nurses include

- Organizing small group learning sessions in their clinical care area weekly.
- Ensuring compliance with IPC practices and HCAI Bundles.
- Filling forms for HCAI surveillance daily. Calculation of VAP, SSI, CLABSI and CA-UTI rates.
- Calculation of Hand hygiene compliance rates.
- Initiate Process monitoring [Bundle compliance rate] if directed by ICT.
- To guide interns /residents in IPC practices and BMW disposal.
- To report Non compliance with IPC practices to ICN.
- Participate in IPC related audits and surveys.
- To enter forms with regard to antibiotic utilization rates.
- Participate in monthly Link Nurses meeting.

Responsibilities Of Ipc Monitor Nurses

Apart from their responsibilities in wards and ICUs, IPC monitors responsibilities are

1. Monitor compliance with HCAI bundles and hand hygiene compliance when link nurses are off duty.
2. To guide interns/residents/students in IPC practices and BMW disposal.
3. Participate in small group learning sessions.

Quality Indicators Calculated In All Icus and HDUs

1. VAP RATE.
2. CLA-BSI RATE.
3. CA-UTI RATE.

4. SSI RATE
5. HAND HYGIENE COMPLIANCE RATE.
7. If HCAI rates calculated are more than the INICC benchmarks , then process monitoring with respect to care bundles [both insertion and maintenance bundles for CLABSI AND CA-UTI, and VAP BUNDLE] to be initiated in that particular ICU.
8. Standardised Infection Ratios [SIR] for HCAI are calculated for benchmarking.
ICU AND ward environmental cleaning and disinfection grid is maintained in all Government Medical colleges.
Blood spill and Mercury spill kits have been kept in all clinical care locations in all Government Medical colleges.
Needle stick injury and vaccination status of staff register maintained in all Govt MCHs.

Cough Corners—

Aim of cough corner is to ensure that all patients presenting with probable droplet or airborne infection are provided with a mask from the first point of contact in the casualty [cough corner] itself. Posters on Cough etiquette and the pivotal role it plays in IPC are displayed in the cough corner. Cough corners have been set up in all Govt hospitals in the state. Functionality of cough corners are monitored daily by link nurse in casualty and weekly supervised by ICN.
CSSD-Monitoring is done routinely..

Best Practices In Ipc Were Identified From Across The State

Video modules for ipc were prepared

1. Video modules for donning and doffing of ppe.
2. Video modules to demonstrate central line insertion bundle and maintenance bundle.
3. Video modules to demonstrate ca-uti insertion and maintenance bundles.

4. Video modules- for vap bundle.
- 5 Video modules for demonstrating hand hygiene steps and five moments.
6. Video modules to demonstrate ssi bundle.
7. Video module to demonstrate cross infection in hospital settings. [spread of mdros in hospitals][
8. Video modules to demonstrate cough etiquette.
9. Video modules for patient and bystander education.
- 10 Posters for patient and bystander education.

Best Practice 2

Inorder to ensure compliance with blood culture collection bundle , the ID of the person drawing the culture should be documented in the requisition form along with their mobile number.In case culture grows skin contaminants , the concerned person will be given a training on sterile precautions to be followed while drawing blood by the Link Nurses in ward/ICU .

Best Practice 3

A circular from superindent empowering the link nurses and Head nurses in wards/ICUs with regard to implementation of IPC guidelines. The circular empowers link nurses to ensure that IPC practices like 5 moments of hand hygiene are ensured to by all staff including doctors.The errors committed by medical students ,interns and residents will be pointed out and corrected at the spot itself. If errors are committed by senior faculty , the same will be recorded by link nurse and will be brought to the attention of Medical superintendent.

Best Practice 4

An APP based checklist for safer practice to be implemented in all ICUs. Infection control checklists in the APP should be

- 1 . Central line insertion check list.
2. Central line maintenance check list.

3. VAP prevention check list.
4. CA-UTI prevention checklist.
5. Checklist to prevent transmission of infections –smear positive PTB , Measles , chickenpox, Diphtheria etc.

Best Practice 5

Topic presentation by a Link Nurse during the monthly Link Nurses meeting. The topics will be selected by the ICT. The link nurses will be helped in the presentation by ICN/Mentor nurses



Small Group Learning Session In Ward



Small Group Learning Session In Icu



Monthly Infection Control Team Meeting



Best Practice 6

Small Group Learning Sessions – Inorder to create awareness about IPC among all staff members , SGL sessions conducted once a week led by link nurses in wards and ICUs , are found to be very useful.

Best Practice 7

Celebrating World Hand Hygeine day [May 5] and Global Handwashing day [OCT 15].An update on IPC activities to be conducted on these days.Best wards and ICUs to be adjudged by ICT. A quiz to be conducted for students and staff Nurses. Antibiotic awareness week to be observed in all Medical colleges from Nov 18 to 24.

Best Practice 8

Commemorating 5 th day of every MONTH as Hand hygiene day.That day , link nurses will encourage all staff members and students to demonstrate the steps in hand-rubbing/hand-washing .

Best Practice 9

Clinical Microbiology /ID rounds – Apart from the ICN , Clinical Microbiologist/ID will visit all the ICUs daily and monitor the IPC practices. The observed lacunae should be documented and corrective measures formulated. Handshake antibiotic stewardship model will be followed.

Best Practice 10

To inculcate IPC ownership in clinicians , to identify nodal officers in all clinical departments and encourage them to take classes.For example critical care consultant is the ideal person to lead classes on VAP and CLA-BSI , surgeon on SSI, Orthopedician on implant infections ,cardiologist on re-use policy etc.

State Ipc Guidelines

State IPC guidelines will be released in February 2020.



GENERAL HOSPITAL, ERNAKULAM
&
INNER WHEEL CLUB OF GREATER COCHIN



SANJEEVANI



HAND HYGIENE CAMPAIGN
AN INITIATIVE FROM HOSPITAL TO COMMUNITY LEVEL



KARSAP Strategic Priority Four

Antimicrobial Stewardship [ASP]

1. Antimicrobial stewardship committees have been set up in all tertiary care centres.
2. Prospective audit and feed back has been started in all ICUs.
3. Low hanging fruit model of ASP has been implemented with focus on
 - A. Antibiotic prescriptions have to be put inside a bracket.
 - B. Appropriate cultures to be sent.
 - C. If de-escalation is not practiced based on culture susceptibility report, reason for same has to be documented in the case sheet.
 - D. If more than two antibiotics are combined, reason for the same has to be documented.
 - E. Double anaerobic coverage is redundant, if used reason for the same has to be documented.
 - F. If antibiotics are used for more than seven days , reason for the same has to be documented.
 - G. If WHO Reserve antibiotics are used, reason for the same has to be documented.
 - H. If surgical prophylaxis is continued for more than 24 hours, the reason for the same has to be documented.
4. AMS metrics are calculated to assess the proportion of WHO Access, Watch and Reserve antibiotics.
5. Link for WHO MOOC on AMR was provided to all doctors and students.
6. Regular sensitization programmes on ASP are given to all categories of health care workers.
7. ASP modules and digital antibiotic policies are being prepared with the help of K-DISC.

8. Defined daily doses of WHO reserve antibiotics are being calculated in all ICUS.
9. World Antibiotic Awareness Week [nov 18-24] is observed in all health care institutions in the state



Workshop On Antibiotic Stewardship By lap

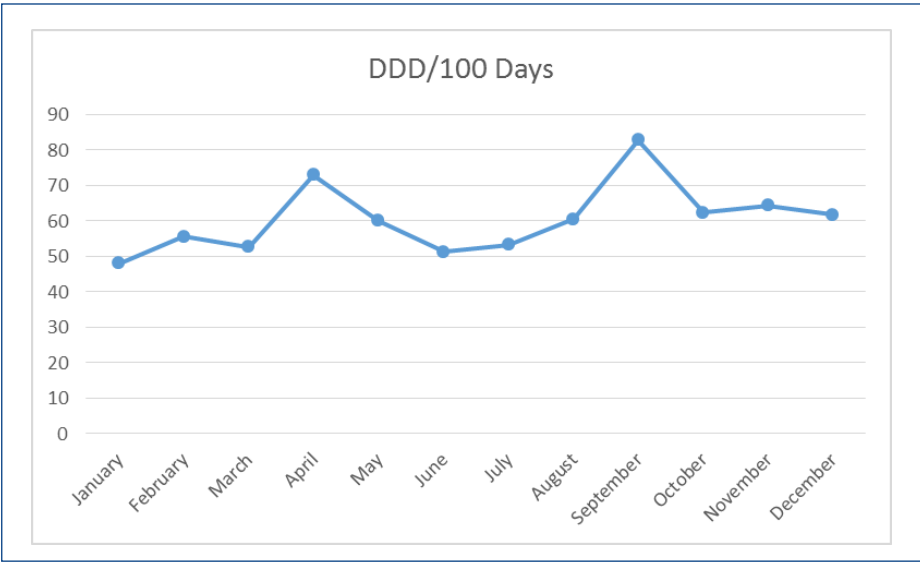


Antibiotic Stewardship Lecture At Govt. Dental College



Antibiotic Literate Campaign At Regional Cancer Centre

AMS metrics – GMCT (Total antibiotic utilization 2018-2019)



MONTH	DDD/100 Days
January	48.05211878
February	55.54465996
March	52.65815483
April	72.99776049
May	60.00914548
June	51.14842999
July	53.16634064
August	60.4322605
September	82.71070732
October	62.36772255
November	64.24180617
December	61.71771044

AWARE target for the State

State has set a goal of achieving the WHO target of having 60% of antibiotics utilization in the state to be from Access category by 2023. A road map to achieve the same for the state is being prepared. The integral components of the road map are

- A. To create an AWARE INDEX for the state.
- B. AMS metrics with regard to the proportion of antibiotic utilization from Access, Watch and Reserve categories to be calculated in all hospitals. This will be collated and will represent the state AMS metrics.
- C. AWaRe Grid for state to be calculated by State Drugs controller from antibiotic purchase/sales data in the state.
- D. An App is being created to enable OPD prescription of antibiotics from Access category. In OPD more than 95% prescription has to be from Access category
- E. A Study was conducted in the OPD of MCH TVPM by department of Clinical Pharmacology by Miss Israth to assess the “ Evaluation of use of WHO Access, Watch and Reserve categories of Antibiotics in outpatient department.

Summary Of The Study

A cross sectional study was conducted in the outpatient pharmacy, Govt. Medical College, Thiruvananthapuram, from January 2019 to June 2019. In order to evaluate the proportional usage of World health organization's Access, Watch and Reserve categories of antibiotics. A total of 10246 prescriptions were analysed. Patients were also interviewed as part of secondary objective, i.e.: patient's knowledge, awareness and practice regarding antibiotic use.

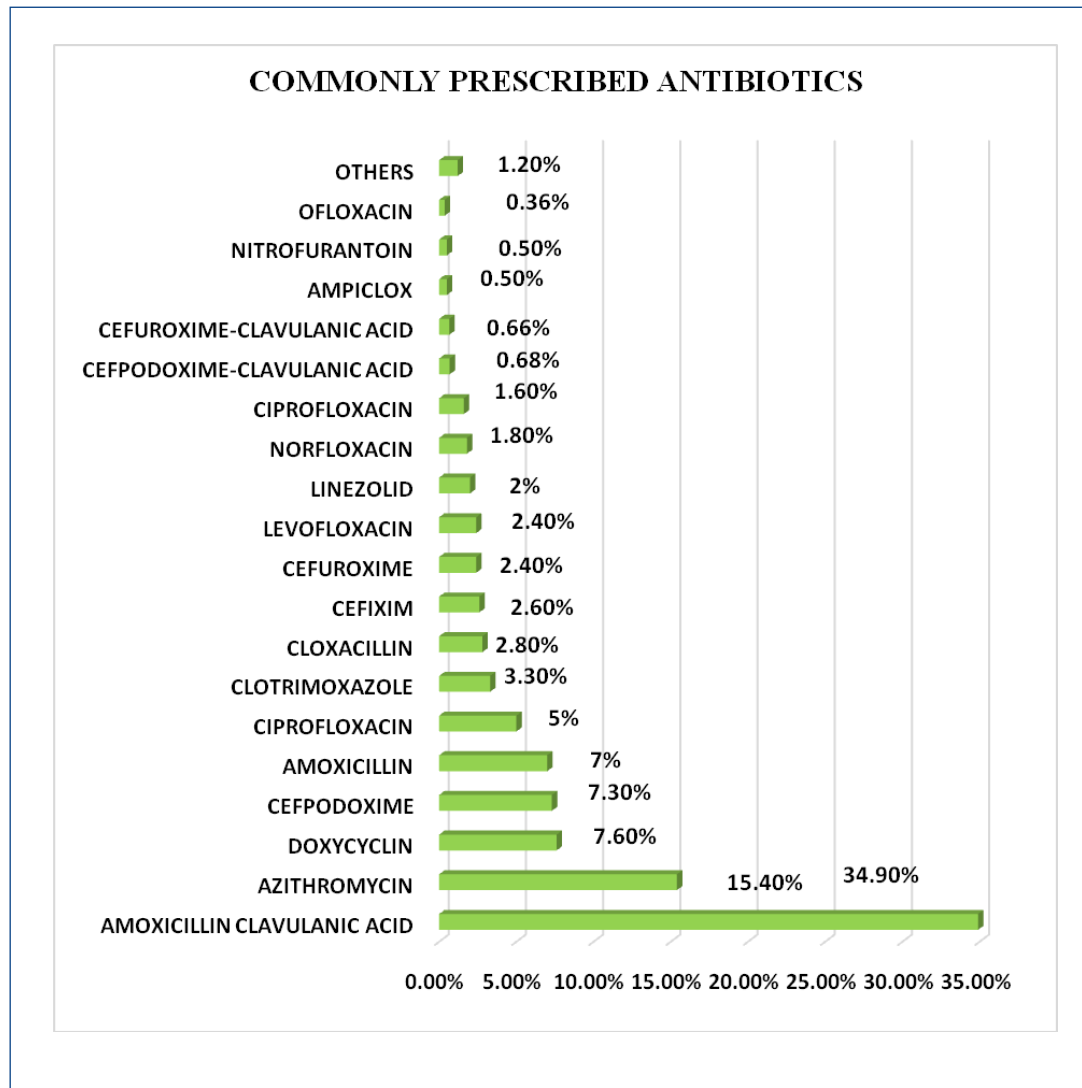
Evaluation Of Use Of Access, Watch And Reserve Categories Of Antibiotics

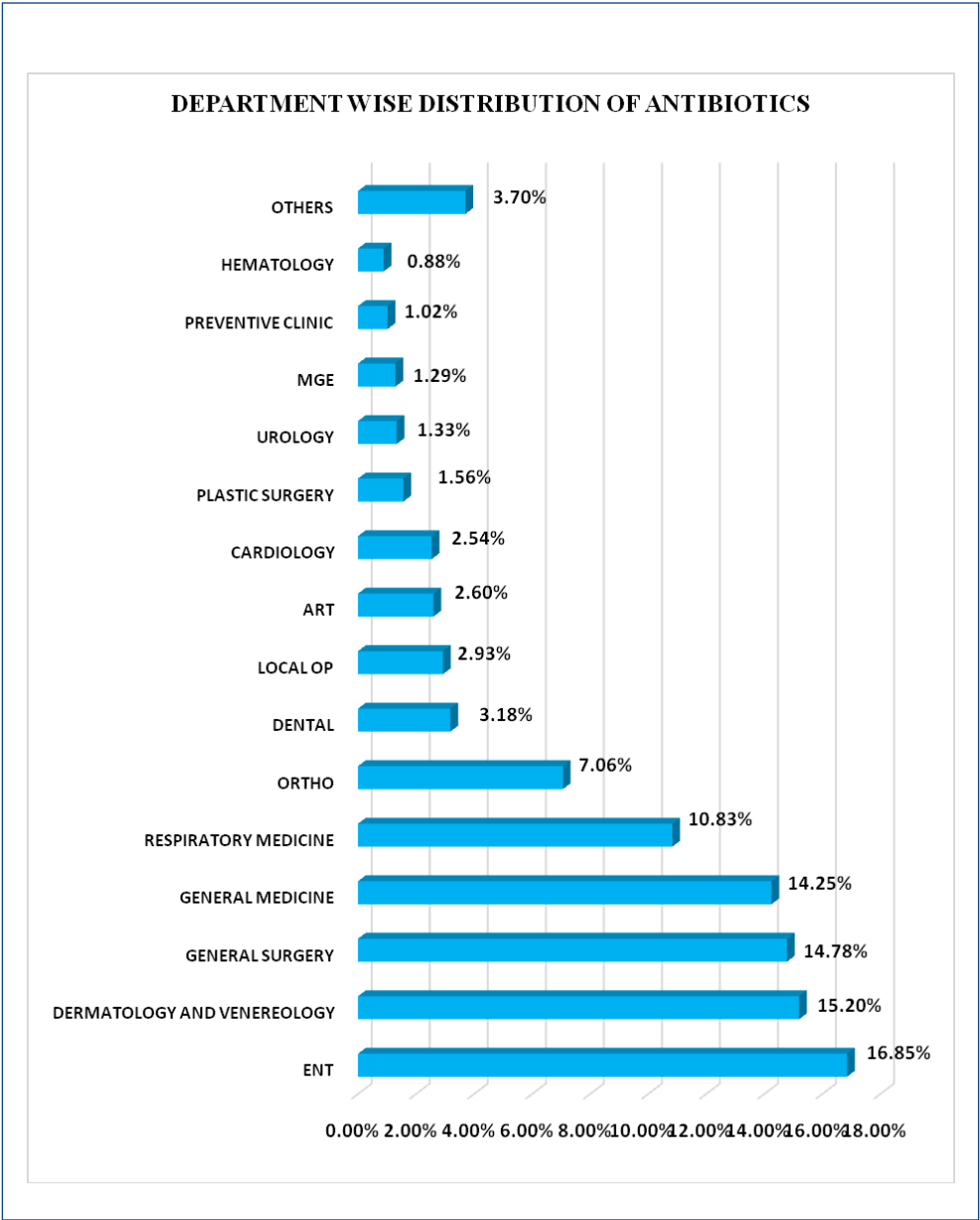
- The most commonly prescribed antibiotics in the outpatient

department include penicillins and cephalosporins, followed by quinolones and tetracyclines.

