

Kerala Strategic Action Plan for  
Antimicrobial Resistance  
Containment  
(DRAFT)

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## Background

Antimicrobial Resistance (AMR) is a global public health problem. 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 the inadequate treatment of effluents from healthcare facilities and farms etc also contribute to the problem of increasing AMR.

The Government of Kerala is committed to take suitable action to address antimicrobial resistance in the state by involving all stakeholders to develop and implement a State Action Plan on AMR, which will be in alignment with the National and Global Action Plan on Antimicrobial Resistance (NAP-AMR& GAP-AMR) for AMR containment. Inter-sectoral collaboration and a One Health Approach are crucial and hence integrated in the government's approach.

Creating awareness on AMR among cross sectoral stakeholders is important for AMR containment. The Government of Kerala has been involved in creating awareness on AMR among the medical community in Kerala. Awareness classes have been held at all Government medical colleges in Kerala for faculty and students. The focus of these classes is to emphasize the importance of rational antibiotic use, infection control practices and need to follow institutional antibiotic policy.

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. As of now, Kerala has initiated AMR surveillance programme in government teaching hospitals and many high end private hospitals also carry out surveillance. Since food of animal origin also represents the major route of human exposure to foodborne pathogens, AMR surveillance in animals and fishes is as critical as it is in human health.

Currently, Government Medical Colleges and General Hospital conducts surveillance of 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.). As a part of next step, GMC Thiruvananthapuram will collate data on AMR surveillance in teaching hospitals to track progress of AMR over time. Government will expand this to district and lower hospitals in order to get more community data, and to conduct a community based study. When the government system is stabilized private hospitals will also be invited to join the data collection system

Application of good Infection Prevention Control (IPC) measures across human health, animal health and agriculture also helps to prevent infections and limit use of antibiotics. Steps are taken to tackle AMR at all government medical colleges in Kerala and include scaling up of infection control program to prevent spread of antibiotic resistant organisms. Health care associated infection rates (HAI) rates

with respect to ventilator associated pneumonia (VAP), catheter associated blood stream infection (CLA-BSI), catheter associated urinary tract infections (CA-UTI) and surgical site infections (SSI) are being calculated in 6 ICUs at MCH TVPM at present. HAI rate calculation is going to be extended to the remaining 14 ICUs and 8 high dependency units at TVM MCH. Infection control nurses (ICN) and link nurses have been identified and trained in all the government medical colleges in Kerala and soon HAI rates will be calculated in all Medical colleges. It is proposed to establish a hub of infection surveillance in the state with TVM MCH Microbiology department as the nodal centre. All the surveillance data from various government medical colleges will be forwarded to department of microbiology at TVM MCH where the surveillance data will be collated. Application of good IPC measures to animal husbandry is important to reduce antimicrobial residues in 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 Organisation for farm implementation and promotion of antibiotic alternatives (such as vaccination). The threat of action under phytosanitary conditionalities by fish importing countries has led to fisheries department to monitor the use of antibiotics in fish hatcheries and farms.

Kerala is considered as a consumer state for pharmaceuticals with a total consumption of drugs in the state at 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. Many prescription medications used for human and animal health ultimately find their way into the environment and can affect the health and behaviour of wildlife. Drugs Control Department has a very significant role to play by way of regulatory action for optimizing the use of antibiotics and for taking action towards prevention of their 'over-the-counter' (OTC) sale. GMC Thiruvananthapuram has also initiated Antibiotic Stewardship Program (ASP) to ensure the right drug gets prescribed at the right time, in the right dose, for right duration for the right patient at all government medical colleges in Kerala. For that purpose antibiotic stewardship committees have been started at all government medical colleges in Kerala. Antibiotic prescription audit has been started in all government medical colleges under department of pharmacology. General Hospital Ernakulam (NABH accredited) has been running a very effective antibiotic stewardship program for the last two years. All the NABH accredited corporate hospitals in the state have good antibiotic stewardship as well as AMR surveillance programs.

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 also 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 ([www.rgcb.res.in](http://www.rgcb.res.in)), a premier national research institute, is exclusively devoted to research in molecular biology and biotechnology.

