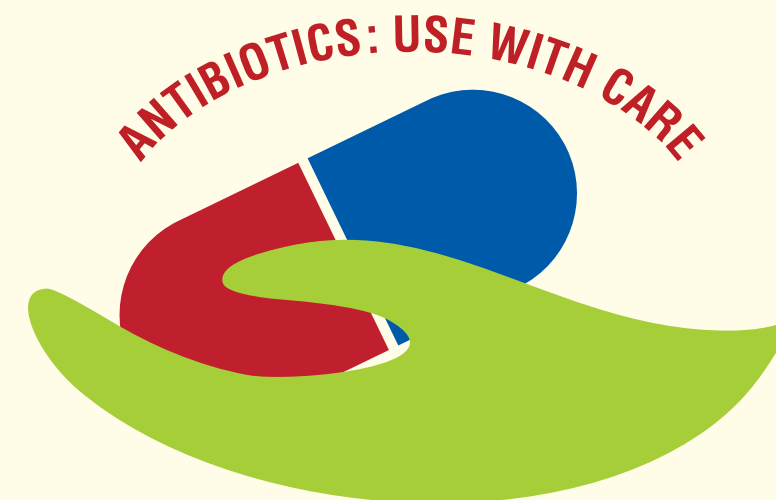




Government of India

National Action Plan on Antimicrobial Resistance



National Action Plan on Antimicrobial Resistance

The spread of infections that are resistant to antimicrobial medicines has emerged as a threat to public health globally. This is promoted by human actions, such as inappropriate prescribing and use of antimicrobials, insufficient hospital hygiene, inappropriate use of antibiotics in the livestock sector, misuse of antibiotics in humans and agriculture, irresponsible manufacturing of antibiotics including uncontrolled release of active antibiotics into the environment.

Global leaders, including India, adopted a political declaration at the high-level meeting on 21 September 2016 at the 71st UN General Assembly, which calls for a collaborative, global response to the threat of antimicrobial resistance (AMR).

For containing antimicrobial resistance, there is need to promote and protect human health within the framework of a One Health approach through coherent, comprehensive and integrated multi-sectoral cooperation and actions, as human, animal and environmental health are interconnected.

This document summarizes the current situation regarding AMR and its containment in India, along with a proposed roadmap to guide the country in tackling this public health challenge. The goal and objectives of the National Action Plan on AMR can only be achieved through implementing strategic interventions and activities with all concerned ministries and departments joining hands with other stakeholders to collaboratively tackle this challenge.

**National Action Plan
on Antimicrobial Resistance
(NAP-AMR) 2017 – 2021**

April 2017 | India

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Abbreviations and acronyms

AMR	antimicrobial resistance
ARB	antibiotic resistance breakers
BIS	Bureau of Indian Standards
CDSCO	Central Drugs Standard Control Organization
CHEB	Central Health Education Bureau
CPCB	Central Pollution Control Board
CSE	Centre for Science and Environment
CSIR	Council of Scientific & Industrial Research
CTD	Central TB Division
CWG-AMR	Core Working Group on AMR
DADF	Department of Animal Husbandry Dairying and Fisheries
DBT	Department of Biotechnology
DCGI	Drug Controller General of India
DCI	Dental Council of India
DoP	Department of Pharmaceuticals
ESBL	extended spectrum beta-lactamase
FAO	Food and Agriculture Organization of the United Nations
FSSAI	Food Safety and Standards Authority of India
GAP-AMR	Global Action Plan on Antimicrobial Resistance
GHSA	Global Health Security Agenda
HAI	healthcare associated infections
HICC	hospital infection control committee
ICC-AMR	Intersectoral Coordination Committee on AMR
ICAR	Indian Council for Agricultural Research
ICMR	Indian Council for Medical Research
IDSP	Integrated Disease Surveillance Programme
IMA	Indian Medical Association
INC	Indian Nursing Council
IPC	Infection Prevention and Control
KAP	knowledge, attitude and practices
KVK	Krishi Vigyan Kendra
MCI	Medical Council of India
MoAFW	Ministry of Agriculture and Farmers Welfare

MoAYUSH	Ministry of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy
MoCAFPD	Ministry of Consumer Affairs, Food and Public Distribution
MoCF	Ministry of Chemicals and Fertilizers
MoDWS	Ministry of Drinking Water and Sanitation
MoEA	Ministry of External Affairs
MoEFCC	Ministry of Environment, Forest and Climate Change
MoF	Ministry of Finance
MoFPI	Ministry of Food Processing Industries
MoHFW	Ministry of Health & Family Welfare
MoHRD	Ministry of Human Resource Development
MoIB	Ministry of Information & Broadcasting
MoST	Ministry of Science & Technology
MRSA	methicillin resistant <i>Staphylococcus aureus</i>
NAP-AMR	National Action Plan on Antimicrobial Resistance
NACO	National AIDS Control Organization
NBE	National Board of Examinations
NCDC	National Centre for Disease Control
NHM	National Health Mission
NIB	National Institute of Biologicals
NIPER	National Institute of Pharmaceutical Education and Research
NLEP	National Leprosy Eradication Programme
NVBDCP	National Vector Borne Disease Control Programme
OIE	World Organisation for Animal Health (Office International des Epizooties)
OPPI	Organisation of Pharmaceutical Producers of India
PCI	Pharmacy Council of India
PHFI	Public Health Foundation of India
RNTCP	Revised National Tuberculosis Control Programme
SPCB	State Pollution Control Board
TAG-AMR	Technical Advisory Group on AMR
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
VCI	Veterinary Council of India
WHA	World Health Assembly
WHO	World Health Organization