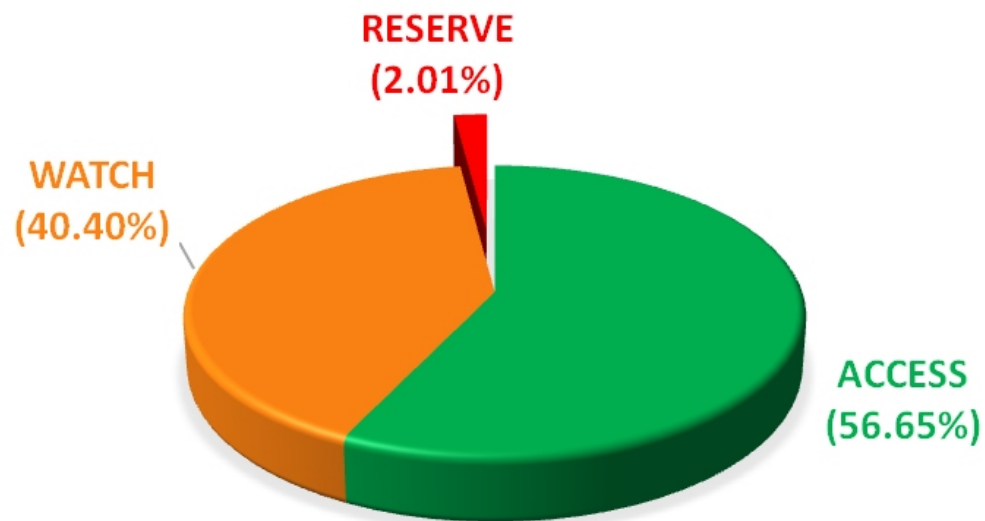
- ENT department was found to have the highest percentage of antibiotic prescription, followed by Dermatology, General surgery and General medicine.
- The percentage of use of Access, Watch and Reserve categories of antibiotics in the outpatient department was found to be 60.66%, 37.33% and 2.01% respectively.
- Amoxicillin-clavulanic acid is the most commonly used drug from the Access group, followed by doxycycline, amoxicillin and co-trimoxazole.
- Indication wise distribution of all Access group antibiotics were found to be as per guidelines by IDSA, ICMR treatment guidelines for antimicrobial use in common syndromes, NCDC guidelines and Antibiotic guidelines of Government Medical College Thiruvananthapuram.
- Azithromycin was found to be the most commonly prescribed antibiotic from the Watch group, followed by cefpodoxime, ciprofloxacin, cefixime and levofloxacin.
- Indication wise distribution of majority of watch group drugs was not according to antibiotic guidelines by IDSA, ICMR treatment guidelines for antimicrobial use in common syndromes, NCDC guidelines and Antibiotic guidelines of Government Medical College Thiruvananthapuram.
- Linezolid (Reserve) was found to be maximally used by orthopedics department followed by General surgery, General medicine and plastic surgery.
- Majority of the linezolid usage (80%) was found to be Empirical, only 20% was based on culture and susceptibility results.
- Drug prescription pattern for infections such as UTI, LRTI, SSTI, URTI, bone and joint infections etc were not totally congruent with syndrome

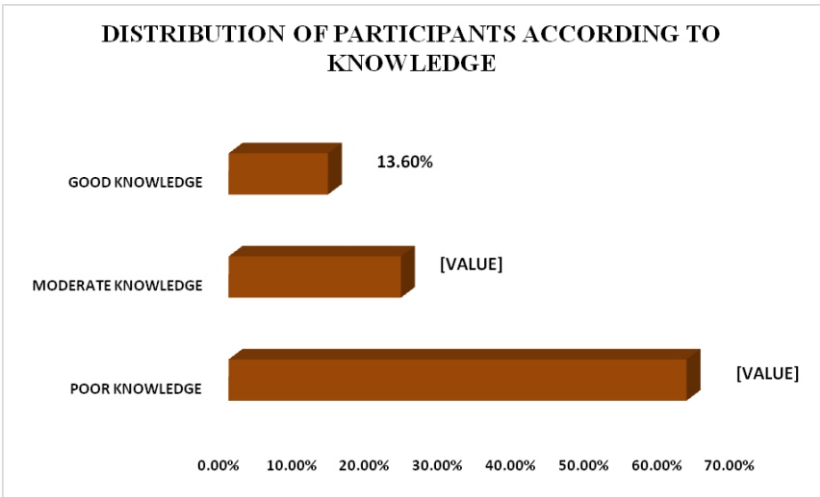
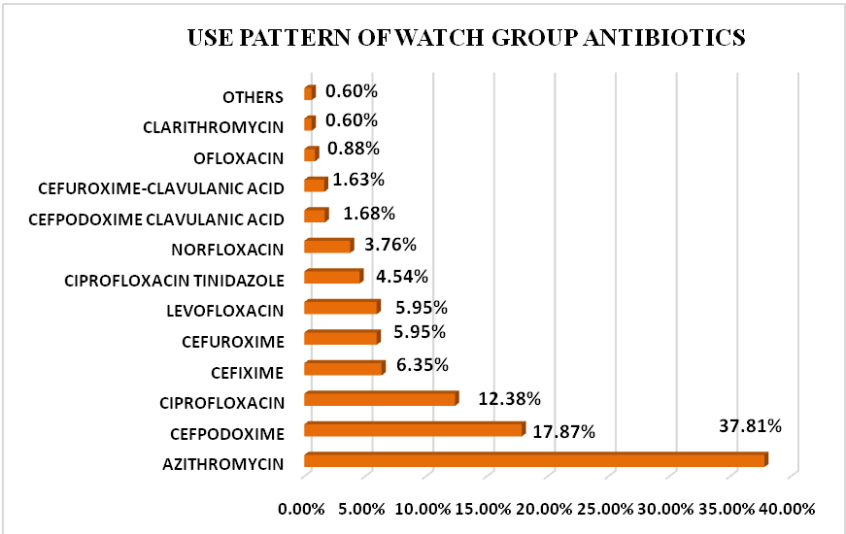
specific IDSA guidelines, ICMR treatment guidelines for antimicrobial use in common syndromes, NCDC guidelines and Antibiotic guidelines of Government Medical College Thiruvananthapuram.





**PROPORTION OF USE ACCESS, WATCH AND
RESERVE CATEGORIES OF ANTIBIOTICS**



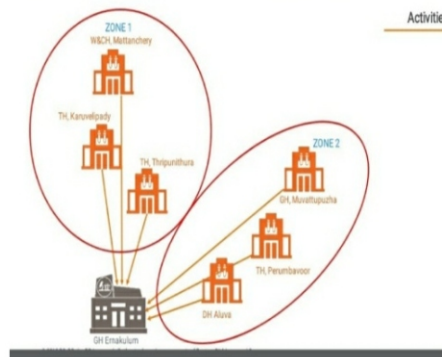


Study results show that in OPD around 30 % of antibiotic prescriptions are unnecessary. Watch group antibiotics can be replaced by antibiotics from Access category. It is easy to have more than 95% of prescription in OPD from Access category. The awareness about rational use of antibiotics among public is poor. Based on the results of this study, it was decided to launch an antibiotic awareness campaign among public to make Kerala an Antibiotic literate state by 2021.

First antibiotic stewardship program, hub & spoke, PPP model in India



Expansion of SMP to six Taluk Hospitals



Activities



Hub & Spoke Model – Integrated sample transport system

The TEAM Ernakulam has successfully introduced hub & spoke model for the sample collection and giving feedback to the hospitals.

As the part of widening the diagnostic facilities through government hospitals hub and spoke model diagnostic facility has been introduced. Two vehicles are provided under district panchayath project and NHM for the purpose.

The diagnostic services include

Blood culture samples under AMR surveillance program

Sepsis management project (SMP) started at General Hospital Ernakulam on 13 th August 2015 to promote rational antibiotic therapy & infection control.

Project expanded to nearby 6 hospitals in Ernakulam district as Hub & Spoke Model for better result in infection control, rational antibiotic therapy and AMR surveillance.

The AMR programme got added to the hub and spoke in November 2019. For the sepsis management programme, GH is the hub with advanced facility, while all the six peripheral hospitals – Perumbavoor, Tripunithura and Karuvelipady taluk hospitals, Women and Child Hospital, Mattanchery; District hospital, Aluva; and General hospital, Muvattupuzha are the spokes.

The facility helped the peripheral hospitals to identify sepsis early and treat it rationally. Sepsis management program has started showing results, with smaller hospitals becoming more confident in managing sepsis cases with GH support.

The hub and spoke model was implemented at GH to help smaller hospitals, with advanced diagnostic facilities at the main hospital. By 3 months, GH has received around 50 blood culture samples from peripheral hospitals.

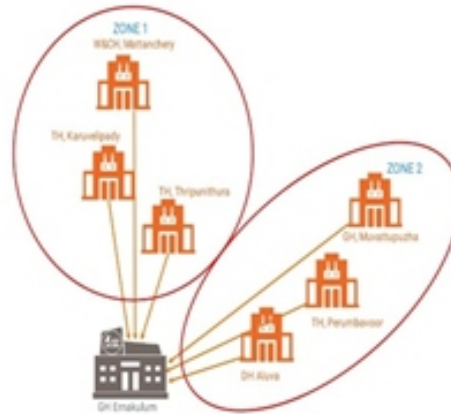
GH Ernakulam is the regional centre to coordinate AMR surveillance in health service dept, getting 30 -40 microbiology samples (blood, CSF, body fluid, pus, sputum, urine, respiratory specimens) that includes 8-10 blood culture per day with positivity of 10-12%.

KERALA

Hospitals get access to advanced lab services



Expansion of SMP to six Taluk Hospitals



Activities to be undertaken

Impact of hub & spoke model in AMR

- 1) Helps the spoke hospitals to identify the sepsis early and to treat it rationally.
- 2) Deescalation and escalation of antibiotics as per blood culture sensitivity report, the most important aspect of antibiotic stewardship program.
- 3) Program helps to find out the resistance pattern in the spoke hospitals and thereby helping AMR surveillance in the district (blood).
- 4) Sepsis a major causes of neonatal mortality and early identification and management of neonatal sepsis may help to reduce the mortality and thereby help to reduce the IMR further (5 out of 6 spoke hospitals of SMP has delivery point).
- 5) Hub & spoke model program (SMP) a new initiative, will definitely reduce the cost of the treatment and improve the quality of treatment of spoke hospitals in identification and management of sepsis.

Kerala Medical Services Corporation Ltd (KMSCL)

Kerala Medical Services Corporation Ltd. (KMSCL) is the central agency for procurement, storage and distribution of essential drugs and medical supplies for the public healthcare institutions under Govt. of Kerala. The procurement and supply of such generic medicines free of cost to the Govt. hospitals is carried out by the Essential Drugs Division of the Corporation. Essential drugs and supplies are procured by inviting National level competitive **e-tenders** and distributed to over **1400** Government healthcare institutions in the State based on their annual indent. Presently 821 drugs and supplies have enlisted under the **Essential Drugs List (EDL)** including **Anti Cancer Drugs** and **Specialty Medicines**, which are being supplied by the **KMSCL** against the budgetary allotment.

KMSCL revalidate the Essential Drug List (EDL) every year. The first EDL was published in 2008 containing 527 items of medicines, sutures, surgical and other hospital items including detergents and chemicals. Currently the EDL carries total no of 556 items. The KMSCL is yet to take up issues like publication of Formulary, Standard Treatment Guidelines (STG) and other publications aimed at promoting rational and scientific use of medicines. Facility categorization of health care institutions has been completed in the state of Kerala ranging from Primary Health Centers to Medical colleges. Drug template in line with National Essential Drug List contains essential items in the primary level comprising of 233 items and those of medical colleges with all 930 items.

At the Sixty-eight World Health Assembly in May 2015, the World Health Assembly has endorsed a global action plan to tackle **antimicrobial resistance**, including antibiotic resistance, the most urgent drug resistance trend.

Antimicrobial resistance is occurring everywhere in the world, compromising our ability to treat infectious diseases, as well as undermining many other advances in health and medicine. The goal of the draft global action plan is to ensure, for as long as possible, continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality-assured, used in a responsible way, and accessible to all who need them.

To achieve this goal, KMSCL in line with global action plan sets the following strategic objectives:

- **To reduce the incidence of infection**

KMSCL along with other stake holders of the state takes a very broad approach in revamping the essential drug list of the state, encompassing new antimicrobial medicines, diagnostic tools, vaccines and other interventions. The term '**antimicrobial medicines**,' which subsumes antibiotics and other medicines, includes antiviral, antifungal, antibacterial and anti-parasitic agents. In principle, it also includes therapies for viral infections such as influenza or HIV. All such medicines are susceptible to the emergence of resistance. Special treatment guidelines and initiatives have been introduced over the past few years to deal with the most distressing diseases, such as HIV/AIDS, malaria, tuberculosis (TB), and other neglected tropical diseases. These initiatives intend to encourage the advancement of new treatments, progress admittance to accessible treatments and, in part, address disease-relevant issues surrounding resistance.

In general the antibiotic market is dominated by generic products that account for approximately 80% of prescriptions in the health sector. High prices thus are less of an issue than in other disease areas. However, antibiotics need to be affordable for those who need them which can be challenging with respect to new patented products. KMSCL is entrusted to supply quality generic drugs free of cost to all health care institutes throughout the state and thus ensures availability of anti-microbials.

- **Stewardship and Access**

The second main element of the global framework is the development of a global approach to stewardship and access. The following section advances an initial definition of stewardship and the potential scope of the global framework with respect to stewardship. It also presents the recent revision of the WHO Model List of Essential Medicines (EML) on antibiotics which will serve as a starting point to the categorization of antibiotics and

related stewardship measures in the human health sector. In general the term 'stewardship' defined as the careful and responsible management of something entrusted to one's care. For antibiotics and other antimicrobials, this means appropriate use to improve patient outcomes while minimizing the development and spread of resistance.

KMSCL as the state agency finds its way to support the development, control, distribution and appropriate use of different tools to tackle antimicrobial resistance. This encompass the whole lifecycle of a product from its development, the selection of the right antimicrobials, how they are distributed, prescribed, used and discarded as waste (expired and unused), as well as aspects of Pharmacovigilance for ongoing assessment of product efficacy, quality and safety.

- **Shortages of Antimicrobials** One reason for the lack of access to antibiotics is shortages of antibiotics in the human and animal sector due to unavailability of certain antibiotics on the market. For certain inexpensive injectable antibiotics like Benzyl Penicillin, very few quality manufacturers remain on the market, which may be due to too-low profit margins in that market or for the animal sector, and low interest in development of treatment for minor species due to the small market size.
- **Ensuring Quality of Antimicrobials**
The prevalence of substandard and falsified medical products is documented as an important factor contributing to antimicrobial resistance. Substandard antibiotics are considered to contribute to the development of resistance due to inadequate dosing, since such products often contain an insufficient amount of active ingredient. KMSCL fixed quality standards of drugs procured as the best among all public procurement practices.
- **Ensuring Access and appropriate use of Antimicrobials in the Health Sector**
 1. Though various antibiotics should be used in a more limiting and conscientious way, affordable access to quality essential

medicines, vaccines, as well as diagnostics needs to be increased. Stewardship and access are closely linked and should not be dealt with separately.

2. KMSCL had already developed & implemented a template for the availability of antibiotics at each & every levels of Health facilities ranging from Primary Health Centers to Medical Colleges. It has already ensured high end broad-spectrum antibiotics only in the levels of higher health facilities to prevent its misuse & development of resistance henceforth.

SI No	Level of Health facility	Number of Antibiotic molecules
1	Primary Health centers	17
2	Community Health Centers	24
3	Taluk Headquarter Hospitals & District/General Hospital	36
4	Medical colleges	45

- **Awareness and education**

1. Raising awareness of antimicrobial resistance and promoting behavioral change through public communication programmes that aim different audiences in human health as well as consumers is critical to tackling this issue. Including the use of antimicrobial agents and resistance in school curricula will also promote a better understanding and awareness from an early age.
2. KMSCL through its retail pharma intervention-Karunya Community Pharmacies had already taken rigid steps to avoid the over the

counter dispensing of Antibiotics without prescription which shall definitely reduce the antibiotic misuse & resistance henceforth.

- **Scientific Disposal of Damaged & Expired drugs**

KMSCL has already taken large scale interventions for collecting back time Expired & damaged medicines including Antimicrobial agents from the Government Health Facilities for scientific disposal so that the ground water cum soil linked possibilities of Antimicrobial resistance can be prevented to an extent.

- **Surveillance of antimicrobial resistance**

To better understand and respond to antimicrobial resistance patterns and key drivers, information about antimicrobial resistance incidence, prevalence, and trends must be gathered.

There are significant gaps in the information available on the development and global economic implications of antimicrobial resistance. Stronger networks of information sharing and a strategic research agenda would improve understanding of antimicrobial resistance.

- **Infection prevention and control**

Stronger hygiene and infection prevention measures, including vaccination, can limit the spread of resistant microorganisms and reduce antimicrobial misuse and overuse. Infection prevention measures such as sanitation, hand washing, food and water safety, and vaccination can decrease the spread of microorganisms resistant to antimicrobial medicines. By preventing infectious diseases whose treatment would require antimicrobial medicines and viral infections which are frequently mistreated with antimicrobial medicines, the global community can better steward these essential medicines.

Our Priorities

KMSCL is working with our partners and other stake holders to tackle AMR holistically by focusing on urgent unmet needs across the spectrum of R&D and access.

- The demand of the hour for the AMR prevention shall be the development of **Standard Treatment guidelines & referral**

- protocol** which shall definitely reduce the misuse of antibiotics.
- The capacity building of the budding Doctors by incorporating the AMR stewardship into the curriculum will have larger impact on the future action plan.
 - Capacity building programmes for the Hospital supporting staffs whose terrain is the cleaning & hospital infection control should be introduced, implemented & strengthened in line with the Hospital infection control protocols so as to minimize or nullify nosocomial infection. The above referred capacity building should be an ongoing programme.
 - There should be strong emphasis in the areas of Biomedical waste management & Disposal of Damaged Drugs.
 - Preventive steps for avoiding self treatment & antibiotic misuse by making the prescription linked dispensing shall be one of the other areas of interest.
 - R & D in collaboration with other stakeholders will be one of the other priority areas.

Conclusion

Bringing the sciences together is the key but it is also vital that collaborative work is needed. As antimicrobial resistance crosses international borders, so must our research efforts. KMSCL plays a central role in enabling the cross-science and collaborations that will deliver the solutions to what is a very urgent and global problem.

Other diagnostic services along with AMR surveillance includes

- 1) Biopsy , FNAC, Pap smear (under comprehensive cancer control program) may be collected from spoke hospitals. Cochin cancer centre and Govt. Medical College, Ernakulam are the hubs.
- 2) Metabolic screening-Delivery point hospitals as spokes and Regional Public health lab, Ernakulam is the hub.
- 3) CBNAAT under RNTCP – Spoke hospitals being Taluk hospitals and hub Govt. Medical College, Ernakulam and General hospital, Ernakulam

Colour coding

Metabolic screening-Blue

Pathology biopsy-White

CBNAAT-Brown

AMR-Red

Lab is the collection point in every hub and spokes and necessary documentation/register is being maintained by the concerned programs and departments. The service is available on all days except Sundays.

Drugs Control Department

The role of the Drugs Control Department in containing AMR are

1. Scientific disposal of unused/ expired medicines
2. Prevention OTC sale of antibiotics
3. Awareness programmes for reducing self medication

The report of action taken by the department is summarised as below:

1. Scientific disposal of unused/expired medicines

As there are no regulatory guidelines in the Drugs and Cosmetics Act 1940, regarding the disposal of unused or expired drugs, and as the public is unaware of the menace of environmental contamination with antibiotics & other medicines the department had to chalk out a programme for containing the issue. As safe disposal of drugs is a costly exercise, which may not be feasible at an individual level. Such unawareness among the public has resulted in disposal of unused and expired medicines especially antibiotics into the ecosystem (agriculture lands, water-bodies etc) subsequently leading to the consumption of these chemicals through vegetables, fish, meat and dairy products, the aggregate of which over a period of time may result in a significant amount of intake. This is considered to be another major factor attributing to AMR.