Various challenges in development and implementation of Kerala State Action Plan on AMR may include human resources, role of anthropogenic activities in contaminating the natural water bodies, OTC sale of antibiotics, absence of antibiotic residue control program, and traceability problems with

food of animal origin. However, despite these challenges the Government of Kerala is extremely committed and supportive of activities and proposals of all relevant stakeholders. Besides, strong collaborations and commitment of stakeholders across human health, animal health, food/agriculture and environment gives a positive direction to success ahead if these efforts are sustained over the coming years.

## State Workshop on Antimicrobial Resistance

The Kerala State Workshop on Antimicrobial Resistance (AMR) was organized by the Department of Health and Family Welfare, Government of Kerala at the State Health Systems Resource Centre in Thiruvananthapuram on 17 October 2017. The aim of the workshop was to share information on AMR and its containment in Kerala and brainstorming to initiate development of the Kerala State Action Plan on AMR Containment in alignment with the National Action Plan on AMR (NAP-AMR). The workshop brought together stakeholders from human health, animal health, agriculture, environment and research, to discuss the importance of a 'One Health' approach in containing AMR and for initiation on development of Kerala State Action Plan on AMR.

After the information sharing session, the participants were segregated in 5 teams based on their domain of expertise to reflect on strategic activities for collaborative containment of AMR, with a One Health approach. The five groups were based on the strategic priorities of the state action plan

- (i) Awareness and understanding – communications and training.
- (ii) Knowledge and evidence – laboratories and surveillance.
- (iii) Infection prevention and control – human health, animal/food and community.
- (iv) Optimizing use of antibiotics – regulations and antibiotic consumption, antimicrobial stewardship in humans and animals.
- (v) Research, innovations and sustainable financing.

The workshop had active engagement of all stakeholders and the key takeaway messages and follow-up action points from the workshop include the following:

- 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 January 2018.
- 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
  - The Department of Microbiology Government Medical College Thiruvananthapuram to collate the data sent in by laboratories participating in the surveillance
- Hospital Infection Control programs to be mainstreamed at all levels
- Review need for microbiology lab automation to guide clinical use of antibiotics
- Regulatory bodies to control use of antibiotics
  - State Drug Controller to suggest a mechanism
  - Review use of electronic prescriptions (similar to NHS)
- WHO County Office for India requested to provide technical support for development and implementation of State Action Plan on AMR in Kerala

- A multi-disciplinary working group to be formed for AMR containment in Kerala with representatives from all key stakeholders, including health department, animal husbandry, fisheries, pollution control board, drug regulator, food safety, science & technology, AYUSH, research institutes, private sector, etc.
- Suggestion to create 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

## Strategic priority 1

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

### Focus area: Communications and IEC

*Objective: To improve the awareness among general public on antibiotic abuse and antimicrobial resistance using standardized IEC material like short videos, pamphlets, animations, booklets, posters articles in media etc.*

- 1.1. Create a framework for engagement using social media  
(**Department of Health and Family Welfare**, Department of IT, State IT Mission, CSIT)Timeline: 3 years

*Objective: To improve the awareness among school children of antibiotic abuse and antimicrobial resistance using tailored educational material, integrated into school curricula*

- 1.2. Make and pilot educational material which can be integrated into the curriculum  
(**Community Medicine departments of medical colleges**, Education department, Civil Society Groups working in AMR, WHO)  
Timeline: 1 year
- 1.3. Celebrate antibiotic awareness week in schools and colleges (**Department of Health and Family Welfare**, Education department and Universities)  
Timeline: 3 years

*Objective: To organize mass sensitization programmes in schools and colleges, using already existing engagement platforms like National Service Scheme, National Cadet Corps, etc.*

- 1.4. Formulate and pilot IEC material on antibiotic use and AMR (**Community Medicine Department of Medical Colleges**, mass media, local self-government institutions, Kudumbashree)  
Timeline: 3-6 months

### Focus area: Education and Training

*Objective: To formulate a system of tailored training programmes on AMR and IPC for doctors at all levels of the health care delivery system.*

- 1.5. Formulate offline and online training programmes for doctors at all levels (**DME and DHS**, IMA, IIMM, IPHA, NIC, ReAct group)  
Timeline: 3 years
- 1.6. Study/research on changes in KAP following implementation (**Community Medicine departments**, Department of Health and Family Welfare)



Timeline: 5 years

*Objective: To plan and implement university level training programmes for undergraduate and postgraduate level students and faculty, under the aegis of Health University*