Executive summary

The threat posed by antimicrobial resistance (AMR) to public health as well as global health security has been reiterated in numerous World Health Assembly (WHA) resolutions. AMR is also prioritized under the Global Health Security Agenda (GHS), and India is one of the contributing countries. The Ministry of Health & Family Welfare (MoHFW) identified AMR as one of the top 10 priorities for the ministry's collaborative work with WHO. The National Health Policy 2017 identifies antimicrobial resistance as a problem and calls for effective action to address it. An international conference on AMR – “Combating Antimicrobial Resistance: A Public Health Challenge and Priority”, was jointly organized by the Government of India and World Health Organization (WHO) in February 2016, which was attended by more than 350 participants. The Hon'ble Prime Minister, Shri Narendra Modi, and the Hon'ble Union Minister for Health, Shri J.P. Nadda have reiterated government's commitment to tackle AMR.

In May 2015, the sixty-eighth World Health Assembly endorsed the Global Action Plan on Antimicrobial Resistance (GAP-AMR) – including antibiotic resistance, the most urgent drug resistance trend. The WHA resolution urges Member States to align their National Action Plan on AMR with GAP-AMR by May 2017. Commitment by global leaders to combat AMR was further strengthened at the High Level Meeting on AMR at the United Nations General Assembly on 21 September 2016.

The Ministry of Health & Family Welfare notified three governance mechanisms in September 2016 to address this challenge. These include the Intersectoral Coordination Committee, Technical Advisory Group and Core Working Group on AMR for technical coordination and oversight. The Core Working Group has been activated and has drafted the National Action Plan on Antimicrobial Resistance (NAP-AMR), which was further reviewed at the National Workshop on Development of National Action Plan on AMR that included members from Core Working Group and the Technical Advisory Group.

The strategic objectives of NAP-AMR are aligned with the global action plan based on national needs and priorities, and in addition to the 5 priorities of GAP-AMR, India has a sixth priority that is India-specific dealing with India's leadership on AMR – including international, national and sub-national collaborations on AMR. Six strategic priorities have been identified under the NAP-AMR (i) improving awareness and understanding of AMR through effective

communication, education and training; (ii) strengthening knowledge and evidence through surveillance; (iii) reducing the incidence of infection through effective infection prevention and control; (iv) optimizing the use of antimicrobial agents in health, animals and food; (v) promoting investments for AMR activities, research and innovations; and (vi) strengthening India's leadership on AMR.

Strategic priority 1 focuses on improving awareness and understanding of AMR through effective communication, education and training, and has 2 focus areas – first is communications and information, education, communication (IEC) resources to raise awareness amongst all stakeholders, and second focus area is education and training to improve the knowledge and behaviour of professionals in all sectors. Strategic priority 2 aims to strengthen knowledge and evidence through surveillance of AMR, with 2 focus areas – strengthening laboratories in human, animal, food and environment sectors, as well as ensuring surveillance of antimicrobial resistance in human, animal, food and environment sectors.

Strategic priority 3 attempts to reduce the incidence of infection through effective infection prevention and control in healthcare to reduce the burden of infection, in animal health and food to reduce spread of AMR and antimicrobials through animals and food, and in community and environment to reduce the spread of AMR and antimicrobials in the environment. Strategic priority 4 shall optimize the use of antimicrobial agents in health, animals and food through strengthening regulations, ensuring access and surveillance of antimicrobial use, antimicrobial stewardship in healthcare as well as animal health and agriculture.

Strategic priority 5 aims to promote investments for AMR activities, research and innovations through new medicines and diagnostics, innovations to develop alternative approaches to manage infectious diseases, and sustainable financing to ensure adequate resources for containment of AMR. Strategic priority 6 focuses on strengthening India's leadership on AMR through international collaborations to ensure India's contributions towards global efforts to contain AMR, national collaborations to facilitate collaborations among vertical disease control programmes and national stakeholders, and state level collaborations to ensure action at the ground level against AMR.

Within each strategic priority and focus area, strategic interventions, key activities and outputs have been defined with tentative responsibility and timelines – short (within 1 year), medium (between 1 and 3 years) and long-term (between 3 and 5 years).

I. Background

Antimicrobial resistance (AMR) has been identified as a global health threat with serious health, political and economic implications. It has also been prioritized in numerous World Health Assembly (WHA) and Regional Committee resolutions. The health ministers from the South-East Asia Region, including the Hon'ble Union Health Minister from India, are signatories to the Jaipur Declaration on Antimicrobial Resistance, 2011.