As the collection of unused & expired medicines from the households and scientific disposal of the same require technical expertise which cannot be handled by common waste disposal methods, the Drugs control department with the assistance of Chemists and Druggist Association, of the state has charted out a Programme for Removal of Unused drugs under the title PROUD, as a pilot project in Thiruvananthapuram district. Around 200 sealed collection bins were placed at various retail medical shops in the city with appeal to the public not to discard the unused medicines carelessly and to use the facility provided. A total of 3500 kg of unused/expired medicines were collected in a span of 6 months. The collection of the medicines from the bins were done in a routine manner (every 15 days) , stored in a central warehouse, sorted item wise and sealed in separate gunny bags item wise and transported to the

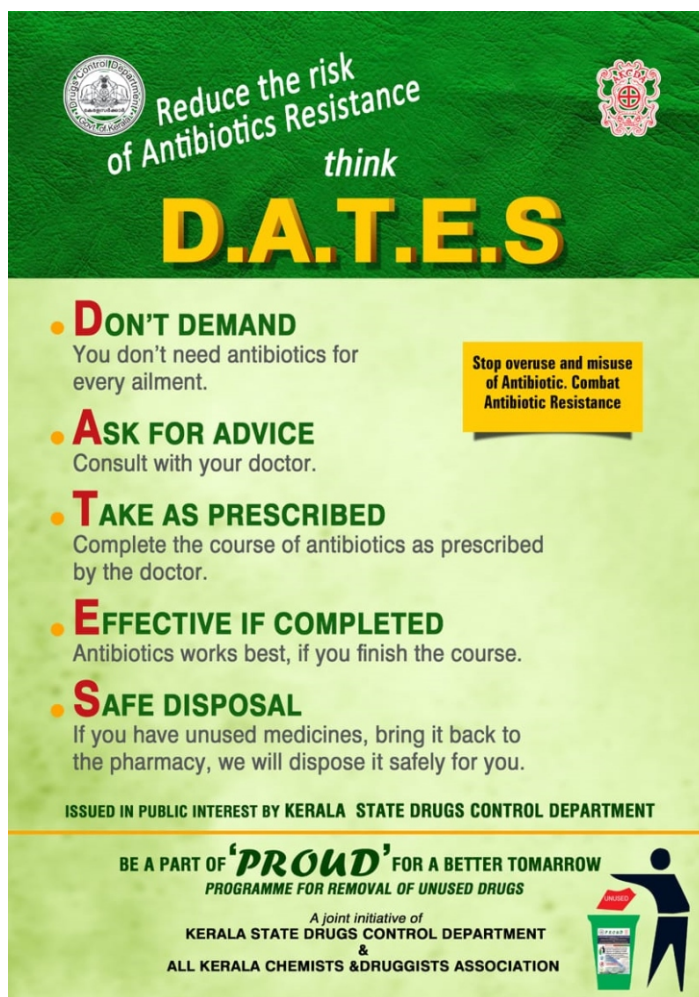
Biomedical waste incineration plant at Mangalore. The medicine wastes were certified to be scientifically disposed by incineration by the Central Government Approved Incinerating Agency.

As the pilot project has gained wide acceptance among the public, the same can be implemented in all the 14 districts of Kerala, thereby aiding the reduction in Antimicrobial resistance to a large extent. Since the running costs of the project (cost of collection boxes, labour charges for sorting & transportation, incineration charges) is high, the department and the Association of Chemist will not be able to carry out the project State-wide, proposal has been submitted to Central Government for necessary financial assistance to widen the plan for the successful drug waste management in the Kerala state.



2. Awareness programmes for pharmacists, licensees and public

Awareness programmes have been conducted by Enforcement Officers in all districts and posters/leaflets regarding rational and safe use of antibiotics have also been displayed in majority of retail shops for educating and creating awareness for public. Specimen poster displayed is given below:





3. Prevention of OTC sale of antibiotics

Action taken by the Drugs Control Department against violation of Rule 65 of Drugs & Cosmetics Rules, 1945 for the last three years is detailed below

YEAR	NO OF LICENCES SUSPENDED	NO OF LICENCES CANCELLED
2017	197	02
2018	243	03
2019 (Till October)	228	02

Also Strict implementation of maintenance of schedule H1 registers in retail shops resulted in identification of 133 new cases of TB patients.

Department Of Fisheries

Aquaculture is a booming sector with more production and income to farmers. The intensification of aquaculture has wide implications in the sector as well in public health domain when considering the use of antibiotics in aquaculture. Antibiotics are rarely used in aquaculture for therapeutic, metaphylaxis and prophylactic methods for treatment, prevention and for various growth benefits. But this indiscriminate use can lead to the development of antibiotic resistance and antibiotic residue in cultured fishes which may ultimately reach humans.

As a preventive measure, the use of 20 antibiotics were banned in aquaculture activities and good management practices were encouraged in order to prevent the development of antibiotic resistance. Kerala fisheries department is committed to take all necessary steps to prevent this menace, as a sector where the use of antibiotics can lead to development of such resistance. As part of KARSAP the following actions were taken

1. The strict compliance to non use of banned antibiotics in the farms was observed through regular monitoring and awareness creation among farmers
2. Random checking of samples from farm sites for antibiotic residue
3. Joint efforts with Kerala University of Fisheries and Ocean Studies (KUFOS) and ICAR-Central institute of Fisheries Technology (CIFT) for initiating research studies, surveillance and monitoring in farming areas
4. In order to reduce the use of antibiotics and for its control a standard operating procedure (SOP) for disease control, its treatment measures and good aquaculture practices is being prepared with the consultation from ICAR-Central institute of Fisheries Technology (CIFT), ICAR-Central Marine Fisheries Research Institute (CMFRI) and Kerala University of Fisheries and Ocean Studies (KUFOS)

Strategic Priority Five

Research

Research partner for co-ordination of all research activities under KARSAP is

RGCB [Rajiv Gandhi Centre for Biotechnology]

Research on AMR is being done in

- A. Animal Husbandry.
- B. Fisheries and aquaculture.
- C. Environmental studies.
- D. Human side.

Major publications in all these fields from different institutions will be compiled into a single document which will be representative of “one health” research from the state.

Research from RGCB

Rajiv Gandhi Centre for Biotechnology, Trivandrum

(Research Collaborator, Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP))

Introduction

Antimicrobial resistance (AMR) is an emerging threat which affects the public health globally. Developing countries like India faces severe problems of AMR due to the high burden of infectious diseases, economic instability and irrational use with inappropriate prescription of antibiotic drugs. In alliance with State Action Plan on AMR launched by Govt. of Kerala, our group is working to find out the major bacterial pathogens causing infections at primary and secondary healthcare settings of Kerala. The studies are focusing to identify the prevalence of antibiotic resistant pathogens circulating in the community, the mechanism of resistance in its molecular level and to monitor the emergence of new antibiotic resistance in bacteria.

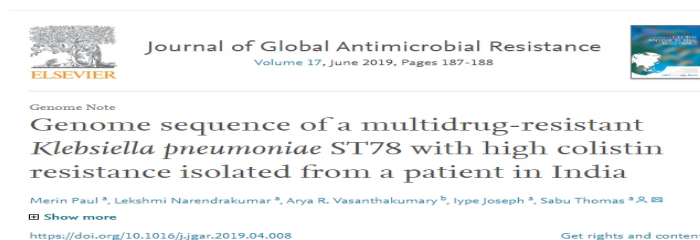
Work done in brief

As part of the program we received an isolate of colistin resistant *Klebsiella pneumoniae* isolated from blood culture of a chronic kidney failure patient admitted in General Hospital Ernakulam. Primary characterization revealed the multidrug resistance nature of the isolate (*K. pneumoniae* CRKP I) and which leads us to evaluate the

genome-wide distribution of antibiotic resistant determinants in the pathogen. The whole genome sequence of the isolate using IlluminaMiSeq platform and the subsequent detailed analysis was carried out using various bioinformatics tools. The findings were published in an international journal of repute in association with General Hospital, Ernakulam.

K. pneumoniae CRKP I carried a genome of 5.1 Mb size with different classes of antimicrobial resistance genes. The isolate was highly resistant to colistin ($\geq 64 \mu\text{g/ml}$) encoding a point mutation in *mgrB* gene, a negative regulator of the PhoP/PhoQ two-component system. Multilocus sequence typing (MLST) showed that the isolate belongs to ST78. This is the first report of a multidrug resistant *K. pneumoniae* with high colistin resistance belonging to ST78 causing infection in a human. All these data offer information for comparative genomic analysis regarding the dissemination of antimicrobial resistance genes in *K. pneumoniae* as well as in other members of Enterobacteriaceae family.

Publication details



Lectures delivered in AMR

1. Emergence of antimicrobial resistance and its burden in Kerala. Indo-UK conference on emerging and re-emerging infectious diseases. IUCBR and MG University, Kottayam, 25-26 February, 2019
2. AMR facilities at RGCB. Kerala Antimicrobial Resistance

Surveillance (KARS-NET) Workshop. Super Specialty Block, Govt. Medical College, Trivandrum, 6th May, 2019

3. Emerging antimicrobial resistance – role of molecular techniques in its detection. National seminar on Molecular biology techniques in Microbial Research, Pushpagiri Research Centre, Thiruvalla, 2018
4. ASEAN-India workshop on AMR organised by IGIB-CSIR, New Delhi, September 2019

Conference presentations

1. Lekshmi N and **Sabu Thomas**. Toxigenic *Vibrio cholerae* O1 gaining reduced susceptibility to Doxycycline, South India. International Conference on Antibiotic Stewardship and Infectious Diseases organized by Amrita Institute of Medical Sciences in Collaboration with World Health Organization (WHO), India and Imperial College of London, October 27-28, 2018. Poster Presentation

Publications

1. Merin.P, Lekshmi.N, Vasanthakumary A. R, Iype Joseph, Sabu Thomas 2019. Genome sequence of a multidrug-resistant *Klebsiellapneumoniae* ST78 with high colistin resistance isolated from a patient in India. ***Journal of Global Antimicrobial Resistance***, 17: 187-188. DOI:10.1016/j.jgar.2019.04.008
2. Lekshmi.N, Gupta S.S, Johnson J.B, T. Ramamurthy and Sabu Thomas 2019. Molecular adaptations and antibiotic resistance in *Vibrio cholerae*: a communal challenge. ***Microbial Drug Resistance***, DOI:10.1089/mdr.2018.0354 3.
3. Lekshmi.N and Sabu Thomas, 2018. *Vibrio cholerae* O1 gaining reduced susceptibility to doxycycline, India. ***Journal of Global Antimicrobial Resistance***, 12:141-142

Whole genome sequence submission

1. Draft genome sequence of an MDR *Klebsiellapneumoniae* ST78

with colistin resistance **Acc.No. CP037927**

The Hindu News link:

<https://www.thehindu.com/news/national/kerala/keralas-first-full-genome-sequencing-in-global-journal/article27029016.ece>

Work done at Amrita Institute of Medical Sciences

(Research publications, awareness creation, surveillance data

In the year 2019, the Department of Microbiology published several articles on topics related to antimicrobial resistance, and participated in a number of activities to create awareness on antimicrobial resistance and hospital infection control.

During the Nipah alert in June, classes for awareness on appropriate infection control measures were held for hospital staff of all cadres including nurses, doctors and hospital attendants.

In September 2019, Amrita Institute in collaboration with WHO and KARS-NET (Kerala Antimicrobial Resistance Surveillance Network) organised a 3-day workshop to train participants from various laboratories and hospitals across Kerala in the use of WHONET software for surveillance of antimicrobial resistance.

A series of talks on Food safety and hygiene, Central Line-associated Bloodstream Infections (CLABSI), standard and isolation precautions were organised by Dr. Anusha Gopinathan, Infection Control officer, during Infection Prevention week in October 2019. Other events during the week included a tableau, poster presentations, quiz, a skit by link nurses, flash mob and mime with active participation from doctors, nurses and undergraduate students. A special edition of the Infection Control newsletter was released to mark the event.

In addition, faculty from the Department of Microbiology have delivered lectures on themes related to antimicrobial resistance on several occasions during the year both within and outside the Institute.

Publications from Amrita Institute of Medical Sciences, Kochi: 2019

S.No.	Title	AMS Domain
1	Khan S, Kurup P, Vinod V, Biswas R, Pillai GK, Kumar A . Reconsidering azithromycin disc diffusion interpretive criteria for <i>Salmonellae</i> in view of azithromycin MIC creep among typhoidal and nontyphoidal salmonella. J Lab Physicians 2019;11:39-44.	Antibacterial drug resistance
2	Singh A, Singh PK, de Groot T, Kumar A, Mathur P, Tarai B ⁵ , Sachdeva N, Upadhyaya G, Sarma S, Meis JF, Chowdhary A. Emergence of clonal fluconazole-resistant <i>Candida parapsilosis</i> clinical isolates in a multicentre laboratory-based surveillance study in India. J Antimicrob Chemother. 2019 Feb 11. doi: 10.1093/jac/dkz029. [Epub ahead of print]	Antifungal drug resistance
3	CP, Anju; Vinod, Vivek; V, Muralidharan; S, Sudarshali; V Nair, Shantikumar; Kumar, Anil; Biswas, Raja; Mohan, C Gopi.. Combination of Repurposed Drug Diosmin with Amoxicillin-Clavulanic acid Causes Synergistic Inhibition of Mycobacterial Growth. Scientific Reports (2019) 9:6800 https://doi.org/10.1038/s41598-019-43201-x 01 May 2019	Repurposed Drug for <i>M.tuberculosis</i>
4	Shiva Muthuswamy ^{†#} , Aparna Viswanathan ^{†#} , Ramanathan Yegappan ^{†#} , Vignesh Selvaprithiviraj [†] , Anil Kumar Vasudevan [†] , Raja Biswas ^{*†} , and Rangasamy Jayakumar ^{*†} Antistaphylococcal and Neutrophil Chemotactic Injectable κ -Carrageenan Hydrogel for Infectious Wound Healing. <i>ACS Appl. Bio Mater.</i> , 2019, 2 (1), pp 378–387 DOI: 10.1021/acsabm.8b00625 issue 22 January 2019	New formulation of Antibacterial for wound healing

S.No.	Title	AMS Domain
5	Anil Kumar , Akhilesh Kunoor, Malini Eapen, Pradeep Kumar Singh, Anuradha Chowdhary “Blastomycosis Misdiagnosed as Tuberculosis, India.” Emerg Infect Dis. 2019 Sep;25(9):1776-1777. doi: 10.3201/eid2509.190587.	D i a g n o s t i c stewardship
6	Grace Li ¹ , Julia Bielicki ^{1,2} , ASM Nawshad Uddin Ahmed ³ , Shahidul Islam ³ , Eitan N Berezin ⁴ , Clery B Gallacci ⁴ , Ruth Guinsburg ⁵ , Carlos Eduardo da Silva Figueiredo ⁶ , Rosilene Santarone Vieira ⁶ , André Ricardo Araujo da Silva ⁷ , Cristiane Henriques Teixeira ⁸ , Paul Turner ⁹ , Ladin Nhan ¹⁰ , Jaime Orrego ¹¹ , Paola Marsela Pérez ¹¹ , Lifeng Qi ¹² , Vassiliki Papaevangelou ¹³ , Pinelope Triantafyllidou ¹⁴ , Elias Iosifidis ¹⁵ , Emmanuel Roilides ¹⁵ , Kosmas Sarafidis ¹⁵ , Dasaratha R Jinka ¹⁶ , Raghuprakash R Nayakanti ¹⁶ , Praveen Kumar ¹⁷ , Vikas Gautam ¹⁷ , Vinayagam Prakash ¹⁸ , Arasar Seeralar ¹⁸ , Srinivas Murki ¹⁹ , Hemasree Kandraju ¹⁹ , Sanjeev Singh, Anil Kumar ,et al. Towards understanding global patterns of antimicrobial use and resistance in neonatal sepsis: insights from the NeoAMR network. Arch Dis Child. 2019 Aug 24. pii: archdischild-2019-316816. doi: 10.1136/archdischild-2019-316816.	Antimicrobial use a n d d r u g resistance
7	Arun CS, Raju P, Lakshmanan V, Kumar A, Bal A, Kumar H. Emergence of fluconazole-resistant candida infections in diabetic foot ulcers: Implications for public health. Indian J Community Med 2019;44:S74-6..	Antifungal drug resistance 84

S.No.	Title	AMS Domain
8	Bhardwaj A, Khan S, Kumar A, George L, Mehta A, Radhakrishnan K. Assessing the Utility of GeneXpert MTB/Rif Assay in a Tertiary Care Centre in Southern India with Established Microscopy and Liquid Culture Facilities. J Assoc Physicians India. 2019;67(8):31-34.	Diagnostic stewardship
9	Yingfen Hsia, Brian R Lee, Ann Versporten, Yonghong Yang, Julia Bielicki, Charlotte Jackson, Jason Newland, Herman Goossens, Nicola Magrini, Mike Sharland on behalf of the GARPEC and Global-PPS networks. Use of the WHO Access, Watch, and Reserve classification to define patterns of hospital antibiotic use (AWaRe): an analysis of paediatric survey data from 56 countries. Lancet Glob Health 2019; 7: e861–71	Antimicrobial use.

Activities Done By Icar-cift

Surveillance Data

Aquaculture farms

- Samples were drawn from a total of 45 aquaculture farms that included 33 from Thrissur and 8 from Alappuzha.
- Due to flood related incidents farming activities were not available in Alappuzha district
- 09 farms harboured *E. coli*.
- Tetracycline resistance was observed in 11.1% of tested samples and resistance for amoxycillin-clavulanic acid at 22.2% of tested samples. Resistance was not observed for any other antibiotics tested.

Vembanad Lake

- 35 different locations of Vembanad Lake, Kerala which extends to Ernakulam, Alappuzha and Kottayam regions were screened for the presence of *E. coli*.
- Cefotaxime resistance was observed in 70.9%, Ampicillin resistance in 28.2% , Tetracycline resistance in 20.5% were observed from the *E. coli* isolated.
- Resistance for other antibiotics observed was less than 20% . No resistance was observed for gentamicin.
- Kerala Pollution Control Board has given support for sampling in all the three regions of Vembanad Lake.

Awareness creation

In commemoration with the observation of World Antibiotics Awareness Week (WAAW) on November 2019, SOFTI, ICAR-CIFT and MPEDA jointly organized a National Seminar on “AMR in Indian Fisheries: Measures of Mitigation” during 7-8 November, 2019 at ICAR-CIFT, Cochin.

To understand the burden of AMR across the sectors, exclusive technical sessions were kept viz., *AMR in Fisheries, AMR in Animal sector, AMR in Human health, AMR in Food and environment, AMR: One health, Recent trends in detection and molecular mechanism of AMR, Prevention and Control of AMR and Industry-Academia-Institution interfacemeet.*

Researchers across the country from human health care, animal sector, fisheries, food and environment attended this seminar.

Projects with CIFT on AMR and its control

- Documentation of AMR surveillance data for trend analysis, transmission pattern and prediction
 - CIFT is a partner in Network Program on Surveillance of AMR (INFAAR with ICAR)

- CIFT is awarded with two Indo-UK project on AMR surveillance in North Eastern region & diagnostic validation in Andhra Pradesh
- Antibiotic resistance in emerging and re-emerging pathogens in seafood and aquatic animals.
- Control of AMR – Alternatives to antibiotics (Phages & probiotic) usage in aquaculture
 - Awarded - DBT funded project on bacteriophages (seafood as well as aquaculture pathogens)
 - Evaluating Probiotics for quality and quantity (Indo-UK project)

Issues and challenges

- Simultaneous sampling in all the sector is very essential (Baseline & trend & dissemination) One health
- Coastal area is vast – Project mode is very essential
- Fisheries is very vulnerable to climate change
- Antimicrobial resistance in aquaculture pathogens & environment is very difficult – since there is no protocol as available in clinical sector.