- 1.7. Formulate and implement customised training programmes for UG & PG students (**KUHS**, Microbiology Departments of Medical Colleges, **WHO**)  
Timeline: 5years
- 1.8. Study/Research on changes in KAP following implementation (**Community Medicine departments**, Department of Health and Family Welfare)  
Timeline: 5 years

*Objective: To train all the pharmacists and supporting staff, in antibiotic protocols, antibiotic abuse and antibiotic resistance*

- 1.9. Training programme for pharmacists and support staff (**Drug Controllers**, KGPA and other pharmacist associations)  
Timeline: 3years
- 1.10. Study/Research on changes in KAP following implementation (**Community Medicine departments**, Department of Health and Family Welfare)  
Timeline: 5 years

*Objective: To devise a system for training other users of antibiotics, like food animal farmers, veterinary doctors and fisheries professionals*

- 1.11. Training programme for other users of antibiotics in veterinary, fisheries and agriculture (**Concerned Directorates**, Department of Health and Family Welfare, Kerala Veterinary and Animal Sciences University, Kerala University of Fisheries and Ocean studies)  
Timeline: 5years
- 1.12. Study/research on changes in KAP following implementation (**Community Medicine departments**, Department of Health and Family Welfare)  
Timeline: 5 years

*Objective: To build capacity among those working in environment and allied agencies, for surveillance antibiotic residues in the environment*

- 1.13. Capacity building workshops for personnel from Environment and Pollution Control(**Concerned Directorates**, Department of Health and Family Welfare, Department of Environment )  
Timeline: 3 years
- 1.14. Study/Research on changes in KAP following implementation (**Community Medicine departments**, Department of Health and Family Welfare)  
Timeline: 5 years

## Strategic priority 2

*Strengthen knowledge and evidence through surveillance*

### Focus area: Laboratories

*Objective: Strengthening of microbiology laboratories to detect antimicrobial resistance*

- 2.1. Establish and Standardize microbiology labs in all district hospital; with MD microbiology; with all labs enrolled in EQAS (**DHS, DME, NHM**)  
Timeline: 1 year
- 2.2. Standardized labs in veterinary sector in every district (**DAH**)  
Timeline: 1year
- 2.3. State level SOP for collection, storage, transportation and processing and QA (**DHS/DME**)  
Timeline: 1year
- 2.4. Establish data collection and collaboration at district levels (**DHS/DME/HoD Microbiology TVM**)  
Timeline: 1year
- 2.5. Upgradation of medical college/dist. labs micro labs - automated systems for identification and AST (**DHS/DME**)  
Timeline: 1year
- 2.6. Strengthen human resources for laboratories in human/veterinary sectors (**DHS, DAH**)

### Focus area: Surveillance

*Objective: Standardize and strengthen AMR surveillance in Kerala*

- 2.7. Establish state referral lab: Department of microbiology at TVM medical college for medical colleges.
- 2.8. State PH Lab TVM and General Hospital Ernakulam identified as two regional centres for District/General Hospitals; all laboratories in the network to be assessed using a standard questionnaire followed by a site visit.
- 2.9. AMR surveillance to be initiated for 6 pathogens, 4 samples – blood, urine, aspirated pus, respiratory specimens
- 2.10. Animal surveillance for sample-bug-drug combinations as per FAO guidelines; coordination by Chief Disease Investigation Office, Palode, Thiruvananthapuram; four apex labs at Palode, Thiruvalla, Ernakulam and Palakad and Kerala Veterinary and Animal

Sciences University, Wayanad; Ernakulam laboratory shall collate, analyse and share data with Director Animal Husbandry.

- 2.11. Surveillance in food animals and their products for sample-bug-drug combinations to be coordinated by State Laboratory for Livestock Marine and Animal Products, Maradu, Ernakulam (NABL accredited)
- 2.12. Surveillance in fisheries for sample-bug-drug combinations – coordinated by Central Fisheries Research Institute, Kochi
- 2.13. Surveillance in dairy products and food for sample-bug-drug combinations to be coordinated by Council for Food Research and Development (CFRD) laboratory at Konni.
- 2.14. Strengthen the state antibiotic residue control plan in animal products by AHD
- 2.15. Strengthen the state antibiotic residue control plan in food by FSSAI
- 2.16. Strengthen the state antibiotic residue control plan in environment done by State Pollution Control Board (SPCB)
- 2.17. Identify nodal persons in all sectors. State level inter-sectoral committee will meet under chairmanship of DHS in every quarter
- 2.18. Separate AMR database for human, animal, food and environment
- 2.19. Strengthen resources for surveillance of AMR and antibiotics/residues in all sectors – human, veterinary, agriculture, food, fisheries, and environment