AMR is also prioritized under the global health security agenda action package, and India is one of the contributing countries. The global commitment to combat AMR was further strengthened by the High Level Meeting on AMR at the United Nations General Assembly on 21 September 2016, in which global leaders reiterated their commitment to act on AMR through a political declaration that was adopted as a UN General Assembly resolution.

The national policy for containment of antimicrobial resistance for India was published in 2011. In November 2014, the WHO Regional Committee meeting advocated with Member States for acceleration of national efforts to build capacities to implement the Jaipur Declaration on AMR and the South-East Asia Regional Strategy on AMR.

The Indian Prime Minister Shri Narendra Modi recently reaffirmed the joint Indo-US commitment to the Global Health Security Agenda (GHSA) and the timely implementation of its objectives. The Prime Minister noted

Prime Minister Shri Narendra Modi noted India's role on the Steering Group of Global Health Security Agenda, and its leadership in the area of antimicrobial resistance

India's role on the Steering Group of GHSA and its leadership in the area of antimicrobial resistance. The Prime Minister also drew attention of the countrymen to the menace of antibiotic resistance in his *Mann ki Baat* on 31 July 2016, and called upon everyone to practice responsible use of antibiotics.

The National Health Policy 2017 highlights the problem of antimicrobial resistance and calls for a rapid standardization of guidelines regarding antibiotic use, limiting the use of antibiotics as over-the-counter medications, banning or restricting the use of antibiotics as growth promoters in animal livestock, and pharmacovigilance including prescription audits inclusive of antibiotic usage – in the hospital and community.

In addition, the Ministry of Health & Family Welfare (MoHFW) has also identified AMR as one of the top 10 priorities for the Ministry's collaborative work with WHO for 2018–2019.

1.1 Introduction

In May 2014, the World Health Assembly requested the development of a global action plan (GAP) on antimicrobial resistance, in resolution WHA67.25, reflecting a global consensus that antimicrobial resistance poses a profound threat to human health.

The WHO Secretariat led the development of the Global Action Plan on AMR (GAP-AMR) that takes into account the commitment, perspectives and roles of all relevant stakeholders, and in which everyone has clear and shared ownership and responsibilities. In May 2015, the sixty-eight World Health Assembly endorsed the GAP-AMR to tackle antimicrobial resistance – including antibiotic resistance, the most urgent drug resistance trend. The WHA resolution also requests Member States to align their national action plans with GAP-AMR by May 2017.

The Global Action Plan on AMR provides a broad framework for combating AMR. The goal of GAP-AMR 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. The FAO Action Plan on AMR has 4 strategic objectives that are aligned with the GAP-AMR.

To achieve its goal, the global action plan sets out five strategic objectives, to:

1. Improve awareness and understanding of antimicrobial resistance;
2. Strengthen knowledge through surveillance and research;
3. Reduce the incidence of infection;
4. Optimize the use of antimicrobial agents in health, animal and food sectors; and
5. Develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

An international conference on AMR – “Combating Antimicrobial Resistance: A Public Health Challenge and Priority”, was jointly organized by the Government of India and World Health Organization (WHO) in February 2016, which was attended by more than 350 participants including policy makers from Ministry of Health and Family Welfare, Ministry of Agriculture

and Farmers Welfare, Department of Animal Husbandry Dairying and Fisheries, Ministry of Environment, and also clinicians and microbiologists, as well as international experts and policy makers from neighbouring countries.

Shri J.P. Nadda, the Hon'ble Union Health Minister reinforced India's strong commitment, leadership and resolve to combat AMR and necessity of all stakeholders involved to contribute to pave the way for effective action to combat AMR. The strategic objectives of the NAP-AMR are aligned to the GAP-AMR based on national needs and priorities.

This document details the national priorities to tackle AMR in India, and provides a roadmap to guide the country in tackling this public health challenge. The next section provides an overview of the AMR situation in India. Subsequent sections cover the goal and objectives of the national action plan, governance mechanisms and strategic priorities along with strategic interventions, key activities, and outputs with timelines.

1.2 AMR and its containment in India

1.2.1. AMR in man and animals

India is among the nations with the highest burden of bacterial infections. An estimated 410,000 children aged five years or less die from pneumonia in India annually; with pneumonia accounting for almost 25% of all child deaths. The crude mortality from infectious diseases in India today is 417 per 100,000 persons. Consequently, the impact of AMR is likely to be higher in the Indian setting.