Recommendations

- This should run in project mode to cover entire coastal states of Kerala
- CIFT can assist in developing SOP for other sectors also
- Capacity building is very much essential for all the coordinating partners

The details of the research activities carried out in various departments of KVASU during the past one year

(from November 1st 2018 to 31st October 2019)

- ❖ Detection of carbapenem resistance among *Escherichia coli*, *Klebsiella pneumoniae* and *Psuedomonas aeruginosa* associated with skin and urogenital tract infections in dogs
 - *Escherichia coli*, *Klebsiella pneumonia* and *Psuedomonas aeruginosa* isolated from skin and urogenital tract infections in dogs were found to be resistant to at least one of the three carbapenems

- (Imipenem, meropenam, ertapenem)
 - o Phenotypic confirmation of presence of carbapenemase enzyme was done using combined disc diffusion method and ertapenem- boronic acid MIC strip method
 - o *NDM*, *KPC*, *VIM*, *IMP* and *OXA* genes were detected using PCR.
- ❖ **Detection of carbapenem resistant *Escherichia coli* in cattle and pigs**
 - o *Escherichia coli* isolates from cattle were found resistant to cefotaxime, ceftriaxone/sulbactam, cefotaxime/clavulanic acid, cefpodoxime and ceftazidime and sensitive to cotrimoxazole
 - o Isolates from faecal samples were resistant to all the three carbapenems (ertapenem, imipenem and meropenem)
 - o The isolates from pigs were resistant to cefotaxime, cefotaxime/clavulanic acid and cefpodoxime. Resistance to ertapenem, imipenem and meropenem were noticed.
- ❖ **Characterisation of antibiotic resistant bacteria in the enteric tract of chicken**
 - o Multi-drug resistant *Staphylococcus aureus*, *E. coli* and *Klebsiella pneumoniae* were isolated from enteric tract of chicken.
- ❖ **Antimicrobial resistance profiling and therapeutic studies of staphylococcal pyoderma in dogs**
 - o Multi drug resistant *Staphylococcus* sp. were isolated from pyoderma in dogs
- ❖ **Occurrence of EAEC in animals, human infants and associated environmental sources in Ernakulam**
 - o EAEC isolates from human infant diarrhoeic stool samples were found resistant to Ampicillin and Streptomycin (75%) followed by Azithromycin (68.07%) Tetracycline and Cefotaxime (68.07%)
 - o Sensitive to Imipenem (100%)

- o EAEC isolates from environment samples (soil, water) were resistant to Norfloxacin (78%), Tetracycline and Cefotaxime (77%) and sensitive to Imipenem (100%) and Nitrofurantoin (87%)
- o Pig diarrhoeic faecal samples were resistant to Cefotaxime and Tetracycline

❖ **AMR related research at Department of Veterinary Public Health and Centre for One Health (COHEART)**

Surveillance data

- A study to evaluate the ESBL resistance of isolates of *E. coli*, *Salmonella* spp., *Shigella* spp. and *Y. enterocolitica* from dogs, cats and bonnet macaques of Wayanad district was carried out by phenotypic disc diffusion method and genotypic PCR assays. The results revealed that 77.77 per cent of *E. coli* isolates were ESBL producers and ESBL gene that could be identified in majority of isolates was *bla*CTX-M. In case of *Salmonella* spp, 22.58 per cent samples were identified as ESBL producers and the most common ESBL genes identified were *bla*SHV and *bla*TEM. *Shigella* spp. and *Y. enterocolitica* were also recovered from dogs and macaques samples, of which 33.33 per cent were ESBL producers. Thus, a diverse genotypic pattern of ESBL resistance was observed among isolates.
- A study was carried out to evaluate the nasal carriage of Community Associates-MRSA and Livestock Associated-MRSA among apparently healthy companion animals, livestock and their handlers. A total of 220 nasal swabs were collected from dogs, cats, cattle, goats, pigs and human handlers (including animal owners, farm workers and veterinarians). All the samples were initially screened for prevalence of *S.aureus*, which was confirmed by PCR using species specific primer (*nuc*). All the *S.aureus* isolates were screened for occurrence of MRSA, both phenotypically (by double disc diffusion using cefoxitin and oxacillin discs) and genotypically (by PCR targeting *mecA* and *mecC* genes). There was significant difference in nasal carriage of

S.aureus among animal population, which was found as 76.67 per cent, 23.33 per cent, 53.33 per cent, 62.5 per cent, 86.67 per cent, and 71.67 per cent among dogs, cats, cattle, goats, pigs and human handlers, respectively. None of the nasal swabs from animals were positive for MRSA. Among human handlers, three human handlers were positive for MRSA (two farm workers and one veterinarian), with a five per cent prevalence rate. Molecular typing of MRSA isolates were done by *spa* typing. Two of the three MRSA isolates belonged to the *spa* type t18050 and one isolate was *spa* type t18230. The present study signifies the prevalence of nasal carriage of MRSA among humans and the absence among domestic animal population of Wayanad district.

Publications

1. Suma N, Prejit, Asha K, Jess V, Hamna Hakim and HemaPersis Andrews. Occurrence of ESBL producing *Yersinia enterocolitica* among companion animals in Wayanad district. *The Pharma Innovation Journal*. 2019; 8(9): 182-187.
2. Dermisha S, **Priya P M**, Sheikh Moin Ahmad, Rinsha Balan and Mini M. 2019. Association between biofilm formation and antibiotic resistance of *Riemerella anatipestifer* isolates of Kerala. *The Pharma Innovation J*. 74-77
3. Paulson, S. T., Sankar, S., Mani, B. K., Ambily, V. R., Akkara, T. S., Bosewell, A. and Mini, M. 2019. Characterisation of extended spectrum β lactamases among *Escherichia coli* and *Klebsiella pneumoniae* with skin and urogenital tract infections in dog. *Indian J. Anim. Sci.* 9(7): 732-734

Strategic Priority Six

Public-private Partnership, ngos

1. State has partnered with Centre for science and environment, for creating grids for monitoring and surveillance in animal husbandry, fisheries and

environment. Two workshops were conducted by CSE and a monitoring frame work was created.

2. REACT Asia Pacific is an NGO active in Kerala with regard to all strategic priorities in KARSAP . Videos made by REACT were used during world Antibiotic awareness Week for public awareness creation.
3. A group of Infectious disease specialists and microbiologists in Kerala have created a free mobile App to aid in antibiotic stewardship and infection prevention and control activities. The academic content was validated and this App was widely circulated among doctors and students in Kerala.

Integrated Antimicrobial Resistance Surveillance Framework for Kerala – Centre for Science and Environment (CSE)
focusing on food-animals, food-animal products and environment
Based on deliberations at the
Workshop on Integrated Surveillance Framework for Antimicrobial Resistance for Kerala – Kochi.

AMR has been recognized as a 'One Health' issue owing to its significant linkages with the health of humans, animals and environment. Antibiotic misuse and overuse in animals – particularly food-animals and in crops is an important driver of AMR. The environment also has a key role in the emergence and spread of AMR. Waste from drug manufacturing units, healthcare settings (human and veterinary), food production systems (such as farms, slaughter-houses, processing units), and community are considered as key contributors of AMR causing determinants such as resistant bacteria, antibiotic residues and resistance conferring genes in the environment. The environment is thus a large pool of these determinants. However, in terms of AMR containment, the human health side of AMR problem has received the most attention, followed by the animal side. The environmental aspects of AMR have received limited attention in comparison.

Of the six key strategic priorities of the KARSAP, the second strategic priority outlines the need for surveillance of AMR in order to generate more knowledge

and evidence. The KARSAP acknowledges that in addition to human health, surveillance in animals, fisheries and agriculture is equally critical. The KARSAP emphasizes on surveillance of AMR and antibiotic residues in food-animals, food-animal products, and environment.

The Centre for Science and Environment (CSE) has been engaging with the Department of Health, Kerala to contribute towards containment of AMR in the state. CSE is also an implementation partner to the KARSAP. As part of this engagement, CSE organized a workshop in Kerala to develop an integrated AMR surveillance plan for the state. The workshop was organized in Kochi in collaboration with the State Department of Health and Family Welfare and the Kerala State Pollution Control Board (KSPCB). An integrated surveillance encompassing all sectors would not only be useful for knowing present AMR trends in the state, but also help generate necessary evidence to guide future AMR containment policy and practice.

1. Surveillance framework for antimicrobial resistance in food-animals, food-animal products and environment for Kerala

With an aim to build a comprehensive surveillance framework for Kerala in the workshop, the expert group collectively finalized three sectors where surveillance would be carried out – livestock (poultry and cattle), fisheries and environment. The framework looks at surveillance of resistant bacteria, antimicrobial residues (AR) and antimicrobial resistance genes (ARGs). The framework is divided into two sections:

- (a) Sampling framework: Across each sector, districts, sampling locations, sample sizes, sample types, frequency of sampling etc. has been identified.
- (b) Key bacteria, antibiotics, genes, standard methods, data analysis and reporting: This section focuses on which bacteria, antibiotics or genes would be monitored, which standardized laboratory methods would be adopted, how data would be analyzed and reported.

The expert group also prioritized a phased approach for surveillance. The surveillance framework is intended to provide a five-year roadmap for

carrying out AMR surveillance. Over a span of these five years, surveillance would be carried out in two phases — Phase 1 (1-3 years) and Phase 2 (4-5 years). The framework may be suitably adapted by other states with similar geographic and socioeconomic features.

1.1. Sampling framework

1.1.1. Poultry

A sampling framework for AMR surveillance in poultry sector of Kerala is provided in Table 1. The focus has been broiler poultry over layers, since poultry meat is the most consumed meat product in Kerala. Eggs from layer poultry are usually procured from other states. Two key stakeholders are involved in this surveillance –the Animal Husbandry Department and Food Safety Department. In Phase 1, sampling is to be done from only three districts. In Phase 2, sampling would be expanded to cover the remaining 11 districts so that all 14 districts are included in the surveillance exercise in the long run. Key sampling sites include broiler poultry farms and retail markets, wherein antimicrobial susceptibility testing (AST) would be done in cloacal swab samples (by the Animal Husbandry Department) and retail meat samples (by the Food Safety Department) respectively. For each sample type (e.g., cloacal swab or meat), the framework proposes testing of 30 samples per district per quarter in Phase 1 in three districts. These districts should continue with similar sampling strategy and surveillance in Phase 2 as well. Sampling for the remaining 11 districts in Phase 2 would include about 40 samples per district every year. A smaller sample size and lesser frequency for 11 districts in Phase 2 is proposed taking due consideration of the collective load on laboratories in the district. However, if the district has capacity to scale up in the long run, then sample size and frequency could be expanded for better understanding of district wise trends. For e.g., each district could consider expanding sample size from 40 to 120 samples in a year and increase sampling frequency

from bi-annual to quarterly. Apart from AST, residue monitoring is to be carried out in all retail products by the Food Safety Department following a similar approach. This will help identify whether unapproved antibiotic has been misused or appropriate withdrawal periods have been followed or not.

Table 1: Sampling framework for poultry sector

	Districts	Sampling locations	Sample types	No. of sampling locations per district*	No. of samples per site	Samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 1 and 2	Emakulam Kozhikkode Trivandrum	Broiler farms	Cloacal swab in healthy birds [#]	10	3	30	Quarterly	120	AMR	Animal Husbandry Department
		Retail outlets	Meat	10	3	30	Quarterly	120	AMR, AR	Food Safety Department
Phase 2	Alappuzha Idukki Kannur Kasaragod Kollam Kottayam Malappuram Palakkad Pathanamthitta Thrissur Wayanad	Broiler farms	Cloacal swab in healthy birds [#]	10	2	20	Biannual	40	AMR	Animal Husbandry Department
		Retail outlets	Meat	10	2	20	Biannual	40	AMR, AR	Food Safety Department

Liver or heart blood samples may be taken from farms with diseased animals. This is not a part of routine monitoring.

*Rotation of sites sampled should be considered. For example, in each district, different sets of 10 sites should be sampled in different quarters. The first set of sites could be revisited again in year 2 and likewise.

Note: Presently, the Animal Husbandry Department has a state disease diagnostic laboratory, four regional disease diagnostic laboratories and 14 clinical laboratories across districts⁵. In the long term, these should be strengthened and capacitated to execute the proposed framework across all districts

1.1.2 Cattle for milk

Table 2 shows sampling framework for dairy sector (cattle for milk) in Kerala. This includes milk (raw and processed) as well as milk products such as cheese, curd, yoghurt etc. While the framework is largely similar to that of the poultry sector, an additional sampling location has been identified in this case which is cooperative societies. The Animal Husbandry Department will carry out surveillance of samples collected from the farms and cooperative societies, while those from retail markets will be carried out by the Food Safety Department. Other than processed milk, raw milk sold at market places or delivered at households for consumption could also be tested by the Food Safety Department.

Table 2: Sampling framework for cattle for milk

	Districts	Sampling locations	Sample types	No. of sampling locations per district *	No. of samples per site	Total samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 1 and Phase 2	Ernakulam Kozhikkode Trivandrum	Farms	Milk [#]	5	2	10	Quarterly	40	AMR	Animal Husbandry Department
		Cooperative society	Milk and milk products	2	5 (2 milk, and 3 milk products, if any)	10	Quarterly	40	AMR	Animal Husbandry Department
		Retail outlets	Milk and milk products	5	2 (1 milk, and 1 milk product, if any)	10	Quarterly	40	AMR in all samples, AR in milk	Food Safety Department

	Districts	Sampling locations	Sample types	No. of sampling locations per district *	No. of samples per site	Total samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 2	Alappuzha Idukki Kannur Kasaragod Kollam Kottayam Malappuram Palakkad Pathanamthitta Thrissur Wayanad	Farms	Milk [#]	5	2	10	Biannual	20	AMR	Animal Husbandry Department
		Cooperative society	Milk and milk products	2	5 (2 milk, and 3 milk products, if any)	10	Biannual	20	AMR	Animal Husbandry Department
		Retail outlets	Milk and milk products	5	2 (1 milk, and 1 milk products, if any)	10	Biannual	20	AMR in all samples, AR in milk	Food Safety Department

*Mastitis pus samples may be taken from farms with diseased animals. This is not a part of routine monitoring.

*Rotation of sites sampled should be considered. For example, in each district, different sets of 5 sites should be sampled in different quarters. The first set of sites could be revisited again in year 2 and likewise.

Note: Presently, the Animal Husbandry Department has a state disease diagnostic laboratory, four regional disease diagnostic laboratories and 14 clinical laboratories across districts⁵. In the long term, these should be strengthened and capacitated to execute the proposed framework across all districts.

1.1.3. Cattle for meat

Beef, after poultry, is the most consumed meat product in Kerala. This section presents the sampling framework for cattle (for meat) in Kerala (Table 3). The framework is designed in line with the dairy and poultry sector. In this case, slaughterhouses have been introduced as a new sampling site. The Animal Husbandry Department would conduct AST in rectal samples collected from farms and meat samples from slaughterhouses. The Food Safety Department will carry out AST and residue monitoring in meat samples from retail outlets.

Table 3: Sampling framework for cattle for meat

	Districts	Sampling locations	Sample types	No. of sampling locations per district*	No. of samples per site	Total samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 1 and Phase 2	Ernakulam Kozhikkode Trivandrum	Farms	Rectal samples	10	3	30	Quarterly	120	AMR	Animal Husbandry Department
		Slaughter houses	Meat	5	3	15	Quarterly	60	AMR	Animal Husbandry Department
		Retail outlets	Meat	5	3	15	Quarterly	60	AMR, AR	Food Safety Department
Phase 2	Alappuzha Idukki Kannur Kasaragod Kollam Kottayam Malappuram Palakkad Pathanamthitta Thrissur Wayanad	Farms	Rectal samples	10	2	20	Biannual	40	AMR	Animal Husbandry Department
		Slaughter houses	Meat	5	2	10	Biannual	20	AMR	Animal Husbandry Department
		Retail outlets	Meat	5	2	10	Biannual	20	AMR, AR	Food Safety Department

*Rotation of sites sampled should be considered. For example, in each district, different sets of 5 sites should be sampled in different quarters. The first set of sites could be revisited again in year 2 and likewise.

Note: Presently, the Animal Husbandry Department has a state disease diagnostic laboratory, four regional disease diagnostic laboratories and 14 clinical laboratories across districts⁵. In the long term, these should be strengthened and capacitated to execute the proposed framework across all districts

1.1.3. Sampling framework for surveillance in fisheries sector

This section discusses the sampling framework for fisheries sector in Kerala (Table 4). To begin with, AMR surveillance will be done in two key fish-producing districts of Kerala in Phase 1 across farms, landing centres and wholesale markets. Surveillance will subsequently expand to cover all five major fish-producing districts of the state in Phase 2, and include retail market as an additional sampling site. The framework suggests monitoring of not just fish meat, but also of environmental samples like soil, water and feed, particularly from fish farms. Frequency of sampling from farms is based on culture period, unlike other cases where samples are to be collected quarterly. The State Fisheries Department and the Food Safety Department would be the key stakeholders. The State Fisheries Department will initially be required to be supported by the resources and infrastructure from the Central Institute of Fisheries Technology and the Kerala University of Fisheries and Ocean Studies.

Table 4: Sampling framework for fisheries

	Districts	Sampling locations	Sample types	No. of sampling locations per district**	No. of samples per site	Total samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 1	Emakulam Kollam	Farms [†]	Soil, water, feed, fish meat	2% of total farms	At least 2 per type	Based on no. of farms sampled	Twice during culture period	Based on no. of farms sampled	AMR in all samples, AR in fish meat	State Fisheries Department
		Landing centres [‡]	Fish meat	2-3	At least 2	Based on variety of marine captures	Quarterly	Based on variety of marine captures	AMR, AR	
		Wholesale markets	Fish meat	10% of total markets	At least 2	Based on no. of markets sampled	Quarterly	Based on no. of markets sampled	AMR, AR	

	Districts	Sampling locations	Sample types	No. of sampling locations per district**	No. of samples per site	Total samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 2	Alleppey Emakulam Kannur Kollam Palakkad	Farms*	Soil, water, feed, fish meat	2% of total farms	At least 2 per type	Based on no. of farms sampled	Twice during culture period	Based on no. of farms sampled	AMR in all samples, AR in fish meat	State Fisheries Department
		Landing centres#	Fish meat	2-3	At least 2	Based on variety of marine captures	Quarterly	Based on variety of marine captures	AMR, AR	
		Wholesale markets	Fish meat	10% of total markets	At least 2	Based on no. of markets sampled	Quarterly	Based on no. of markets sampled	AMR, AR	
		Retail markets	Fish meat	10% of total markets	At least 2	Based on no. of markets sampled	Quarterly	Based on no. of markets sampled	AMR, AR	Food Safety Department

* Farms include freshwater and brackish water farms; # Landing centres for marine capture; ** Rotation of sites sampled should be considered.

1.1.3. Sampling framework for surveillance in environment sector

The broad structure of the environment sector w.r.t. AMR has been categorized into point sources and non-point sources. Point sources refer to a single pollution source that could contribute AMR determinants through waste from these sources. These include factories, healthcare settings, farms and the community. AMR determinants may then directly, or after treatment, reach the larger external environment. Non-point sources are part of this larger environment, which include rivers, lakes, ponds, oceans, groundwater and soil. These act as sinks of AMR determinants contributed by point sources. In addition, they also act as sources since AMR determinants can find their way back into humans, animals and the food chain from the larger environment.

The sampling framework for surveillance across point and non-point sources in environment sector in Kerala is shown in Table 5 and 6

respectively. Sampling will expand from three districts in Phase 1 to all districts in Phase 2. For point sources, effluent samples will mostly be monitored, except in case of municipal solid waste dump sites, where soil and water will be monitored. For non-point sources, seasonal sampling (i.e., before, during and after monsoon) of surface or ground water samples will be done and monitored for resistant bacteria only. The key stakeholder involved would be the KSPCB. The KSPCB could initially seek technical and capacity building support from the other stakeholders in the state such as the state Animal Husbandry Department, Fisheries Department, Central Institute of Fisheries Technology etc. In the meantime, laboratories of the KSPCB could be strengthened and resources trained w.r.t. microbiology, analytical chemistry and molecular biology in order to conduct AMR surveillance independently.