### Strategic priority 3

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

#### Focus area: IPC in human health

*Objective: Reduction of HAI rates by 20% of the existing rate by one year and 50% by three year and attaining international benchmark by five years*

- 3.1. Development and implementation of IPC and SOPs
- 3.2. Appropriate isolation/standard precautions (**individual institutions**)
- 3.3. Medical and surgical asepsis (**ICD**)
- 3.4. Sterilization & disinfection (**HICC & CSSD**)
- 3.5. Immunization
- 3.6. Sharp policy – Needle stick injury prevention
- 3.7. Administrative involvement (**HICC, ICT, RRT, SAP**)

*Objective: Hand hygiene compliance 80% by one year and 100% by three years*

- 3.8. Hand Hygiene (**ICT**)

*Objective: Adherence to Antibiotic Policy and Antimicrobial Stewardship Programme*

- 3.9. Appropriate antibiotic prophylaxis and use (Antimicrobial Stewardship Committees/Teams)

*Objective: Regular monitoring and evaluation framework*

- 3.10. Baseline data collection (**PCB, LSG**)
- 3.11. Source identification (**PCB, LSG**)

*Objective: Reducing environmental contamination with MDRP & antimicrobial residues*

- 3.12. Housekeeping and environment management (**Housekeeping Dept, Engineering Dept**)

3.13. Waste management (**Institution**)

3.14. Infrastructure facility strengthening including STP (**PCB, health institutes**)

#### Focus area 3.2: Animal feed & food

*Objective: Reducing incidence of infection through effective infection prevention and control in animals*

3.15. Vaccination & biosecurity measures

3.16. Sterilization & disinfection

3.17. IPC during production/processing of food& food storage

3.18. Establishment of statutory regulatory bodies (**Government**)

3.19. Development of SOPs

#### Focus area 3.3: Environment

*Objective: Reducing incidence of infection through effective infection prevention and control in environment*

3.20. Baseline data collection (**PCB, LSG**)

3.21. Source identification (**PCB, LSG**)

3.22. Monitoring

3.23. Source tracing

3.24. Prevention of contamination

3.25. Establishment of statutory regulatory bodies (**Government**)

3.26. Development of SOPs

## Strategic priority 4

*Optimize the use of antimicrobial agents in health, animals and food*

### Focus area: Regulations

*Objective: Stepwise introduction to reduce OTC sale of drugs*

- 4.1. Announcement, notification, circulars in pharmacies
- 4.2. Awareness campaign/IEC for pharmacists, licensees and pharmacy students: State Drugs Control Department and State Pharmacy Council
- 4.3. Education – pharmacy councils, pharmacy association, IMA, API, IAP
- 4.4. Prepare modules/booklets
- 4.5. Compulsory attendance – pharmacy council.
- 4.6. At least 6 monthly educational sessions
- 4.7. Public awareness activities, social media
- 4.8. Proper disposal measures of antibiotics – by pharma distributors with accountability to manufacturer
- 4.9. Implement and monitor sale of antibiotics as per state and national guidelines – centralised database of import, distribution and sales
- 4.10. Centralised prescription audits by State Drugs Control Department
- 4.11. Monitoring the quality of antimicrobials by State Drugs Control Department
- 4.12. Monitor presence of antibiotics in feeds used in veterinary sector and aquaculture

### Focus area: Hospitals and healthcare institutions

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

- 4.13. Institutional antibiogram and policy for empiric use of antibiotics
- 4.14. All the hospitals in the state, including private sector, should have an antibiotic policy and antimicrobial stewardship committee