AMR is a major public health concern in India. The emergence of resistance is not only limited to the older and more frequently used classes of drugs but there has also been a rapid increase in resistance to the newer and more expensive drugs, like carbapenems. Available data indicates to rising rates of AMR, across multiple pathogens of clinical importance, at the national scale. In 2008, about 29% of isolates of *Staphylococcus aureus* were methicillin resistant, and by 2014, this had risen to 47%. In contrast, in countries which have established effective antibiotic stewardship and/or infection prevention and control programs, the proportion of methicillin resistant *Staphylococcus aureus* (MRSA) isolates have been decreasing. Extended-spectrum beta-lactamase (ESBL) producing strains of Enterobacteriaceae have emerged as a challenge in hospitalized patients as well as in the community. In a multicentric study conducted in seven

tertiary care hospitals in Indian cities, 61% *E. coli* were ESBL producers. In the same study, 31-51% *Klebsiella* species were carbapenem resistant and 65% *Pseudomonas* sp. were resistant to ceftazidime, and 42% were resistant to imipenem.

The Indian Network for Surveillance of Antimicrobial Resistance (INSAR) reported MRSA prevalence rate of 41% based on data from 15 tertiary care centres, and also showed a high rate of resistance to ciprofloxacin, gentamicin, cotrimoxazole, erythromycin, and clindamycin. Another study showed incidence of community acquired MRSA about 10% and reduced susceptibility to vancomycin in about 12% of the isolates of *Enterococcus faecalis*. Among blood cultures isolates of *Salmonella* Typhi at a tertiary care hospital in Delhi, resistance was observed to nalidixic acid (96.7%), ciprofloxacin (37.9%) and azithromycin (7.3%) and multi-drug resistance in 3.4% isolates.

Recent studies in India show that most isolates of *V. cholerae* O1 are resistant to the commonly-used antibiotics, such as ampicillin, furazolidone, ciprofloxacin, and tetracycline. Resistance of *V. cholerae* to ceftriaxone has been reported from Delhi. A report of *Neisseria gonorrhoeae* from patients at a sexually transmitted diseases clinic in Delhi highlighted alarming increase in multidrug resistant isolates (23.3%) over 14 years (1996-2008).

The burden of AMR in livestock and food animals has been poorly documented in India. Aside from sporadic, small, localized studies, evidence that can be extrapolated to the national level is lacking. Given that there are few regulations against the use of antibiotics for non-therapeutic purposes in India, the emergence of AMR from antibiotic overuse in the animal sector is likely to be an unmeasured burden in India.

Drug resistant bacteria have been isolated from dairy cattle as early as the 1970s. One of the most common clinical issues encountered in the dairy farms is mastitis, which maybe sub-clinical or overtly symptomatic. Commonly thought to be a disease of production, milk from mastitic cows and buffaloes have been shown to contain a wide range of bacteria, with a wide spectrum of resistance against commonly used antibiotics. In some cases, multiple drug resistant bacteria have been seen to co-infect animals suffering from mastitis.

As with the dairy sector, there is limited evidence available on the exact amount of antibiotic consumed within the poultry industry, and what are the various indications for which the medications were prescribed. In many cases, since the antibiotic is given as a growth promoter through the premixed feed, which comes with added antibiotics that are not even mentioned on

the label, it is difficult to exactly estimate the dose or the consumption levels of antibiotics in the poultry sector. Individual studies have consistently shown that bacteria isolated from animals or seafood have high levels of resistance.

The legislative conditions regulating the aquaculture processes is different from those in the poultry or the dairy industry. The Food Safety and Standards Authority of India (FSSAI) banned the use of antibiotics and several pharmacologically active substances in fisheries. In contrast, there is no regulation in the poultry industry where many of the commercially available pre-mixed feeds come with added antibiotics. These drugs can, of course, be added to the feeds separately by the farmers. Compared to the poultry and dairy sector, antibiotic resistance has been scrutinized more closely in the aquaculture sector. The existence of legislative provisions to contain the inappropriate and non-therapeutic use of antibiotics in fisheries is expected to impact the levels of AMR in the aquaculture sector. However, in a recent study that examined over 250 samples, it was seen that multi-drug resistant bacteria were isolated from over two-thirds of the samples.

There exists a large body of evidence, which comprises of studies investigating the resistance profiles of bacteria isolated from both sick and healthy cattle. However, these studies cannot be compiled to obtain a representative picture of the problem at the national scale. Driven by local contexts, these studies can provide a rough overview of the magnitude of the problem of drug resistance in bacteria, but for obtaining a more comprehensive and holistic understanding, it is imperative to have a broad based surveillance system in place.

1.2.2. Awareness and understanding of AMR

The GAP-AMR states that the first strategic objective in effectively containing AMR is to improve awareness and understanding of AMR through effective communication, education and training. The strategy envisions that the awareness building has to proceed on several fronts at the same time. On one hand it has to leverage public communication programs to encourage behaviour change in target populations – namely stakeholders in human health, animal health and agriculture; and on the other there needs to be concerted efforts to incorporate AMR as a core component in the professional education of medical and veterinary professionals.

The need to focus on awareness building, both in consumers and providers, was highlighted by the results of the multi-country public awareness survey that was conducted by WHO in 2015.

The findings of the study highlight important deficits in the understanding of what antibiotics are, how they should be used and when to take them. There is ample evidence to suggest that there is some pressure from patients which forces medical practitioners to overprescribe antibiotics, especially for conditions like viral illnesses, upper respiratory tract infections and diarrhoea, for which antibiotic therapies are not the recommended first line of approach.