Table 5: Sampling framework for point sources in environment

	Districts	Sampling locations	No. of sampling locations per district	Sample types	No. of samples per site	Total samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 1	Kozhikkode Ernakulam Trivandrum	Sewage Treatment Plant (STP)	1 modern plant at Muttathara, Trivandrum	Effluent	3 (inlet, midpoint, outlet)	3	Quarterly	12	AMR, AR	KSPCB
		Residential STPs in high rise buildings	5 (initial pilot in Trivandrum)	Effluent	1	5	Quarterly	20	AMR, AR	
		Hospital	1 each of general hospital, medical college, corporate hospital, veterinary hospital, polyclinic (5 sites)	Effluent	1	5	Quarterly	20	AMR, AR	
		Slaughter houses	2	Effluent	1	2	Quarterly	8	AMR, AR	

	Districts	Sampling locations	No. of sampling locations per district	Sample types	No. of samples per site	Total samples per district	Sampling frequency	Samples per year per district	AMR, AR	Stakeholder
Phase 2		Biomedical waste treatment plant	Only 1 present in Palakkad	Effluent	1	1	Quarterly	4	AMR, AR	
		Farms (poultry, dairy, aquaculture)	5 (consider 5-10% of farms selected for surveillance in livestock/fisheries)	Effluent	1	5	Quarterly	20	AMR, AR	
		Municipal solid waste dump sites	2	Soil, water	2 per sample type	8	Quarterly	32	AMR, AR	
	Alappuzha Ernakulam Idukki Kannur Kasaragod Kollam Kottayam Kozhikkode Malappuram Palakkad Pathanamthitta Thrissur Trivandrum Wayanad	STP	1 modern plant at Muttathara, Trivandrum	Effluent	3 (inlet, midpoint, outlet)	3	Quarterly	12	AMR, AR	KSPCB
		Residential STPs in high rise buildings	5 (initial pilot in Trivandrum)	Effluent	1	5	Quarterly	20	AMR, AR	
		Hospital	1 each of general hospital, medical college, corporate hospital, veterinary hospital, polyclinic (5 sites)	Effluent	1	5	Quarterly	20	AMR, AR	
		Slaughter houses	2	Effluent	1	2	Quarterly	8	AMR, AR	
		Biomedical waste treatment plant	Only 1 present in Palakkad	Effluent	1	1	Quarterly	4	AMR, AR	

	Districts	Sampli ng locatio ns	No. of sampling locations per district	Samp le types	No. of sampl es per site	Total sampl es per district	Sampli ng frequen cy	Samples per year per district	AM R, AR	Stakeh old er
		Aquaculture farms, poultry farms, dairy farms	5 (consider 5- 10% of farms selected for surveillance in livestock/fisheri es)	Effluent	1	5	Quarterly	20	AMR, AR	
		Municipal solid waste dump sites	2	Soil, water	2 per sample type	8	Quarterly	32	AMR, AR	

Note: Based on learning from Phase 1, number of sampling locations will be expanded for other point sources. Antibiotic residue testing could be done on 1/3rd of samples collected for AMR surveillance and involve qualitative testing before quantitative estimation.

Table 6: Sampling framework for non-point sources in environment

	Districts	Sampli ng locatio ns	No. of sampli ng locatio ns per district	Samp le types	No. of sampl es persit e	Total sampl es per district	Samplin g frequenc y*	Sampl es per year per district	AM R, AR	Stakehold er
Phase 1	Ernakulam Kozhikkode Trivandrum	Rivers and Lakes [#]	At least 5	Water	3 (at different points along a river)	15	Seasonal	45	AMR	KSPCB
		Ope n well s	10	Groun d water	1	10	Seasonal	30	AMR	
		Estuaries	5	Water	1	5	Seasonal	15	AMR	
		Coast line	5	Sea water	1	5	Seasonal	15	AMR	
P	Alappuzha Ernakulam Idukki Kannur Kasaragod	Rivers and Lakes [#]	At least 5	Water	3 (at different points along a river)	15	Seasonal	45	AMR	KSPCB

	Districts	Sampling locations	No. of sampling locations per district	Sample types	No. of samples per site	Total samples per district	Sampling frequency*	Samples per year per district	AMR, AR	Stakeholder
	Kollam	Open wells	10	Ground water	1	10	Seasonal	30	AMR	
	Kottayam	Estuaries	5	Water	1	5	Seasonal	15	AMR	
	Kozhikkode	Coast line	5	Sea water	1	5	Seasonal	15	AMR	
	Malappuram									
	Palakkad									
	Pathanamthitta									
	Thrissur									
	Trivandrum									
	Wayanad									

Examples: Pamba, Periyar rivers, Ramsar sites e.g. Vembanad lake, Ashthamudi lake (brackishwater lake), Sashthamkotta Lake (freshwater lake); *Seasonal sampling could be carried out pre-monsoon, monsoon, post-monsoon.

1.2. Key bacteria, antibiotics, genes, standard methods, data analysis and reporting

	Poultry (Broiler)	Cattle for milk and meat	Fisheries	Environment
Key bacteria (for AST)	<i>Escherichia coli</i> <i>Salmonella</i> spp. <i>Klebsiella</i> spp.	<i>Escherichia coli</i> <i>Staphylococcus aureus</i>	<i>Escherichia coli</i> <i>Vibrio parahaemolyticus</i> <i>Aeromonas</i> spp.	Phase 1: <i>Escherichia coli</i> (focus on ESBL producing <i>E. coli</i>) Phase 2: <i>Escherichia coli</i> <i>Enterococcus</i> spp. <i>Klebsiella</i> spp.
Key antibiotics (for AST)	<i>Escherichia coli</i> and <i>Klebsiella</i> spp. Tetracyclines Sulfonamides (e.g. suphaquinoxaline) Fluoroquinolones (e.g. enrofloxacin) Third generation cephalosporins (e.g. ceftriaxone)	<i>Escherichia coli</i> Tetracycline Beta lactams Third generation cephalosporins (e.g. ceftriaxone) Fluoroquinolones (e.g. ciprofloxacin) Carbapenems (e.g. imipenem) Aminoglycosides (e.g. gentamicin)	Tetracyclines Cephalosporins Quinolones	Carbapenems (e.g. imipenem) Fluoroquinolones (e.g. ciprofloxacin) Beta Lactams and Beta Lactamase Inhibitor

	Poultry (Broiler)	Cattle for milk and meat	Fisheries	Environment
	<i>Salmonella</i> spp. Beta lactams (e.g. ampicillin) Chloramphenicol Sulfonamides (e.g. cotrimoxazole)	<i>Staphylococcus aureus</i> Tetracyclines Beta lactams (e.g. oxacillin) Macrolides		
Method for bacterial isolation, identification, characterization	Biochemical identification system (VITEK)	Biochemical identification system (VITEK)	Biochemical identification system (VITEK)	Selective media and biochemical analysis
Method for AST*	Kirby Baur Disc Diffusion, MIC and interpretation using CLSI			
Key antibiotics (for residue monitoring)	Tetracyclines Fluoroquinolones (e.g. enrofloxacin) Third generation cephalosporins (e.g. Ceftriaxone) Sulfonamides (e.g. suphaquinoxaline)	Tetracyclines Beta lactams (e.g. penicillin, amoxicillin, cloxacillin) 3rd generation cephalosporins Fluoroquinolones (e.g. enrofloxacin, ciprofloxacin) Aminoglycosides (e.g. gentamicin)	Tetracyclines Nitrofurans	Antibiotics to be tested will be site-specific and also depend on its concentration and rate of breakdown (only for point sources)
Method for residue testing	ELISA; 10% of ELISA positive samples to be further validated using HPLC/LCMS			
Genetic markers**	ESBL genes (blaCTX-M, blaSHV, blaTEM etc.) Tetracycline resistance genes (tet-A, tet-B, tet-M, tet-O, tet-S etc.) Sulfonamide resistance genes (sul1-3 etc.) Quinolone resistance genes (<i>qnrA</i> , <i>qnrB</i> , <i>qnrS</i> etc.)	ESBL genes (blaCTX-M, blaSHV, blaTEM etc.) Tetracycline resistance genes (tet-A, tet-B, tet-M, tet-O, tet-S etc.) Macrolide resistance genes (<i>err</i> , <i>mef</i> , <i>msr</i> , <i>ere</i> etc.)	Tetracycline resistance genes (tet-A, tet-B, tet-M, tet-O, tet-S etc.)	ESBL genes (blaCTX-M, blaSHV, blaTEM etc.)
Data harmonization and reporting	WHONET; Annual reporting			

*Minimum Inhibitory Concentration (MIC) method is ideal and recommended for large antibiotic molecules. Laboratories with necessary infrastructure may prefer MIC (if required in Phase 2); **Along with resistant bacteria and residues, presence of genetic markers responsible for AMR in bacteria should also be tested. This could however be initiated in Phase 2 of surveillance.

ReAct Asia Pacific: Activities undertaken in the state of Kerala, India, in 2019

ReAct Asia Pacific in Kerala

ReAct started working in the state of Kerala, India, in 2017. The mandate was to look at the relatively well-developed health systems and a robust community mobilization infrastructure in the state; and evaluate whether it can be used to develop systems for community-based action on AMR. Being a global science-based network, ReAct had the necessary policy expertise at the international level to work on issues that needed attention of the Antimicrobial Resistance (AMR) community. But complementing it with data and experiences from grassroot level was considered as quintessential in launching any effective programme for containing the issue. ReAct Asia Pacific also wanted to create models for community action, which can possibly be scaled up in multiple Low-Middle Income Country (LMIC contexts)

In the initial part of our action, the focus was to hold start-up meetings. A workshop for discussing antibiotic use in non-human sectors attracted more than 60 participants, including the then directors of animal husbandry and fisheries departments. We held a media sensitization workshop at Thiruvananthapuram and it was attended by representatives from more than 20 prominent news outlets. A workshop for sensitize local Non-Governmental Organizations saw participation from over 40 organizations across the state and southern part of the country. Once we did the scoping and identified possible areas for action, the focus was on engaging specific target groups. A project was launched to pilot antimicrobial stewardship in 8 smaller secondary-level hospitals in the state, with an aim to document the course and challenges. ReAct Asia Pacific associated with Kerala Institute of Local Administration (KILA) to develop and pilot a training manual on AMR for local self-government representatives. Projects targeting farms, communities and students were undertaken; and we are continuing with the work now.

Antibiotic Smart Communities Project

ReAct Asia Pacific (RAP) has been doing preliminary preparation work on the concept of Antibiotic Smart Communities. We have been looking at the robustness of this concept in implementing National Action Plans on

Antimicrobial Resistance (NAP-AMR) in community settings apart from being an effective tool to quantify efforts to tackle the issue locally. Through this project, we were trying to define what constitutes an antibiotic smart community, formulate a set of indicators that define antibiotic smartness and construct a roadmap to achieve the same

ReAct Asia Pacific started working with a community in the state of Kerala, India, in 2018. In the first year, the work was focussed on interacting with community leaders, GIS mapping of the non-domestic antibiotic use sites and a community survey to understand perceptions about antibiotic use and antibiotic resistance. In 2019, the focus was on developing a conceptual framework to find the contours of a 'smart community' and also evaluate how to measure it objectively. Three workshops were held as a part of this- one for public health experts, one for agriculture/veterinary professionals and one for environment/development experts. At these workshops, we tried to find out the existing initiatives which can possibly affect the various drivers of resistance. Also, we undertook a prioritization exercise for the indicators mentioned in the SDG framework.



Workshop for Public Health Professionals

The first workshop under the 'Antibiotic Smart Communities' project of React Asia Pacific was organized on 10th May 2019 at Hotel Le Meridien, Kochi, India. The workshop was organized in association with Indian Association of Preventive and Social Medicine (IAPSM); and saw 18 selected public health experts brainstorming on the concept of antibiotic smart communities. The sessions were moderated by Dr. Sujith J Chandy, Head, ReAct Asia Pacific. The workshop was attended by all the office-bearers of IAPSM Kerala Chapter along with the immediate past National president of the organization. There was also representation from Indian Dental Association. The first session highlighted the threat of antibiotic resistance in healthcare; and its possible impact in terms of rising morbidity/mortality, health capacity utilization and higher healthcare expenditures. Improving the visibility of the issue and finding out potential allies for action on AMR were discussed during the meeting. The possible strategies for mainstreaming the issue and engaging a larger public health community were assessed. ReAct's position that AMR is a development issue and antibiotics should be seen as public goods, was conveyed to the workshop participants. Major part of the workshop was discussion about how to engage communities on the action on AMR. There are several public health initiatives which has been successful through effective co-opting of communities and participants wanted to see whether any cross-learning is possible. The workshop also debated the kind of competence we want to see from the general public and local self-government representatives.



Workshop for environment and development experts

React Asia Pacific organised a one-day expert consultation & workshop for environment experts at Hotel Holiday Inn, Kochi, India, on 28th June 2019. This was the second workshop as a part of the project to develop metrics for Antibiotic Smart Communities; and had more than 35 participants. The workshop had representation from various environmental groups, fisheries experts, development professionals, pollution control board of the government and college environment networks. The workshop was led by Dr Vishal Diwan (Environment health expert), Dr Sudhi R (Environment activist & veterinarian) and Dr Philip Mathew (Consultant, RAP). Dr Vishal Diwan made a brief presentation on 'Environment Dimensions of AMR' to sensitize the participants about the various aspects of antimicrobial resistance which are influenced by environment factors. Dr Sudhi R spoke in detail about the human and environmental microbiome; and its impact of the life and health of people. The meeting discussed various drivers for environmental contamination with antibiotics and the possible solutions. It was accepted that the data available in the public domain is scant and there are no reasonable standards for no-effect concentrations. Also, the current sewage treatment systems do not account for antibiotic residues or antibiotic resistance genes. There is an acute need to map the sources of antibiotics in the environment and implement feasible containment strategies. The workshop later discussed the impact of AMR on human and economic development. Some participants were of the opinion that highlighting the potential economic impact of AMR can help to mainstream the issue and channelize more funds into this domain.



Workshop for agriculture experts

ReAct Asia Pacific organised a one day expert consultation & workshop for agriculture experts at Hotel Le Meridien, Kochi, India, on 29th June 2019. This was the third of a series of workshops held as a part of the antibiotic smart community project. The workshop was meant to identify the possible indicators for the multi-parameter composite index that we are planning to design, for measuring the level of implementation of NAPs at a community setting. The workshop was moderated by Dr Robin Paul (Quality Manager of State Laboratory for Livestock, Marine and Agriculture products) and Dr Philip Mathew (Consultant, RAP). The workshop had wide participation which included fisheries experts, animal husbandry experts, officials from Food Safety and Standards Authority of India (FSSAI), faculty from agriculture universities and farmers organizations. The initial session was led by Dr. Philip Mathew on core questions on antibiotic use in agriculture. The session entailed increased use of antibiotics in farms, increase in incomes and lifestyle changes. The session also focused on the need for investing in smallholder agriculture for food security which included defining small holder farms, provisioning for domestic market, food resilience and social security net. It was noted that the investments in smallholder agriculture needs to be improved. The discussion points of the session included concessions and incentives for farmers; and identifying antibiotic usage and its drivers. Dr Robin Paul led the group through the potential issues associated with antibiotic use in agriculture and methods to contain the same. He highlighted the efforts of the government of Kerala to operationalize Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP). The participants discussed about the need to have robust structures in place to incentivise small farmers to move away from antibiotics

Antibiotic Smart Farms Project

The antibiotic smart farm project aims to sensitize farmers about antibiotic resistance and devise methods to help them transition away from antibiotic use. In 2018, the focus of the project was to sensitize

farmers about ABR and map out their challenges in reducing antibiotic use in farms. We identified groups of poultry, shrimp and dairy farmers from the state of Kerala, India, and organised one day workshops at various places. From this interaction we found that the farmers did not have the competence to take action on ABR and that they needed synthesised information on biosecurity measures which are feasible in their contexts. In 2019, we identified experts from these sectors and organised workshops to identify the biosecurity measures which are feasible in low-resource settings for poultry and shrimp farms. In addition, we brought together domain experts, veterinarians and administrators on the same platform to have a 'Kerala Veterinarians' summit on AMR'. This was accompanied by a 'Kochi declaration on one health action on ABR' which was endorsed by the presidents of the medical, dental and veterinary associations, in the presence of the minister for animal husbandry & fisheries. In 2020, RAP is aiming to design biosecurity education toolkits for farmers and government agencies, using the information harvested through the workshops of 2019. These toolkits can be a part of the antibiotic smart communities project and we assume that it will be a means to engage the farming communities in the area. In addition to the toolkit, we also propose to have a small workshop with consumer groups and domain experts to develop a consensus on possible certification and labelling practices for food produced without routine use of antibiotics.



Workshop on antibiotic use and biosecurity in shrimp aquaculture

A workshop for aquaculture experts and shrimp farmer representatives were held on 8th March 2019, at Hotel Holiday Inn, Kochi, India. The workshop was organised by ReAct Asia Pacific in collaboration with Kerala University of Fisheries and Ocean Studies. There was representation from Prawn Farmers Federation of India and All India Shrimp Hatcheries Association, apart from experts of Central Institute of Brackish Aquaculture. The primary objective of the workshop was to discuss about practical measures to avoid antibiotic use in shrimp farms, especially in the context of Low-Middle Income Countries. The workshop discussed the various options available for small shrimp farmers to reduce the use of antibiotics in their farms. The biosecurity measures were evaluated by the group in terms of its feasibility of implementation in low-resource settings. The biosecurity measures for shrimp farms and hatcheries were discussed during the meeting. The event also had some pioneering farmers who had successfully eliminated antibiotics from their farms through use of various interventions like probiotics and high-quality inputs. Those interventions were also discussed in detail during the proceedings. The restrictions on export and the testing facilities for antibiotic residues were also

d e b a t e d
during the
workshop. The
K U F O S
faculty also
presented the
results of a
study that they
h a d
undertaken in
t h e
waterbodies



Workshop on antibiotic use and biosecurity in poultry

near hospitals and shrimp farms in various regions of the state. Dr Devika Pillai (Professor, KUFOS) and Dr Philip Mathew (Consultant, ReAct Asia Pacific) led the workshop proceedings.

ReAct Asia Pacific organized a workshop for poultry experts and representatives of farmers, on 29th June 2019 at Hotel Le Meridien, Kochi, India. The workshop was led by Dr Jalalluddin M (Expert in poultry and Managing Director, Kerala Chicken) and Dr Sudhi Rangorath (Poultry expert). The poultry farmers were led by experts from the All Kerala Poultry Federation, an apex body of more than 30,000 small scale poultry farmers in the state. The primary objective of the workshop was to discuss the biosecurity measures which are possible in small poultry farms and hatcheries in low-resource settings. The meeting discussed the poor state of regulatory affairs in the poultry sector and the need for better legal framework. Issues like alternatives to antibiotics, incentives to farmers and insurance support for farmers were debated. The form of support which should be made available to farmers and the medium of transmission of credible information to farmers were also discussed during the workshop. A list of biosecurity measures which are possible to implement in our settings, were identified through the meeting.

ASPIC Clubs to engage college students

In 2018, ReAct Asia Pacific launched the ASPIC club initiative to engage students from universities and colleges. This was done as a pilot to evaluate whether students can be engaged effectively on a topic like AMR and their ability to plan community-based interventions. The initiative was modelled on the 'Red Ribbon clubs' which achieved remarkable success in the HIV/AIDS domain. In the latest count, we have ASPIC clubs in 15 reputed institutions and more are in the pipeline. They organise various community engagement activities, apart from science related events to increase awareness or competencies regarding AMR. In 2020, we will be working towards increasing the number of clubs to 20 and linking at least 50% of them to local civil society organisations. This is to address the sustainability component of the project and to increase the linkages with the general public. Also, we will be launching 'ASPIC Junior' initiative which is targeted at schools. This initiative will form similar clubs in schools and will take an educational approach to teach the students about basics of personal hygiene, nutrition, microbiome and appropriate use of medicines. This will be

meant to frame the issue properly in the minds of children and discredit the 'war metaphor' which defines any usual narrative about bacteria. Each of the clubs organize several programmes related to AMR and ReAct supports these activities through a seed fund. In addition to the club level activities, the following events were organised by ReAct:



Annual Photography Competition



ReAct Asia Pacific and ASPIC club network organised the third edition of its annual photography competition to commemorate the World Antibiotic Awareness Week. The competition received wide participation and we received entries from south and south-east Asia. The expert panel of judges found it to be a tough call choosing between various entries to the competition. In the end a total of seven winners emerged for the top three prizes, with two sharing the first one, three sharing the second prize and again two dividing the third prize among themselves. The winners received cash prizes and certificates; and all the winning entries were published in the ReAct network's website.



Short courses on research laboratory techniques

ReAct Asia Pacific organised several short courses on Research Laboratory Techniques in association with Pushpagiri Research Centre (PRC) for students of ASPIC clubs of various institutions. The course is organised only when the clubs come forward with a request to enhance the understanding of the members in basic scientific aspects of AMR. The course comprises of anti-microbial susceptibility testing and molecular techniques like PCR & RT-PCR, apart from a practical session to integrate knowledge within a diagnostic and research facility. The students are given an overview about the impact of AMR within a hospital setting. Also, the course faculty highlights the importance of anti-microbial resistance in healthcare which warrants proper diagnostic testing based on standard guidelines and the need to develop newer anti-microbials to contain this global threat. The students are given information on ideal test conditions and troubleshooting in setting up a PCR reaction. The students are also given a demonstration, which includes DNA, RNA extraction, setting up of both conventional and qRT-PCR, post-PCR gel-documentation etc. This is usually followed by the demonstration which includes the different AST methods and its interpretation. Members of 5 ASPIC clubs have been trained so far.