- 4.15. Formulary restriction (pre-authorization) with respect to high-end antibiotics like tigecycline, minocycline, colistin, polymyxin B and fosfomycin, etc. Carbapenems and linezolid to be included after 6 months into the list of drugs requiring pre-authorization.
- 4.16. Antibiotic stewardship training to all doctors and MBBS students.
- 4.17. Surgical prophylaxis policy to be adhered to in all hospitals.
- 4.18. Pharmacologists to be trained as clinical pharmacologists. Proposal submitted to DME for establishing clinical pharmacology departments in all government medical colleges.
- 4.19. Electronic prescriptions – review legislation, training, implementation and monitoring.
- 4.20. **Create and using mobile apps for antimicrobial stewardship**
- 4.21. Reporting to a committee under chairmanship of **health secretary**. The committee to include DMO, DME, DHS, principals of medical colleges, IMA representative and API members.
- 4.22. Training modules to be developed for medical, pharmacy and nursing students
- 4.23. Educational sessions for private practitioners – IMA, IAP, API, IAMM, DMO
- 4.24. Prescription audits.

#### Focus area: Veterinary and aquaculture

*Objective: Optimize the use of antimicrobials in veterinary and aquaculture*

- 4.25. Steps to be taken to prevent use of ‘antibiotics for human use’ as ‘antibiotics for growth promotion in veterinary and aquaculture’ (Department of Drug Control, Veterinary Council, IVRI, Coastal Aquaculture Authority, State Fisheries Department, FSSAI)
- 4.26. Ban colistin usage as a growth promotor ASAP
- 4.27. Measure to rationalize antibiotic usage in veterinary practice- treatment and prophylaxis (Departments of Animal Husbandry, Fisheries, Agriculture, Drugs Control, Veterinary Council, IVRI,)

## Strategic priority 5

*Promote research and innovations for AMR containment*

Focus area: Research on AMR

*Objective: To compile the research activities on AMR in Kerala*

- 5.1. Review of literature (**RGCB**, KVASU, MCH-KZD, MCH-TVM, GAC-TVM, AHD-Kerala, ISM-Kerala)  
Timeline: 1 year

*Objective: To identify potential research institutes/university departments working on AMR*

- 5.2. Compilation of institutes and relevant investigators (**RGCB**, KVASU, MCH-KZD, MCH-TVM, GAC-TVM, AHD-Kerala, ISM-Kerala)  
Timeline: 1 year

*Objective: To define the research priorities on AMR in Kerala*

- 5.3. Veterinary aspects (**KVASU**, AHD-Kerala)  
Timeline: 1 year
- 5.4. Human aspects(**MCH-TVM AND MCH-KZD**, RGCB-TVM)  
Timeline: 1 year
- 5.5. Ayurvedic aspects (**GAC-TVM**, ISM Dept-TVM)  
Timeline: 1 year

*Objective: Research for special attention on Zoonotic bacteria – Campylobacter sp., EHEC, Salmonella enteritidis, S. typhimurium*

- 5.6. Isolation, identification & antibiogram profiling of the above organisms from animals and their products (**KVASU**, AHD-Kerala)  
Timeline: 3 years
- 5.7. Isolation, identification , antibiogram profiling and global surveillance of bacterial pathogens [*E. coli*, *Klebsiella*, *Acinetobacter spp.*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Enterococcus spp.*] using whole genome sequencing from humans (**MCH-KZD**, MCH-TVM, RGCB-TVM)  
Timeline: 3 years



Focus area: Innovations

*Objective: Alternate strategies for combating AMR- screening of phytochemicals/herbal extracts*

- 5.8. Herbal drug research and development(**GAC-TVM**, ISM-Kerala, KVAS)  
Timeline: 3 years
- 5.9. Promote research on biofilm inhibition (**RGCB**, GAC-TVM, ISM-Kerala)  
Timeline: 3 years

*Objective: Development of new diagnostics*

- 5.10. Promote research for rapid bacterial diagnostic kits (**RGCB**, MCH-TVM)  
Timeline: 3 years
- 5.11. Research on cytokine response – resistant/susceptible bacteria (**RGCB**, ID Dept-MCH-TVM)  
Timeline: 3 years

## Strategic priority 6

*Partnership with private sector and civil society organizations for AMR containment*

Focus area: Private public partnership

*Objective: Co-opting private hospitals into the AMR programme*

6.1: Develop partnership with private hospital groups and individual hospitals (IMA, QPMPA, CHAI, CMAI)

Time line: 2 years

6.2: Provide space for private firms in Infection Prevention Programmes (DHS, DME, Director State Public Health Lab, MD-KMSCL)

Time line: 2 years