Given the financial incentives to prescribe antibiotics and the role of the pharmaceutical industry in encouraging prescription of antibiotics in India, there is a need to approach the process of awareness generation with additional legislative support. Internationally there is evidence that awareness generation campaigns in combination with other interventions that are organized at the national level may be successful to reduce antibiotic use.

There is also a need to increase the awareness about the need to contain AMR at the higher levels of policy-making, so that it may emerge as a priority in the health policies of the nation. In 2011, the health ministers of the South-East Asia Region's Member States articulated their commitment to combat AMR through the Jaipur Declaration on AMR. This was a high-level commitment to prioritize AMR control programmes at the highest levels of national policy making.

1.2.3. Surveillance of AMR

India has previously instituted surveillance of the emergence of drug resistance in disease causing microbes in the context of vertical programmes, like the Revised National Tuberculosis Control Programme (RNTCP), the National Vector Borne Disease Control Programme (NVBDCP), and the National AIDS Control Programme (NACP), to name a few. However, a cross-cutting programme dealing with antimicrobial resistance across multiple microbes has been lacking.

The “National Programme on the Containment of Antimicrobial Resistance” was launched under the aegis of the National Centre for Disease Control (NCDC) under the 12th Five Year Plan (2012 – 2017). The objectives of this programme were to establish a laboratory based AMR surveillance system of 30 network laboratories, generating quality data on AMR for pathogens of public health importance; to strengthen infection control guidelines and practices, and promote rational use of antibiotics; and to generate awareness about the use of antibiotics in both healthcare providers and in the community. The policy focus included: situation analysis

regarding the manufacture, use and misuse of antimicrobials; creating a national surveillance system; identifying prescription patterns and establishing a monitoring system for the same; enforce enhanced regulatory provisions with respect to marketing of antimicrobials; develop specific intervention measures such as antibiotic policies for healthcare facilities; development of diagnostic aids related to monitoring AMR.

At present, ten network laboratories have been identified in the first phase of the programme, in course of which four pathogens of public health importance are being tracked: *Klebsiella* spp, *E. coli*, *Staphylococcus aureus*, and *Enterococcus* spp. The network intends to extend testing of resistance to two more index bacteria: *Pseudomonas aeruginosa* and *Acinetobacter* spp. Reporting from the ten laboratories puts overall resistance rates to be very high, against the commonly used fluoroquinolones, third generation cephalosporins and carbapenems, although resistance against reserve drugs like vancomycin was not noted in isolates of *Staphylococcus aureus*, or against colistin in gram negative bacteria. A strategy to scale the programme up in order to carry out surveillance of hospital acquired infections and antibiotic use patterns in healthcare settings has also been outlined; additional focus on building awareness about rational use of drugs on a continuous basis is also being planned.

The Indian Council of Medical Research (ICMR) established a national network on surveillance of antimicrobial resistance in laboratories based at tertiary care academic centres, targeting medically important index microbes which have been identified by WHO. The Antimicrobial Resistance Surveillance Research Network (AMRSN) established by the ICMR started with six reference labs located in four tertiary care medical institutions. The network is being expanded to include 15 more medical colleges/corporate hospitals.

The AMRSN also incorporates in-depth understanding of clonality of drug resistant pathogens and the transmission dynamics to enable better understanding of AMR in Indian context and devise suitable interventions. The AMRSN, although currently limited to the human health side, plans to scale up on a national scale and expand its ambit to include samples from a wider spectrum of sources, including animal, environmental and food samples, to reflect the principles of a One Health approach based surveillance system. Currently the laboratory network has been expanded to include ten centres.

Aside from the absence of a One Health approach to surveillance, another weakness of the existing surveillance systems for AMR in India is that it does not account for antibiotic use. The existence of a surveillance system that can establish the relationship between the antibiotic

consumption patterns and emergence of AMR is vital to producing evidence that may help in the designing and evaluation of effective interventions.

1.2.4. Infection prevention and control

The background report on the role of infection prevention and control (IPC) programmes in order to contain AMR, which was commissioned by the WHO, has highlighted the critical nature of this issue. Functional infection control programs not only cut down the rates of nosocomial infections, but also reduce the volume of antibiotic consumption and have been identified to be part of any comprehensive strategy to contain AMR.

The ICMR guidelines on infection control, which are locally relevant and implementable for India were released last year at the international conference on AMR, which further identified the need to develop IPC standards for each level of healthcare facility, not just tertiary care centres. It noted the need to establish functional hospital infection control committees (HICCs) to provide leadership to the IPC programs at the institutional level. The need to integrate IPC programs, both from the policy making and implementation angles, was also stressed. Establishing IPC focal experts at the policy making levels and linking of IPC programs to AMR surveillance, and nosocomial infection surveillance were identified as key policy integrations to drive more successful IPC programs in India. NCDC has recently developed guidelines for hospital infection prevention and control and is also developing a policy on infection control, which is in the final phases of preparation.