ASPIC Annual meeting

ReAct Asia Pacific organised the first ever annual meeting of APSIC Clubs on 21st February 2019 at Hotel Aida, Kottayam, India, with an aim to bring together representatives from all the ASPIC clubs. The idea was to have a platform to share experiences and also create a sense of camaraderie among the club members from various institutions. The one-day meeting was attended by members of ASPIC clubs from different colleges and universities across the state of Kerala, India. The students were accompanied by faculty representatives too, for the meeting.

The annual meeting discussed the need to publicize the issues related to AMR and public health, the importance of de-jargonizing science for public consumption, the requirement to understand the concept of antimicrobial resistance and the ever-evolving nature of drug-resistant infections. The students were also explained the various career options available and the paths which they can take to launch their careers. The annual meeting was a great platform to engage students and understand their perceptions of antimicrobial resistance. Also, ReAct Asia Pacific needed a self-appraisal on progress of the student engagement initiatives. It was found that the level of understanding of students was quite good, but they needed a helping hand in translating the understanding into definite community-based actions. All the students expressed the need for more robust communication mechanisms which can enable the various clubs to stay in touch. The participants wanted more programmes which can improve the capacity of the students in taking action on antimicrobial resistance.

Report of AMR control activities in Animal Health by *Animal Husbandry Department* under KARSAP



The activities to control AMR in Animal Health & Foods is coordinated by the State Laboratory for Livestock Marine & Agri Products, Ernakulam the nodal center for AMR and reviewed by the Working group on AMR. The working group on AMR was constituted by Director, AHD in accordance with the general terms of reference stated in GO (Rt) No 3553/2017/H & FW dtd. 18-12-2017.

Actions taken on each of the 6 strategic priorities of KARSAP after the launch of KARSAP-One Health by Hon. Chief Minister on 25-10-2018 is detailed below.

1. Awareness & understanding

a) Communication & IEC

1st meeting of the working group on AMR of the Animal Husbandry Department held on 20-03-19 at SLMAP Lab, Ernakulam reviewed all the activities proposed under KARSAP. 2nd meeting is proposed by the 3rd week of February.



Meeting of the working group on AMR for the Animal Husbandry Department

b) Education & Training

1. Awareness programs for Farmers and sensitization program for Vets
2. Training program to veterinarians on AMR at Trivandrum, Ernakulam and Pathanamthita districts
3. Kerala State Veterinary Council conducted first Continuing Veterinary Education (CVE) program on AMR on 14-05-19 at Trivandrum

**KSVC First Continuing Veterinary Education (CVE) program on AMR**

4. The extension & training wing of AHD are the 9 Livestock Management Training Centers (LMTCs) located across various districts of Kerala. Each of these centers train around 200 farmers every month on various subjects. A one day training program was conducted on 03-06-2019 to 36 veterinarians of LMTCs at Chengannur titled '**Train the trainers on AMR**'.



Extension & Training wings, AMR program to Livestock Management Training Centers (LMTCs)

5. A one day seminar titled '**Kerala Veterinarians AMR summit**' with technical support from WHO India was conducted on 02-09-2019 at Ernakulam for 114 Veterinarians from Kerala with attendance of the Hon Animal Husbandry Minister Adv. K Raju. A wide range of subjects from Global AMR actions to specific issues in Poultry Husbandry, Dairy production and Drug regulations were discussed

In conjunction with the summit a joint declaration '**Kochi Declaration on 'One Health' Action on Antibiotic Resistance**' by various prescribers of antibiotics in the state of Kerala viz the Kerala Presidents of Indian Medical Association, Indian Dental Association, Indian Veterinary Association was made in the august presence of Hon. Minister of Animal Husbandry Kerala, Vice Chancellor of Kerala Veterinary & Animal Sciences University, Technical Officer of World Health Organization and Director Animal Husbandry. The program was facilitated by Indian Veterinary Association Kerala and ReAct Asia Pacific



Hon. Minister of Animal Husbandry Kerala Adv. K Raju addressing gathering for Kochi Declaration on One Health for AMR



Kerala Veterinarians AMR summit' with technical support from WHO India

2. Knowledge & evidence

a) Laboratories- strengthening

1. ISO 17025 –**NABL accreditation for Labs**, Accreditation of Apex Labs SAID Palode, ADDL Thiruvilla, NPRE Palakkad & SLMAP Ernakulam completed. Now all four apex labs of AHD accredited to the International Standard
2. ISO 9001 for Directorate completed & select hospitals in every district are being upgraded to obtain ISO 9001 & Lab Staff training is ongoing
3. Two lab staff attended FAO supported WHO-NET training at CIFT Kochi

b) Surveillance.

1. Residue Monitoring for Antibiotics in Broiler Chicken in Kerala by SLMAP Ernakulam. Now covered 79 farms from 5 districts of Kerala.
2. Antimicrobial Resistance (AMR) In Food and Food Animals: An Integrated Veterinary Surveillance Program For Kerala (Meat, Milk, Poultry) out of the 25 milk samples tested MRSA could not be isolated from 11 Staph isolates
3. Molecular Identification and Resistance Study of bacterial isolates from Animal Products
4. Detection of Oxytetracycline & Penicillins in Milk in Thiruvananthapuram dist; screening by Immuno chromatography & Quantification of Oxytetracycline by HPLC by SIAD Palode
5. AMR patterns for Staphylococcus in Milk by SIAD Palode, out of the 129 milk samples tested MRSA could be isolated from 17 samples from Trivandrum district.
6. Tetracycline resistance study in Enterobacteriaceae in Poultry, 90 % of E coli & Kleb were resistant to this widely used poultry antibiotic.
7. AST for Bacterial Avian Diseases by ADDL, Thiruvilla is an ongoing activity.

3. Infection prevention & control

a) Animal feed & food

1. To optimize the use of antibiotics, the AMR working group at (ADDL,Thiruvalla) has developed a SOP for IPC in veterinary hospitals and will distribute among DVC /VPC's in Kerala.
2. An SOP for biosecurity for livestock and Poultry farms, has been developed by the AMR working group at SIAD, Palode so that the same can be given to departmental farms in the first phase.
These SOPs will be finalized after the proposed working group meeting on AMR and discussion with the relevant stakeholders

4. Optimize use of antibiotics

a) Regulations

Kerala Livestock and Poultry feed (Regulation of manufacture and sale act 2018) in draft stage, work is going on at Directorate Thiruvanthapuram.
Govt .of India bans use of Colistin for manufacture, sale and distribution in Animal Health& Aquaculture vide its Gazette notification SO 2607 (E) dtd. 19-7-2019, KARSAP was first to formally propose this as a part of State Action Plan.

b) Veterinary & aquaculture

AHD dept. manual revised and reissued, this has recommendation of antibiotics for select diseases

c) Surveillance of AM use

Restricting Veterinary Antibiotic use by making them prescription only medicines by RVP and conducting a web survey on prescription practice w.r.t Antimicrobials among Veterinary Doctors in select districts is planned.
Analysis of antibiotic tetracycline in poultry feed is being done by SAID, Palode with LC MS MS to detect ultra-trace levels in collaboration with MG University. An AMR survey has also been initiated by the institute.

5. Research & Innovations

a) Research

New R & D project on Studies on AMR gene flux between livestock and society, risk assessment and development of management strategies Collaboration of SIAD, Palode with Mahatma Gandhi University, Kottayam

Under This project the following molecular work was undertaken

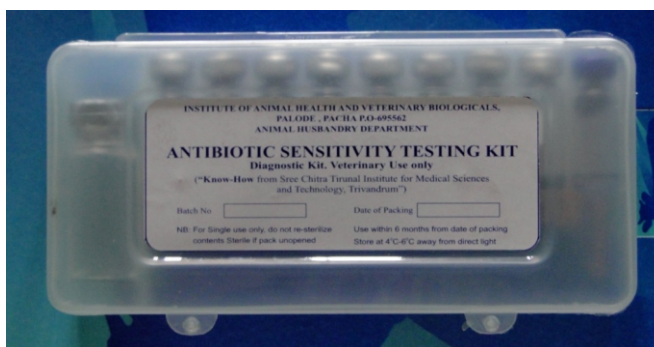
1. PCR for MecA gene in Staph aureus
2. PCR for TetA & TetB in E coli & Kleb

SLMAP is standardizing a PCR for Mec gene cassette of resistant Staph aureus and other AMR genes under the project Molecular Identification and Resistance Study of bacterial isolates from Animal Products.

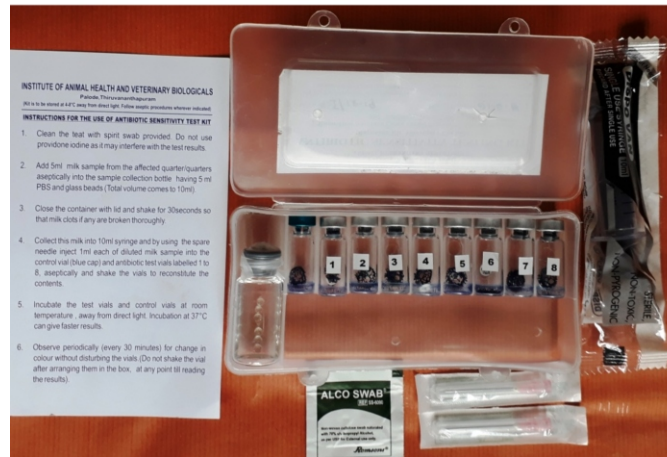
1. PCR for MecA gene in Staph aureus
2. PCR for CTX M&TEM genes in E coli & Kleb

b) Innovations

1. AHD/KSPDC+ Kudumbashree (State Livelihood Mission) launches “Kerala Chicken” being tested for antibiotic residues.
2. Novel Diagnostics- Distribution of field level rapid antibiotic sensitivity kits to Veterinary Institutions throughout Kerala. This kit was developed by Institute of Animal Health & Veterinary Biologicals (IAH & VB), Palode (Aprox 5000 nos per year)

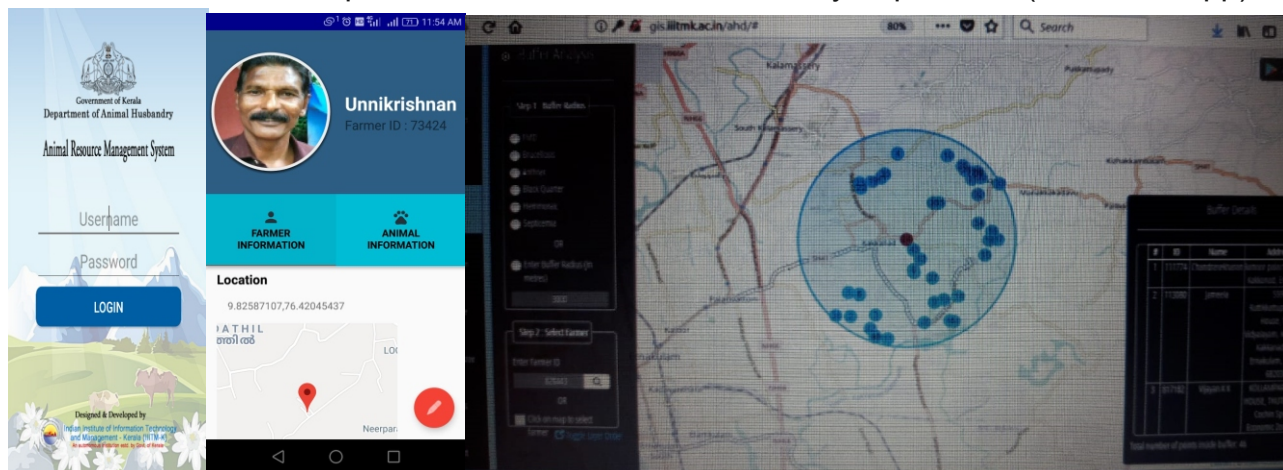


Rapid Diagnostics- Field level antibiotic sensitivity kits to Veterinary Hospitals by IAH & VB, Palode, AHD Kerala



Kit Contents and Instructions for Rapid AST

- Mapping and geo tagging of all animal farms in Kerala along with individual animal identification, disease and outbreak management and food traceability. More than 4000 mobile computing device provided to all field staff of Veterinary Department (BHUMIKA app)



Geo tagging of animal farms for individual animal identification & disease management (BHUMIKA app)

6. Collaborations

a) Public private partnerships

1. ReAct Asia Pacific conducted a one day workshop at Ernakulam on Biosecurity and Antibiotic issues in Poultry Industry on 12-04-2019



ReAct Asia Pacific workshop at Ernakulam on Biosecurity and Antibiotic uses in Poultry Industry

2. ReAct Asia Pacific conducted a one day workshop at Ernakulam on Antibiotic smart communities on 29-06-2019
3. Training program for veterinarians on AMR were organized by Indian Veterinary Association, Kerala in Trivandrum and Thrissur Districts



ReAct Asia Pacific workshop at Ernakulam on Biosecurity and Antibiotic uses in Poultry Industry

4. Training program for Govt. Veterinarians from other states and sharing of Kerala model on AMR action plans and phasing out use of Growth promotants in Animal Husbandry, facilitated by CSE New Delhi was held at Thiruvanthapuram on 10-06-19 and 11-16-19, there was participation from 9 different states.



**Kerala model on AMR action plans for Animal Husbandry facilitated by
CSE New Delhi**

b) Disease control programs

The department of animal husbandry had two major diseases control programs viz. ADCP and ASCAD for control of major diseases in Animals and Poultry. Better Animal Health Management is very important as 'Healthy Animals and Birds, just like Healthy Humans do not require any antibiotic'.

World Antibiotic Awareness Week-2019

Based on instructions from Director Animal Husbandry the programs associated with WAAV 2019 was conducted in various districts to increase awareness among Veterinarians, Farmers and General Public. Programs were also held by District Animal Husbandry Officers in Ernakulam and Idukki Districts.



**Awareness program to School Students during WAAV,
Dr. Eapen John Asst. Director AHD**



**WAAV AMR awareness to Livestock Inspectors at LMTC,
Dr .C K Shaju, Dy .Director AHD**



WAAV AMR awareness at LMTC



WAAV AMR awareness poster for farmers & public;
Dr Leena Paul, Veterinary Surgeon AHD

7. AMR Surveillance network for Non-Human Sector for Kerala (KARSFi-Vet)

An initial meeting of the working group for creating an AMR surveillance network for foods and environment sector held on 03-12-19 at SLMAP, Ernakulam. The scientists from laboratories of KVASU and KUFOS representing Foods, Animal Health and Fisheries were present. The training is now being arranged by SLMAP with help of State AMR nodal office at Govt. Medical College, Trivandrum on WHO-NET as part of the network initiation.

8. Other programs

- a. Director, AHD attended the FAO/ICAR-USAID workshop on operationalization of Animal Health Component of National Action Plan on AMR at Kolkotta from 25-27 April 2019
- b. World Organization for Animal Health (OIE) conducted performance assessment of Veterinary Services of AHD Kerala including its AMR work.
- c. The stakeholder's workshop for developing AMR action plan for Delhi on 26 & 27-08-2019, The Kerala experience was shared on invitation from DHS, Govt. of Delhi.
- d. Dr. Robin Paul attended annual conference of NAMSCON-2019 at AIIMS Bhopal on 11-10-2019 and delivered a lecture on AMR in Animal Husbandry the missing one health link.

Kochi Declaration on 'One Health' Action on Antibiotic Resistance

We represent the various prescribers of antibiotics in the state of Kerala, India; and we have assembled on the second day of September of the year Two Thousand and Nineteen at Kochi to affirm the following:

- 1 We understand the threat of antibiotic resistance to human & animal health and food security; and we realize that inappropriate use of antibiotics constitutes one of the main drivers of the problem.
- 2 We commit to inform all the prescribers about antibiotic resistance and the need for rationalizing antibiotic use; and we will work

- towards improving the prescribing competence among our members.
- 3 We will strive to ensure that all human and animal healthcare facilities follow standard treatment guidelines; and have norms for infection prevention and antibiotic stewardship.
 - 4 We have decided to take efforts to reduce the use of those antibiotics classified as Watch and Reserve for human use, as per the AWaRe classification in the Essential Medicines List published by World Health Organization.
 - 5 We commit to phase out the use of Highest Priority Critically Important Antibiotics for Human Health from agriculture and farms; and appreciate the gazette notification issued by the Government of India banning the use of Colistin in agriculture.
 - 6 We realize the need to work together as antibiotic resistance is a complex issue with multi-sectorial causes; and for this we need to locally complement the efforts made by the Tripartite agencies at the global level.
 - 7 We call upon the government to improve the capacity of regulatory agencies to ensure that antibiotics are not available to the end users, without advice from licensed prescribers.
 - 8- We are committed to the welfare of farmers and will strive to find ways by which they can shift to safer use of medicines, such as antibiotics, without affecting their livelihoods.

By the Kerala Presidents of Indian Medical Association, Indian Dental Association, Indian Veterinary Association in the august presence of Hon. Minister of Animal Husbandry Kerala, Vice Chancellor of Kerala Veterinary & Animal Sciences University, Technical Officer of World Health Organization and Director Animal Husbandry. Facilitated by Indian Veterinary Association Kerala and ReAct Asia Pacific

AMR SURVEILLANCE PROGRAM : GH Ernakulam -A regional Centre to coordinate AMR action plan

Health service dept is running an effective antibiotic stewardship program, Sepsis Management Project, at General Hospital Ernakulam for the last 3 yrs. Project played crucial role in early diagnosis & management of sepsis, rational antibiotic therapy, AMR surveillance of the institution.

Project has produced good outcome as General hospital Ernakulam developed antibiogram, antibiotic policy. The automated blood culture method has helped the institution in identifying the organism involved in bacterial infection early and giving correct antibiotics resulting in reduction of mortality, duration of hospital stay.

Sepsis management project (PPP model with BD India) extended to 3 more years, and expand to near by 6 hospitals as Hub & spoke model (**GH Muvatupuzha, DH Aluva, TH Thripunithura, TH Karuvellipady, TH Perumbavoor, W&C Mattancherry**) in Ernakulam dist for better results in infection prevention control, rational antibiotic therapy. Health service dept is playing a crucial role in AMR surveillance program of the state, GH Ernakulam as the regional centre contributing a large extent to this program. Sepsis management project, PPP and hub & spoke Model (an antibiotic stewardship program) is the ongoing program at GH Ernakulam contributing mainly to AMR surveillance of the institution.

Sepsis management project is the first antibiotic stewardship program as public private partnership (PPP) and Hub & spoke model in India.

General hospital Ernakulam ; A regional centre to coordinate AMR surveillance program in health service dept

Strategic priority 1 Awareness and understanding

Improve awareness and understanding of AMR through effective communication, education, training.

- 1) As the part of sepsis management project (World Antibiotic Awareness week, Nov 12-19, 2017 & 2018) various training

program, awareness classes conducted at GH Ernakulam on Infection prevention control, rational antibiotic therapy , optimal utilization of lab in clinical practices to doctors, house surgeons, staff nurses, lab technicians, other staff. Training program to all categories of staff done periodically .

- 2) state level training on AMR surveillance program for health service dept done on march 8 th,2019 at GH Ernakulam.
- 3) General hospital Ernakulam initiated a program with the support from inner wheel club of greater cochin " sanjeevani" a Hand hygiene campaign for one year and all staff including doctors, house surgeons, staff nurses, nursing assistant in maternity ward, labour room, gynaec ward, SNCU, pediatric ward may give training on hand washing in a sustainable manner & not only staff ,but the mothers in the respective units also may train in hand hygiene so that around 3000 mothers (250 delivery per month) may be given awareness on hand washing, which eventually reaches community also.