ICMR launched the programme on Antimicrobial Stewardship, Prevention of Infection and Control (ASPIC) in 2012 through the collaboration between the office of the National Chair of Clinical Pharmacology, ICMR and the Christian Medical College, Vellore. A national workshop was hosted as a part of a one year programme to develop capacity of key stakeholders in Antibiotic Stewardship. In addition to launching the AMRSN, the ICMR also instituted an evaluation of the AMSP practices through an in-depth facility survey in private and government health care institutions.

The results showed that though there was a very high degree of adherence to the guidelines when it came to dealing with healthcare associated infections (HAIs) or hospital infection control (HIC) measures, compliance was poor with the other aspects of antibiotic stewardship, especially with respect to having a documented stewardship programme, antibiotic prescription

guidelines and usage surveillance, and a truly multidisciplinary team. It was also seen that the stewardship programmes in private institutions were better equipped to deal with emerging crises like AMR or HAI outbreaks, in comparison to the government facilities in the survey. It is suggested that the accreditation mandates, which certain private institutes adhere to on account of financial compulsions, may have a positive impact on the programme. The evaluation report recommends that government healthcare facilities also need to seek mandatory accreditations to improve their stewardship programmes. The survey revealed a paucity of implementation strategies, including formulary restrictions and drug rotation policies. Prescription audits were conducted in very few institutions; efforts in development, dissemination and regularly updated prescription policies were also deficient; absence of computer assisted programmes, especially in government facilities, also hampered the work of the stewardship programme.

1.2.5. Use of antimicrobials

At 12.9×10^9 units of antibiotics consumed in 2010, India was the largest consumer of antibiotics for human health. Although the per capita consumption of antibiotics in India (10.7 units per capita) was lower than that seen in many other countries (e.g. 22 units per capita in USA).

Since March 2014 a separate Schedule H-1 has been incorporated in Drug and Cosmetic rules to regulate the sale of antimicrobials in the country. About 24 antimicrobials belonging to third and fourth generation cephalosporins and carbapenems are covered under the schedule. These antimicrobials cannot be sold without a proper medical prescription and these drug packaging are required to be labelled with the following text along with red border. "Schedule H1 Drug – Warning: It is dangerous to take the drug except in accordance with medical advice, Not to be sold by retail without the prescription of a registered medical practitioner." A separate register has to be maintained by the pharmacist giving details of the prescriber, the patient as well as the drug sold.

With respect to consumption of antimicrobials in food animals, the global consumption was estimated to be 63,151 ($\pm 1,560$) units in 2010; India accounts for 3% of the global consumption and is the fourth highest in the world, behind China (23%), the United States (13%) and Brazil (9%). The consumption of antimicrobials in the food animals sector in India is expected to double by 2030.

The absence of stringently framed and implemented regulatory frameworks to limit the use of antimicrobials in livestock and food animals, especially for non-therapeutic purposes, like growth promotions, has been one of the drivers of antibiotic overuse at the community level. A more recent directive has been issued in January 2015 by the FSSAI which outlines certain principles that include limiting the use of antibiotics in livestock rearing; it does little besides reiterating the directives of a previous advisory from the Department of Animal Husbandry, Dairying and Fisheries. The National AMR Containment Policy highlighted the need to establish a separate Schedule H1, under the Drugs and Cosmetics Rules, to regulate the sales of antibiotics. Guidelines for punitive actions against agencies that are in contravention of such policies are also outlined. The national policy also outlined the proposal for colour-coding antibiotic strips, and newer molecules (carbapenems, tigecycline, daptomycin, etc.), to eliminate their use outside of tertiary care settings. The Red Line Campaign developed along with Organisation of Pharmaceutical Producers of India (OPPI) was launched in New Delhi in February 2016.

1.2.6. Research and innovations

In 2004, in the 15 largest pharmaceutical companies, only 1.6% of the drugs in the development stages were antibiotics, and none of them were from novel classes, nor were they targeted to treat multidrug resistant agents. Despite the obvious need to develop newer classes of drugs to respond to the challenges of emerging AMR, there are few late stage candidates in the process of development. Additionally, pharmaceutical agencies have been reluctant to invest in research and development of antibiotics owing to the nature of the market, the current policies on conservation of newer classes of antimicrobials and the nature of antibiotic chemotherapy for infectious diseases.

Development of antibiotic resistance breakers (ARBs) to restore effectiveness of older classes of antibiotics has also emerged as an innovative way around the issue of resistance. ARBs can be known compounds as well as novel molecules which have no or minimal antibacterial activity, but which help in restoring the effectiveness of drugs to which the microbes would otherwise be resistant. The current consensus seems to be that there is a need to develop ARBs that are likely to salvage key members of each group of antibiotics, especially those that target Gram negative bacteria.

1.2.7. National response

Historically, AMR has not received adequate focus and attention in India. However, recent trends clearly illustrate the growing political commitment at the highest levels to have a coherent response in place that can provide the necessary gravitas for nation-wide surveillance and stewardship for containment of AMR. Efforts are also being made to incorporate the One Health approach into these plans.

Acknowledging the problem of antimicrobial resistance, the Government of India has taken series of initiatives to tackle the growing antimicrobial resistance including constitution of a National Task Force on AMR Containment in 2010 leading to development of the national policy on AMR containment in early 2011. The Ministry of Health and Family Welfare, Government of India launched the National Programme on Containment of Antimicrobial Resistance under the Twelfth Five Year Plan (2012–2017).

National Centre for Disease Control (NCDC), New Delhi is the focal point for implementation and coordination of the AMR programme. Ten network laboratories in different parts of the country are part of a surveillance network on four common bacterial pathogens of public health importance. The network laboratories and pathogens are being expanded in a phased manner and 30 laboratories are targeted in the next couple of years to generate quality data on antimicrobial resistance for pathogens of public health importance.

To promote rational use of antibiotics, national treatment guidelines for antimicrobial use in infectious diseases has been released to serve as a reference guide for hospitals in the country for formulating their own local guidelines on the basis of which physicians will be trained. National infection control policy has been drafted and is in the process of finalization for strengthening infection control practices.

The Ministry of Health and Family Welfare has recently notified 3 governance mechanisms towards this – an Intersectoral Coordination Committee, a Technical Advisory Group and a Core Working Group on AMR.

The recent political declaration/UN resolution on AMR following the high level meeting on AMR at the United Nations General Assembly is an opportunity for the technical leadership in India to leverage the current conducive policy environment for effective action against AMR.

2. Developing the National Action Plan on AMR

2.1 Governance mechanisms

The Government of India is strongly committed to tackling AMR in the country and lead the global and regional AMR agenda. The Prime Minister Shri Narendra Modi highlighted India's role in tackling AMR at the joint statement issued after the meeting with President Barack Obama of the United States of America, as well as the Government's commitment to tackle AMR during his *Mann ki Baat* address in July 2016.

Governance mechanisms are essential for effective intersectoral coordination of activities to combat AMR. They are also important to engage key stakeholders in the development of NAP-AMR to ensure their ownership during the implementation phase. Governance mechanisms need political support and authority to take actions, and are more likely to be effective with clearly defined terms of reference. The following AMR committee/groups (figure 1) were notified on 27 September 2016.

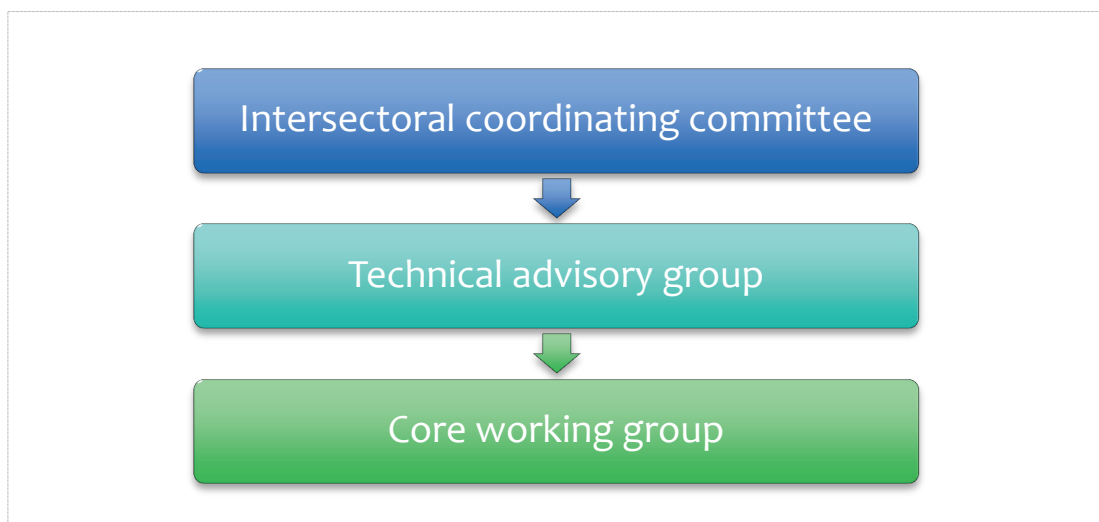


Figure 1: Key governance mechanisms for AMR

2.1.1. Intersectoral Coordination Committee on AMR

The purpose of the Intersectoral Coordination Committee on Antimicrobial Resistance (ICC-AMR) is to oversee and coordinate policy decisions for activities related to antimicrobial resistance in all sectors in alignment with AMR-related public health goals.

The ICC-AMR shall lead and facilitate the coordination of the national (along with sub-national and international) response to the threat of AMR; ensure information sharing to reinforce AMR-related activities amongst all sectors; review and revise terms of reference of the technical advisory group on AMR; ensure coordination of the health system and other sectors to achieve the AMR-related public health goals; facilitate and synergise existing and new initiatives to achieve the goal of combating AMR in India; facilitate collaboration with internal and external agencies and organizations for AMR-related activities; endorse national action plan on AMR, and ensure adequate logistic and resource mobilization to cover any funding gap; and oversee progress of efforts to combat AMR and ensure programme planning and implementation.