Strategic priority 2: Knowledge and Evidence

Aim: Strengthen knowledge and evidence for containment of AMR through surveillance

Focus area: Laboratories & surveillance

Objective: Strengthening of microbiology laboratories to detect antimicrobial resistance

- I. General Hospital Ernakulam & State public health lab as two regional centres for AMR surveillance in district/ general hospitals .
- II. AMR surveillance to be initiated at all levels for 6 pathogens (E coli, Klebsiella spp, Acinetobacter spp, Pseudomonas aeruginosa, Staphylococcus aureus, and Enterococcus spp) in 4 samples- blood, urine, pus/exudate, respiratory specimens ,
- III. Microbiology lab at GH, Ernakulam receiving 30-35 culture sample

per day (**6 to 8 blood culture sample per day with positivity around 10%**) and around 200-250 culture positive per month (blood, urine, pus, sputum, etc). Every month consolidated data send from Micro dept of GH Ernakulam (Regional centre) to the nodal centre (Micro Dept Govt Medical college TVM) through WHO NET for the last one year .

- IV. Dr Arya RV ,Clinical microbiologist ,coordinating the AMR surveillance through WHONET.
- V. GH Ernakulam is the only general hospital to initiate AMR surveillance through WHONET.

Report on sepsis management project :Every month Dr Sivaprasad PS ,Nodal Officer may collect the data with the help of Microbiology dept, MRD dept and submit to Superintendent and send to DHS , ADHS medical , through DMO (mail). 3yrs consolidated report on sepsis management project submitted to DHS and GOVT .

Strategic priority3

Infection prevention control

Aim: Reduce the incidence of infection through effective infection prevention and control (IPC)

Focus area: Infection Prevention and Control in human health

Health service dept is running an effective antibiotic stewardship program, Sepsis Management Project, at General Hospital Ernakulam for the last 3 yrs.

Impact Of The Program

- I. Sepsis management project played crucial role in early diagnosis & management of sepsis , rational antibiotic therapy and antibiotic stewardship program, AMR surveillance of General Hospital Ernakulam.
- II. Duration of stay at SNCU for presumed and probable neonatal sepsis reduced from 7.2 days to 5.4 days, (reduction of 44 hrs) result in reduction of antibiotics use, rational antibiotic therapy, less hospital stay for newborns for the hospital .

- III. Project helped the clinicians to build up the confidence to deescalate from higher antibiotics to lower one according to culture report, (one of the most important step in antibiotics stewardship program) and choose correct antibiotics according to culture report .
- IV. General Hospital Ernakulam won the first Kayakalp award (award for clean hospital initiative, infection prevention control) in the state. Sepsis management project contributed to the quality initiative and Dr Arya RV, Clinical Microbiologist , SMP was the nodal officer of Kayakalp
- V. Program also played an important role in NABH activities, like infection control, making antibiotic policy, antibiotic prescription audit and clinical audit. Clinical audit conducted in connection with the project was the only clinical audit accepted by the NABH team during their reaccreditation visit to General Hospital, Ernakulam .
- VI. Formulated the antibiotic policy of the institution after discussing with all departments ,submitted and implemented.
- VII. Isolated and identified the Colistin resistant *Klebsillaepneumoniae* from the blood culture of 63 yrs old patient with chronic kidney disease
stage 5 , severe sepsis and confirmed the colistin resistance by microbroth dilution test(gold standard test) from Govt medical college
Trivandrum and Rajeev Gandhi Centre for Biotechnology, Trivandrum.
- VIII. RGCB isolated the mgr B gene responsible for Colistin resistance from the isolate send from the general hospital Ernakulam, (Colistin resistance confirmed by gene analysis) first in health service dept probably in the state also .
- IX. First international article with respect to AMR surveillance program (KARSAP) from GH Ernakulam, “full genomic sequence of colistin resistant *klebsiella*” in association with RGCB .

- X. Antibiotic prescription audit conducted as a part of the project to know the prescription pattern, adherence to the policy ,antibiotics written in generic name, use of microbiology lab in clinical practices
- XI. Clinical Microbiologist post created at GH Ernakulam as the good out come from the project (C4-7364/2015 sepsis management project > C5-3856/2015 > MH 3 -52311 > F1-172 /17 Health – GO(MS) 215/2018 dated 24-11-2018)
- XII. A committee formulated under the leadership of Superintendent to monitor the usage of high end antibiotics like Colistin .
- XIII. Training and awareness on infection prevention control, rational antibiotic therapy , optimal utilization of lab in clinical practices were done to clinicians periodically.

Strategic priority 4

Optimizing use of antibiotics

Focus area: Hospitals and healthcare institutions

Objective: Optimize the use of antimicrobials in hospitals and healthcare institutions

- 1) Formulated ,implemented , audited the antibiotic policy at GH Ernakulam .
- 2) Antibiotic prescription audit conducted at GH Ernakulam to know the adherence to the policy and KAP (Knowledge,awareness,practice) survey among doctors, housesurgeons
- 3) Antibiotic prescription audit conducted in the 6 hospitals at Ernakulam as the part of the Sepsis Management project .(Muvatupuzha,DHALuva, TH Thripunithura,THKaruvellipady, TH Perumbavoor, W&C Mattanchery)
- 4) A committee formulated at GH Ernakulam to monitor high end antibiotics usage in the institution .

Strategic Priority 5: Research & innovation

Aim: Promote research and innovations for AMR containment

Focus area: Research on AMR

Objective: To compile the research activities on AMR in Kerala

AMR RESEARCH – GH INITIATIVE

➤ RESEARCH WORK ON CRE

- *"A prospective observational study comparing clinical and microbiological parameters of carbapenem sensitive, resistant enterobacteriaceae infections in a tertiary care centre in kerala " (3 YRS RESEARCH WORK)*

one year report submitted to DHS

➤ CLINICAL AUDIT IN SNCU on antibiotic usage

➤ MULTICENTRIC STUDY ON CRE , COLISTIN RESISTANCE WITH ASTER, AIIMS COCHIN (first multicentric research in the state in AMR) On going research program ...

Genome sequence of a multidrug resistant Klebsiella pneumoniae ST78 with high colistin resistance isolated from a patient",

first research paper on antibiotic resistance from health service dept (GENERAL HOSPITAL ERNAKULAM) published in an international journal , Journal of Global Antimicrobial Resistance - JGAR.

Whole process started around one year back ,(MAY 2018) when the microbiology lab of GH Ernakulam identified and isolated the multidrug resistant Klebsiella pneumoniae from the blood culture sample of 63 yrs old female patient with CKD stage 5, sepsis. The isolate was colistin resistant .

The isolate send to RGCB,Trivandrum &Govt Medical college Trivandrum Microbiology Dept for Microbroth dilution test (gold standard test), both institutions identified the isolate as Colistin resistant . mgr B gene responsible for Colistin resistance identified in the isolate from RGCB ,Trivandrum (AUG 2018).RGCB conducted the Whole genome sequence of the isolate from national centre for cell science Pune , research paper submitted to JGAR on MAR 2019 , and was accepted on (APRIL 2019) and available online from 18th APRIL,2019 .

This is the first research paper on antibiotic resistance from heath dept ,in connection with KARSAP ,AMR surveillance program , accepted in an international journal .

Strategic priority 6- collaborations

Aim: Partnership with private sector and civil society organizations for AMR containment

Focus area: Public private partnership Objective:Co-opting private hospitals into the AMR programme

- A. Co-opting private hospitals in to AMR program including research work. Multicentric research work on CRE , colistin resistance initiated between GH Ernakulam, aster, aims cochin (first multicentric research in the state in AMR).
- B. Hand hygiene campign for one year with inner wheel club of greater cochin
 - a. “An initiative from hospital to community level”sanjeevani program with inner wheel of greater cochin
- C. Health service dept is playing a crucial role in AMR surveillance program of the state , GH Ernakulam as the regional centre contributing a large extent to this program. Sepsis management project, PPP Model with BD india(an antibiotic stewardship program) is the ongoingpogram at GH Ernakulam contributing mainly to AMR surveillance of the institution.

Summary Of Karsap Activities Over Last Year

Activities of KARSAP in all the 6 strategic priorities are as follows:

Strategic Priority One

Awareness And Understanding Creation

1. During first year of KARSAP[2018 -2019], activities were focused on knowledge and awareness creation regarding need for surveillance platforms, infection prevention and control [IPC] and antimicrobial stewardship[ASP]. These activities done under one health approach and included activities in human side, animal husbandry, aquaculture and fisheries, dairy and environment.
2. Awareness creation in human side was co- ordinated by antibiotic stewardship committees in all tertiary care centers, Professional organizations, Civil society organizations and NGOs.
3. A free mobile App, ID Consult was launched by a group of ID physicians and Microbiologists in the state for knowledge and awareness creation in health care workers regarding antibiotic stewardship and IPC.
4. Classes on IPC and antibiotic stewardship have been included in MBBS curriculum right from foundation course of first year onwards.
5. All interns, post-graduates and faculty members are given periodic training in IPC and ASP.
6. To optimize prescription of antibiotics ASP modules in App format are being developed by Kerala Development and Innovation strategic council [K-DISC].
7. World antibiotic awareness week is observed in all hospitals in the state from Nov 18 to 24.
8. Focus in 2020-2021 is public engagement and awareness creation among public with regard to AMR and rational use of antibiotics. The activities for public engagement started from 2019 world antibiotic awareness week onwards. Aim is to make Kerala an antibiotic literate /Aware state in 2021.
9. In animal husbandry, fisheries and dairy sector, regular awareness

campaigns were organized to educate the farmers regarding the harmful effects of using antibiotics as growth promoters and for prophylaxis. Farms are being monitored through geo-tagging.

10. Antibiotic residue free chicken was introduced by a Govt of kerala self-help group, under the label ' Kerala Chicken'.
11. Under the state drugs controller, regular awareness classes are organized for Pharmacists and public regarding over the counter sale of antibiotics, disposal of unused and expired antibiotics

Strategic priority 2

Knowledge and evidence

Strengthening laboratory capacity for AMR surveillance and collating the data on AMR is essential for assessing baseline AMR burden and providing evidence based information for action. Kerala initiated the AMR surveillance programme in human health at the Government teaching hospitals and tertiary care private hospitals.

- Kerala antimicrobial resistance surveillance network (KARSNET) was established. KARSNET is a network of 27 microbiology laboratories in the state [10 from Government sector and 17 from Private sector].
- All Microbiology laboratories in the state were strengthened.
- AMR surveillance in animal husbandry and fisheries are being done through accredited laboratories across the state.
- Grid for environmental surveillance has been prepared.
- Antibiotic residue checking in food, meat, milk etc are being done.

Strategic Priority 3

Infection Prevention And Control [ipc]

1. Infection prevention control activities were strengthened in all hospitals of the State.
2. Intensive training was given to healthcare workers in the state with regard to IPC. These trained personnel were in the fore front of the State's fight

- against Nipah.
3. In order to maximise the existing resources, link nurse system was established in all Medical colleges to supplement function of infection control officers.
 4. Small group learning sessions were introduced in all hospitals to augment the existing training sessions.
 5. Health care associated [HCAI] rates are calculated in all hospitals.
 6. Measures were taken to ensure good IPC measures in farms to reduce antibiotic residues in environment. This was done in animal husbandry and aquaculture.
 7. Kerala state pollution control board has recommended strict adherence to good farm management practices and adherence to biosecurity guidelines.

Karsap Strategic Priority Four

Optimise the use of antibiotics

1. Antimicrobial stewardship committees have been set up in all hospitals.
2. Antibiotic utilization metrics are calculated to assess the proportion of WHO Access, Watch and Reserve antibiotics.
3. Link for WHO MOOC on AMR was provided to all doctors and students.
4. Regular sensitization programmes on ASP are given to all categories of health care workers.
5. ASP modules and digital antibiotic policies are being prepared with the help of K-DISC.
6. World Antibiotic Awareness Week [nov 18-24] is observed in all health care institutions in the state.
7. State has set a goal of achieving the WHO target of having 60% of antibiotics utilization in the state to be from Access category by 2023. A road map to achieve the same for the state is being prepared. The integral components of the road map are
 - A. To create an AWARE INDEX for the state.
 - B. AMS metrics with regard to the proportion of antibiotic utilization

- from Access, Watch and Reserve categories to be calculated in all hospitals. This will be collated and will represent the state AMS metrics.
- C. AWaRe Grid for state to be calculated by State Drugs controller from antibiotic purchase/sales data in the state.
 - D. An App is being created to enable OPD prescription of antibiotics from Access category. In OPD more than 95% prescription has to be from Access category
 - E. State aims to cut down the OPD prescription of antibiotics by 50% by 2021.

Strategic Priority Five

Research

Research partner for co-ordination of all research activities under KARSAP is RGCB.

Research on AMR is being done in

- A. Animal Husbandry.
- B. Fisheries and aquaculture.
- C. Environmental studies.
- D. Human side.

Major publications in all these fields from different institutions have been compiled into a single document which will be representative of “one health” research from the state. This document will be published soon.

Strategic Priority Six

Public-private Partnership, ngos

1. State has partnered with Centre for science and environment, for creating grids for monitoring and surveillance in animal husbandry, fisheries and environment. Two workshops were conducted by CSE and a monitoring frame work was created.
2. REACT Asia Pacific is an NGO active in Kerala with regard to all strategic priorities in KARSAP . Videos made by REACT were used during world Antibiotic awareness Week for public awareness creation.

3. A group of Infectious disease specialists and microbiologists in Kerala have created a free mobile App to aid in antibiotic stewardship and infection prevention and control activities. The academic content was validated and this App was widely circulated among doctors and students in Kerala.

Road Map To Make Kerala An Antibiotic Literate/aware State By 2021.

KARSAP can become a success only by public engagement and awareness. In order to achieve this , state has formulated an action plan to make Kerala Antibiotic Literate/Aware by 2021. This will be done with the help of local self government agencies and Aardram mission.

ANNEXURES

The State Team

1	Principal Secretary, Health & Family Welfare Department
2	Director of Health Services, Thiruvananthapuram
3	Director of Medical Education, Thiruvananthapuram
4	Director, Indian Systems of Medicine, Thiruvananthapuram
5	Director of Homeoeopathy, Thiruvananthapuram
6	Director, Animal Husbandry Department, Thiruvananthapuram
7	Director, Fisheries Department, Thiruvananthapuram
8	Director, State Public Health Laboratory, Thiruvananthapuram
9	Commissioner of Food Safety, Thiruvananthapuram
10	Chairman, Kerala State Pollution Control Board, Thiruvananthapuram
11	Registrar, Kerala Veterinary and Animal Sciences University (KVASU)
12	Registrar, Kerala University of Fisheries and Ocean Studies (KUFOS)
13	Dr. Sharada Devi, Professor and Head of Department, Microbiology, Government Medical College, Thiruvananthapuram - Convenor
14	Nominee of the Indian Medical Association, Thiruvananthapuram
15	Nominee of the Department of Science and Technology
16	Nominee of Director, Rajiv Gandhi Center for Biotechnology, Thiruvananthapuram

17	Dr.A.V.Jai,akrishnan, Former President, Indian Medical Association, Kerala
18	Dr.Sohan Lal Microbiologist, MIMS Hospital, Kozhikode
19	Dr.Sanjeev K Singh. Medical Superintendent, Head (Infection Control and Quality & Standards), Amritha Institute of Medical Sciences, Kochi, Kerala

ANNEXURE - 1

Monitoring and Evaluation framework of KARSAP

Priority indicators	Input (basic resources)	Process (activities)	Outputs (results at programme level)	Outcomes (results at population level)
1. Awareness and Understanding	IEC materials for relevant groups (public, farmers, professionals in health, agriculture and environment sectors) developed	AMR awareness campaign organized Awareness activities for media at State, District and sub-district level AMR module developed for CME/CPD for relevant professional groups	Number of print articles covering AMR Inclusion of AMR in curricula of professional Universities [KUHS, KVASU] Inclusion of AMR in curricula at school and college level	AMR awareness levels in target populations, e.g. % of population who know that it is inappropriate to use antibiotics for common cold or viral infections Knowledge, attitudes and practices of health workers and vets on AMR and its implications for antimicrobial use and misuse (via standard online survey)
2. Knowledge and Evidence	State Coordinating Centre for AMR surveillance established with clear terms of reference Operational plan developed for AMR surveillance	Number of hospitals - /laboratories participating in quality assurance programme SOPs established for AMR surveillance in animals, aquaculture and environment AMR data received from all sectors	Surveillance system for AMR in animals, food and environment established Report on AMR (humans, animals/food/aquaculture and environment) and AMR residues in food and environment	Reduced levels and trends of resistance in <i>E. coli</i> , <i>Klebsiella</i> spp., <i>Pseudomonas aeruginosa</i> , <i>Acinetobacter</i> spp., MRSA and <i>Enterococcus</i> spp.

Priority indicators	Input (basic resources)	Process (activities)	Outputs (results at programme level)	Outcomes (results at population level)
4. Optimising Use of Antibiotics	State nodal institution identified for antimicrobial stewardship	Treatment guidelines reviewed and updated considering patterns of resistance and use Monitoring antimicrobial use (AMU)/consumption at facility level Legislation approved, banning sales of antibiotics incorporated in animal food Vets involved in drug control in the state Methodology developed for calculating antimicrobial use at state level	Numbers of hospitals with updated AB guidelines based on local AMR pattern Percentage of tertiary care hospitals with AB stewardship programme Percentage of medical colleges/hospitals with AB stewardship programme Implementation of ban/restrictions on antibiotic premixed food in animal husbandry and aquaculture	Total consumption of antibiotics monitored (state level) % of antibiotics tested by State Drug Controller with acceptable quality
5. Research and Innovations	-	State AMR research agenda established Collaboration between Rajiv Gandhi Centre and stakeholders for AMR research	Financing sources for KARSAP identified Monitoring indicators at state level (% major hospitals and labs reporting to government)	Proportion of KARSAP activities (1) With identified funds (2) Adequately funded and implemented
6. Collaborations	State AMR monitoring cell established	State AMR monitoring cell functional Number of AMR projects under PPP	State AMR forum established and functional	Data/information from KARSAP to be reported to State and Central Government**

** Responsibility for assimilating data and reporting on M&E indicators shall sit with State AMR Coordinating Institution (GMCT); data and information will be collated and shared by GMCT with State Government and Central Government (NCDC and MoHFW).

ANNEXURE – 2

KARSAP - LIST OF MEETINGS CONDUCTED

	24 th – 25 th August 2017	National Consultation to operationalise action plan for AMR containment – New Delhi
2.	11.10.2017	Review meeting on AMR by Hon'ble Chief Minister
3.	17.10.2017	Kerala State Workshop on AMR at SHSRC
4.	13 th – 19 th November 2017	World Antibiotic awareness week
5.	15.12.2017	Review meeting in Medical College – Report on AMR awareness / Training activities in Kerala during the World Antibiotic awareness week, Governance mechanisms for AMR in Kerala finalize KARSAP.
6.	04.01.2018	RGCB – Research partner – Workshop
7.	22 nd – 24 th January 2018	Implementation of National action plan on AMR at CSE's Anil Agarwal Environmental Training Institute – Tijara, Rajasthan
8.	18.04.2018	Workshop on role of Non Governmental Stake holders for AMR containment in Kerala – SSB Seminar Hall
9.	10.07.2018	SHSRC – IPC activation reviewed
10.	27.09.2018	Workshop on Integrated Surveillance for AMR for Kerala – CSE & KSPCB, Ernakulam
11	28.09.2018	Workshop on waste water treatment to combat AMR – KSPCB, Ernakulam
12	25.10.2018	Launch of KARSAP
13	21.02.2019	Meeting of KARS-NET involving the private sector
14	06.05.2019	Strengthening of KARS-NET involving both Govt & private
15	10-11.06.2019	National Workshop on development & implantation of SAP on AMR- CSE & H & Fw Kerala
16	17- 19. 09.2019	WHONET training workshop at Amrita Kochi

Annexure - 3

Hai Surveillance Definitions For Rate Calculation Followed In All The Reporting Units

Types of HAI surveillance definitions (Based on definitions given by WHO)

1. Ventilator Associated Pneumonia (vap)
Ventilator-associated pneumonia is defined as pneumonia occurring more than 48 hours after patients have been intubated and received mechanical ventilation or within 48 hours after extubation.
2. Surgical Site Infection (ssi)
A surgical site infection is an infection that occurs after surgery in the part of the body where the surgery took place. Any infection at the site of surgery that occurs within one month of surgery/ within 90 days if a device is implanted, like Sternal wire or prosthetic valve is taken as SSI.
3. Catheter Associated Uti (ca-uti)
UTI that occurs in a patient who had an indwelling urinary catheter and symptoms appearing 48 hours after insertion of catheter or within 48 hours after removal of catheter.
4. Central Line Associated Bloodstream Infection (clab-si)
A central line-associated bloodstream infection (CLABSI) is a serious infection that occurs when microbes (usually bacteria or candida) enter the bloodstream through the central line appearing 48 hours after insertion, or within 48 hours after removal of central line. The differential time to positivity should be 2 hours [Time taken for growth to appear in central line culture minus peripheral line culture].

Data collection

Data of infection and surveillance rates should be collected by ICN through link nurses and should include only actual HAI as defined by Center for Disease Control and Prevention (CDC).

NB: Device days are the number of days the device has been used for patients in a unit (theatre, ward and icu) in one month.

Calculation of HAI rate

Rates of infection have been calculated, as follows:

$$\text{Rate} = (\text{No. of infections} / \text{No. of device days}) \times 1000 \text{ for VAP, CAUTI \& CLABSI}$$
$$\text{Rate} = (\text{No. of infections} / \text{No. of surgeries}) \times 100 \text{ for SSI rate}$$

Rates of infection should be calculated based on the output of devices days generated from the EMR or manual data entry done by the link nurses in each ward/ICU/OT.

Rates can be compared across similar facilities all over the world and within the same hospital between different units/ICUs. Rates help to set a goal for infection control, help to understand the reason for any increase and evaluate control measures. Any sudden increase in device days or infection rates is to be viewed with concern and the effort should always be to reduce both rates of infection and device days. If outcome surveillance data points to increased HAI rates in any particular ICU, then PROCESS surveillance should be initiated to identify the breach in bundle care practices. As part of process surveillance, bundle compliance rates with respect to each component of the bundle should be calculated, the breach identified and rectification measures should be taken.

Annexure - 4
Ipc Monitoring Grid

Monthly infection control team meeting

	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
YES												
NO												

Three monthly hicc meeting

	1 quarter	2 quarter	3 quarter	4 quarter
yes				
no				

Monthly ipc monitoring rounds

	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
YES												
NO												

Annexure - 5**Grid used to monitor the progress of KARSAP****Human****Awareness & Understanding****%of students & facult trained in Antibiotic Stewardship**

	2018 Quarter/4	2019 Quarter/1	2019 Quarter/2	2019 Quarter/3
Undergraduate students				
Post graduate students				
Faculty members				

%of students & Facult members who have completed W O AMR MOOC

	2018 Quarter/4	2019 Quarter/1	2019 Quarter/2	2019 Quarter/3
Undergraduate students				
Post graduate students				
Faculty members				

Antimicrobial stewardship: a competency based approach is a free AMR MOOC conducted by WHO.

Number of classes on AMR conducted for the public in the Hospital.

2018 Quarter/4	2019 Quarter/1	2019 Quarter/2	2019 Quarter/3

State Drugs Controller

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of ACCESS antibiotics sold in State				
% of WATCH Antibiotics sold in State				
% of Restricted (RESERVE) antibiotics sold in State				

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
Number of training sessions given to Retail Pharmacists in State				

Knowledge & Evidence For Dhs**% of hospitals under DHS with a Microbiologist**

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of hospitals under DHS with a Microbiologist				

% of hospitals having a functional Infection Control Committee

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of hospitals having an functional Infection Control Committee				

% of hospitals having an ASP committee

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of hospitals having an ASP committee				

% of hospitals conducting HICC meeting

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of hospitals conducting HICC meeting				

% of hospitals having an institutional Antibiotic policy

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of hospitals having an institutional Antibiotic policy				

% of hospitals with an institutional infection control policy

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of hospitals with an institutional infection control policy				

% of doctors trained in ASP

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of doctors trained in ASP				

. % of Doctors trained in IPC

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of doctors trained in IPC				

. % of Nurses trained in IPC

	2018Quarter/4	2019Quarter/1	2019Quarter/2	2019Quarter/3
% of nurses trained in IPC				
% of hospitals which observed World Antibiotic Awareness week				
	2018Quarter/4	2019Quarter/1	2019Quarter/2	2019Quarter/3
% of hospitals which observed World Antibiotic Awareness week				

% of Hospitals which observed World Hand Hygiene Day.

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
% of Hospitals which observed World Hand Hygiene Day.				

Knowledge & Evidence**Ipc**

Total No. of Infection control Nurses

Total No. of Link Nurses

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
Total No. of classes on IPC				

Hand Hygeine Compliance %

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
ICU				
IPD				
OPD				

WHO Surgical safety check list implemented Yes ☐ No ☐

Are you using hair clipping or shaving prior to Surgery?

% of patients who receive Surgical Antimicrobial prophylaxis within one hour of skin incision?

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3

% of patients who receive more than 1 dose of Antibiotic used for surgical Antimicrobial prophylaxis?

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3

Vap Rate

ICU	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
MICU												
SICU												
ORTHO												
NSICU												
CTVS												
Trauma ICU												

% of compliance with HCAI prevention Bundles in ICU

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
VAP Bundle				
CLABSI Bundle				
CA-UTI Bundle				
SSI Bundle				

CLABSI Rate

ICU	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
MICU												
SICU												
ORTHO												
NSICU												
CTVS												
Trauma ICU												
MD ICU												

CA-UTI Rate

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
MICU												

SSI Rate

ICU	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec

Drug Utilization Metrics

% of access Antibiotic used

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
ICU				
IPD				
OPD				

% of reserve Antibiotics used

	2018Quarter/ 4	2019Quarter/1	2019Quarter/ 2	2019Quarte r/3
ICU				
IPD				
OPD				

Aim of who is to have 60% of total antibiotic utilization from access category by 2023. in order to achieve this target, more 90% of antibiotics used in opd should be from access category.

Do you have a Hospital Policy with regard to formulary restriction / prospective Audit and feed back of use of WHO reserve Antibiotics? ☐ ☐

KEY PERFORMANCE INDICATORS of AMR Surveillance program at district level NO: 1	OPD Prescription audit with respect to antibiotics usage & Number of units antibiotics consumed per patient in OPD in a month in hospitals	INSTITUTION	Number of hospitals in the district initiated prescription audit with respect to antibiotics in OPD	Number of units antibiotics consumed per patient in OPD in a month in hospitals (example Amoxicillin , amoxicillin +clavulanic acid , azithromycin , cefixime like)
		PHC		
		FHC		
		CHC		
		TALUK Hospitals		
		DISTRICT HOSPITALS		
		GENERAL HOSPITALS		
		MEDICAL COLLEGE		
NO : 2	Number of hospitals initiated AMR surveillance ,(KARS-NET –WHO NET) in the district	MEDICAL COLLEGE		
		GENERAL/DISTRICT HOSPITAL		
		PUBLIC HEALTH LAB		

		PRIVATE MEDICAL COLLEGE /HOSPITAL/LAB																																			
NO :3	Number hospitals formulated and implemented functional HICC in the district	<table border="1"> <tr><td>PHC</td><td colspan="3"></td></tr> <tr><td>FHC</td><td colspan="3"></td></tr> <tr><td>CHC</td><td colspan="3"></td></tr> <tr><td>TALUK HOSPITALS</td><td colspan="3"></td></tr> <tr><td>DISTRICT HOSPITALS</td><td colspan="3"></td></tr> <tr><td>GENERAL HOSPITALS</td><td colspan="3"></td></tr> <tr><td>MEDICAL COLLEGE</td><td colspan="3"></td></tr> <tr><td>PRIVATE MEDICAL COLLEGE/HOSPITAL</td><td colspan="3"></td></tr> </table>	PHC				FHC				CHC				TALUK HOSPITALS				DISTRICT HOSPITALS				GENERAL HOSPITALS				MEDICAL COLLEGE				PRIVATE MEDICAL COLLEGE/HOSPITAL						
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DISTRICT HOSPITALS																																					
GENERAL HOSPITALS																																					
MEDICAL COLLEGE																																					
PRIVATE MEDICAL COLLEGE/HOSPITAL																																					
NO :4	Number of hospitals conducted <i>HAND HYGIENE CAMPAIGN</i> in the district	<table border="1"> <tr><td>PHC</td><td colspan="3"></td></tr> <tr><td>FHC</td><td colspan="3"></td></tr> <tr><td>CHC</td><td colspan="3"></td></tr> <tr><td>TALUK HOSPITALS</td><td colspan="3"></td></tr> <tr><td>DISTRICT HOSPITALS</td><td colspan="3"></td></tr> <tr><td>GENERAL HOSPITALS</td><td colspan="3"></td></tr> <tr><td>MEDICAL COLLEGE</td><td colspan="3"></td></tr> <tr><td>PRIVATE MEDICAL COLLEGE/HOSPITALS</td><td colspan="3"></td></tr> </table>	PHC				FHC				CHC				TALUK HOSPITALS				DISTRICT HOSPITALS				GENERAL HOSPITALS				MEDICAL COLLEGE				PRIVATE MEDICAL COLLEGE/HOSPITALS						
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DISTRICT HOSPITALS																																					
GENERAL HOSPITALS																																					
MEDICAL COLLEGE																																					
PRIVATE MEDICAL COLLEGE/HOSPITALS																																					
NO : 5	Number of districts initiated an integrated veterinary surveillance program with respect to AMR (meat, milk, poultry)																																				
NO:6	Number of hospitals formulated and implemented	<table border="1"> <tr><td>PHC</td><td></td><td></td></tr> <tr><td>CHC</td><td></td><td></td></tr> </table>	PHC			CHC																															
PHC																																					
CHC																																					

	Antibiotic policy in the district & percentage of adherence to the policy	FHC			
		TALUK HSOPITALS			
		DISTRICT HOSPITALS			
		GENERAL HOSPITALS			
		MEDICAL COLLEGE			
		PRIVATE MEDICAL COLLEGE/HOSPITAL			
NO: 7	Number of awareness program on AMR conducted by hospitals in the districts	PHC			
		CHC			
		FHC			
		TALUK HOSPITALS			
		DISTRICT HOSPITALS			
		GENERAL HOSPITALS			
		MEDICAL COLLEGE			
		PRIVATE MEDICAL COLLEGE/HOSPITAL			
NO :8	Number of districts initiated survey on prescription practice with respect to antimicrobial among veterinary doctors				
NO :9		DME- GOVT MEDICAL	NATIONAL	INTERNATIONAL	

	Number of research paper published with respect to AMR in national/ international journal	COLLEGE		
		DHS - GENERAL/DISTRICT HOSPITAL/PUBLIC HEALTH LAB		
		PRIVATE MEDICAL COLLEGE/HOSPITALS/LAB		
		VETERINARY DEPT		
		AGRICULTURE DEPT		
		FISHERIES DEPT		

Annexure - 6

Recommendations for State Action Plans on Antimicrobial Resistance

Table 1: Recommendations for human health sector

Table 1: Recommendations for human health sector

	Over-the-counter sale of antibiotics	Prescription practices	Infection prevention and control (IPC) in healthcare settings	Antimicrobial use and AMR surveillance
Policy/laws/regulations/standards	- Policy to display a list of schedule H1 drugs in all retail pharmacy outlets - Law to restrict/ban retail sale of oral formulations of linezolid, fosfomycin (CIA) and faropenem (HPCIA) - Revise list of schedule H1 drugs to include HPCIA's like colistin in view of AMR - Laws to ensure non-availability of substandard and pilferage drugs	- Develop Standard Prescription Guidelines - Policy for conducting prescription audits - Law to delink incentives associated with sale of antibiotics	- Policy an IPC policy in healthcare settings - Policy to accredit health care settings based on IPC - Develop standards for hand sanitizers - Develop a sanitation program	- Develop an AMR surveillance programme along with necessary policy frameworks, baseline guidance, assessments etc. - Policy for obtaining data from manufacturer/producer - Develop online system for drug traceability at state level and notify CDSCO's online tracking platform for regulating drug sales in the country
Implementation tools—Infrastructure/ capacity/ systems/ resources	- Strengthen enforcement of Schedule H1 - Conduct periodic random checks to ensure Schedule H1 compliance - Strengthen capacity of state drug control departments for better enforcement - Strengthen implementation of laws to ensure non-availability of substandard drugs	- Enable regular circulation of Standard Treatment Guidelines (STGs) to healthcare professionals in public and private sectors - Revise STGs to include guidelines on "when not-to-use antibiotics"	- Ensure compliance to IPC policies/guidelines in healthcare settings - Digitize IPC guidelines to enable greater access and readership - Enhance vaccination strategies for greater infection prevention	- Initiate an AMR surveillance network and implement surveillance - Initiate collaborations with private institutions to acquire community data - Establish/upgrade laboratories for AMR surveillance - Ensure generation of quality data from different labs across the country

	Over-the-counter sale of antibiotics	Prescription practices	Infection prevention and control (IPC) in healthcare settings	Antimicrobial use and AMR surveillance
Awareness and education/training	• Increase awareness on AMR and optimal use of antimicrobials • Revise pharmacy and medical education curricula regulation to include AMR	• Sensitize healthcare professionals on judicious use of antibiotics, AWaRe categorization of antimicrobials and other relevant resources • Revise pharmacy and medical education curricula w.r.t. judicious antibiotic use and antibiotic prescription practices • Provide orientation classes for medical students (2nd year) on prescription practices	• Increase awareness on IPC through hand-washing campaigns, Kayakalp initiative etc. • Involve professional organizations such as IMA, HSI, APIC for development of guideline/ certification courses/ classroom or practical courses on IPC • Conduct training programs for Link nurses on IPC • Revise pharmacy and medical curricula about IPC • Provide orientation classes for medical students (2nd year) on IPC	• Strengthen laboratory based competence and capacity w.r.t. AMR surveillance • Impart training on areas related to AMR surveillance such as WHO-NET etc.
Database generation/ collation/ dissemination		• Push for localized studies or research based projects aimed to generate data on antibiotic prescription practices • Collate data on antibiotic prescription practices, and make it publically available		• Collate AMR surveillance data from healthcare settings across surveillance networks and make it publically available

Table 2: Recommendations for food animals and crop sector

	Non-therapeutic antibiotic use and use of CIAs (for humans) in animals	Good animal husbandry practices	Surveillance of AMR, AMU and antibiotic residues in food	Infection prevention and control, biosecurity
Policy/laws/ regulations/ standards	- Develop a roadmap, based on ground realities, to phase out routine and non-therapeutic antibiotic use and use of CIAs in food-animal production - Phase out all HPCIA for non-therapeutic use in short term (0-1 year), CIA for non-therapeutic use in medium term (2-5 years) - Regulations/guidelines to restrict the use of antibiotics in feed or feed supplements - Labeling laws for antibiotics used in animal feeds and feed supplements - Law to enable veterinarians to enter, inspect and audit integrated/commercial farms <u>Alternatives</u> - Modify the Indian Veterinary Council Act to allow use of alternative therapies, disallow quack practices	Minimum standards of education for fisheries professionals	- Law to designate a separate Drugs Controller for veterinary drugs - Law to regulate online sale and pilferage of antibiotics for veterinary use - Law to ensure sale of veterinary antibiotics strictly on prescription	- Develop a disinfection policy for animal husbandry - Standards for inlet pond water and disinfection in aquaculture - Law for registration and licensing of all farms - Scheduled vaccination in animals to be made mandatory across all states

	Non-therapeutic antibiotic use and use of CIAs (for humans) in animals	Good animal husbandry practices	Surveillance of AMR, AMU and antibiotic residues in food	Infection prevention and control, biosecurity
Implementati on tools— Infrastructure/ capacity/ systems/ resources	- Run pilot/demonstration projects in few farms to implement farming practices with no antibiotic use, better farm and waste management - Encourage judicious use of antibiotics for therapeutic purposes strictly under veterinary supervision; no routine use of antibiotics in the absence of medical supervision should be allowed <u>Alternatives</u> - Gradually adopt use of alternative over antibiotics - Promote alternatives such as disinfectants, ethno-veterinary medicines as well as point-of-care diagnostics etc.	- Ensure stronger implementation of existing guidelines and policies such as Livestock Policy, Poultry Farm Manual. - De-link the influence of feed supplier/drug supplier on farmers - Develop and promote rating of farms based on compliance to good animal farming, antibiotic use and waste management practices - Incentivize farmers for compliance to good farming and waste management practices, no antibiotic use and adoption of alternatives - Certification of farms/hatcheries that raise food animals with judicious use of antibiotics or no antibiotic use - Increase number of veterinarians for improved farmer to veterinarian ratio - Improve farmers' awareness about good farming and waste management practices	- Increase capacity of drug regulators to ensure better regulatory compliance - Upgrade laboratories for AMR and antibiotic residue surveillance - Upgrade microbiology and analytical capacity in district-level laboratories for AMR and antibiotic residue surveillance - Strengthen implementation of laws to ensure non-availability of substandard and pirferage drugs	- Issuance of pond health cards to aquaculture farmers based on healthy water parameters in the farm - Strengthen vaccination programs - Ensure farmers' compliance to good farming practices, internal/external biosecurity and better waste management practices - Adopt better broodstock management practices in aquaculture - Strengthen existing vaccination programs - Promote the use of vaccines, antioxidants, immunostimulants (poultry sector), encourage clean milk production and vaccination against FMD (dairy sector), encourage use of SPF seed, bioflock technology (aquaculture sector) - Improve farmers' awareness about good farming and better waste management practices
Awareness and education/ training	- Improve farmers' awareness about farm health and impact of antibiotic misuse/use in animals - Ensure understanding of patho-physiology of the disease in animals before prescription - Improve farmers' awareness about availability and use of alternatives to antibiotics in food-animal production		- Improve farmers' awareness about biosecurity, IPC in farms, good farming and waste management practices - Modify veterinary curriculum to enable sector-specific training at post graduate level e.g. poultry, fishery, dairy, etc	
Database generation/ collation/ dissemination			Collate AMR, antibiotic residue and antibiotic use surveillance data and make it publically available	

Table 3: Recommendations for waste and environment sector

	Waste management from different sources	Environmental monitoring of AMR and antibiotic residues	Siting guidelines and biosecurity	Disposal of unused or expired drugs
Policy/laws/ regulations/ standards	- Set standards for antibiotic residues for waste/effluent from all point sources - Regulation to ban use of poultry litter in aquaculture	- Develop a plan for AMR surveillance in environment - Integrate environmental AMR surveillance plan with existing environmental monitoring programs such as National Water Monitoring Programme	Develop siting guidelines for all farms	- Regulation to prevent disposal of unused or expired antibiotics with solid waste - Guidelines on how to dispose expired or unused drugs in hospital settings
Implementati on tools— Infrastructure/ capacity/ systems/ resources	Design/upgrade Effluent Treatment Plants (ETP) with technology that addresses AMR determinants in effluent	- Consider all point and non-point sources for surveillance of AMR and antibiotic residues in environmental samples - Build microbiological and analytical capacity of State Pollution Control Board (SPCB) laboratories for AMR surveillance		- Initiate drug take-back initiatives for unused or expired drugs* - Association of drug manufacturing companies to take back expired drugs
Awareness and education/ training	Create awareness about environmental AMR			
Database generation/ collation/ dissemination				Mandate maintaining records of volume of antibiotics produced, sold and used, and make them publically available

* Kerala's ongoing drug-take back initiative - PROUD (Programme for Removal of Unused Drugs) could be referred and adopted by other states