2.1.2. Technical Advisory Group on AMR

The purpose of the Technical Advisory Group on Antimicrobial Resistance (TAG-AMR) shall be to review the approach and initiatives for combating AMR in India and make recommendations on technical issues.

The TAG-AMR shall provide technical advice and reports to the ICC-AMR; technically review and revise the draft national action plan on AMR; provide technical oversight for existing and new initiatives to combat AMR in India; and review and revise the terms of reference of the core working group on AMR.

2.1.3. Core Working Group on AMR

The Core Working Group on Antimicrobial Resistance (CWG-AMR) shall provide technical and operational inputs to the designated national coordinating centre for AMR in India i.e. National Centre for Disease Control (NCDC) to develop and implement the National Action Plan on Antimicrobial Resistance (NAP-AMR).

The CWG-AMR shall identify and map stakeholders for AMR-related activities; lead the development of the national action plan on AMR in India with involvement of all key stakeholders; ensure regular data collection and information sharing; coordinate national activities for establishing/strengthening surveillance systems; develop and disseminate national AMR reports; and facilitate and monitor/evaluate the overall implementation of NAP-AMR. The details of these committees/groups are provided in annex 1. The Technical Advisory Group and Core Working Group are specific for governance mechanisms in the human health sector. Similar groups are needed in the other sectors to coordinate their response in tackling AMR.

3. National Action Plan on Antimicrobial Resistance

3.1 Goal

The overarching goal of the National Action Plan on Antimicrobial Resistance (NAP-AMR) is to effectively combat antimicrobial resistance in India, and contribute towards the global efforts to tackle this public health threat. It shall establish and strengthen governance mechanisms as well as the capacity of all stakeholders to reduce the impact of AMR in India. The scope of the NAP-AMR focusses primarily on resistance in bacteria.

3.2 Objectives

The following are the specific objectives of the NAP-AMR:

1. Define the strategic priorities, key actions, outputs, responsibilities, and indicative timeline and budget to slow the emergence of AMR in India and strengthen the organizational & management structures to ensure intra- & inter-sectoral coordination with a One Health approach;
2. Combat AMR in India through better understanding and awareness of AMR, strengthened surveillance, prevention of emergence and spread of resistant bacteria through infection prevention and control, optimised use of antibiotics in all sectors, and enhanced investments for AMR activities, research and innovations; and
3. Enable monitoring and evaluation (M&E) of the NAP-AMR implementation based on the M&E framework.

3.3 Strategic priorities

The NAP-AMR outlines the priorities and interventions planned to be implemented over 2017 – 2021 to tackle the public health challenge of AMR in India.

The first 5 strategic priorities of NAP-AMR (figure 2) are aligned with the Global Action Plan on AMR and the sixth strategic priority highlights India's role in containment of AMR at the international level with other countries and organizations, national disease control programmes and at the sub-national/state level through development of state action plans on AMR to ensure action at the ground level.



Figure 2: Priorities of NAP-AMR

A harmonized approach across various sectors to address the use of and resistance to antimicrobial agents in human health, animal health, agriculture, food products and the environment is critical to address these strategic priorities.

The focus areas of the six strategic priorities of NAP-AMR (figure 3) are:

1. Improve awareness and understanding of AMR through effective communication, education and training
 - a. Communication, IEC resources – to raise awareness amongst all stakeholders, including policy makers, general public and farmers
 - b. Education and training – to improve the knowledge and behaviour of professionals
2. Strengthen knowledge and evidence through surveillance
 - a. Strengthen laboratories – in human, animal, food and environment sectors – for evidence-informed policy-making
 - b. Surveillance of antimicrobial resistance – in human, animal/food and environment sectors – for evidence-informed policy-making
3. Reduce the incidence of infection through effective infection prevention and control
 - a. Healthcare – to reduce the burden of infection
 - b. Animal health/food – to reduce spread of AMR and antimicrobials through animals and food
 - c. Community and community environment – to reduce the spread of AMR and antimicrobials in the community and environment

4. Optimize the use of antimicrobial agents in health, animals and food
 - a. Regulations, access and surveillance of antimicrobial use – to ensure rational use without affecting access to antimicrobials
 - b. Antimicrobial stewardship in healthcare – to optimise use of antimicrobials in humans
 - c. Animal health, agriculture – to optimise use of antimicrobials in animal and food sectors
5. Promote investments for AMR activities, research and innovations
 - a. New medicines and diagnostics – to ensure availability of effective diagnostics and drugs to treat infections
 - b. Innovations – to develop alternative approaches to manage infectious diseases
 - c. Financing – to ensure sustainable resources for containment of AMR
6. Strengthen India's leadership on AMR
 - a. International collaborations – to ensure India's contributions towards global efforts to contain AMR
 - b. National collaborations – to facilitate collaborations among vertical disease control programmes and national stakeholders
 - c. State level collaborations – to ensure action at the ground level against AMR

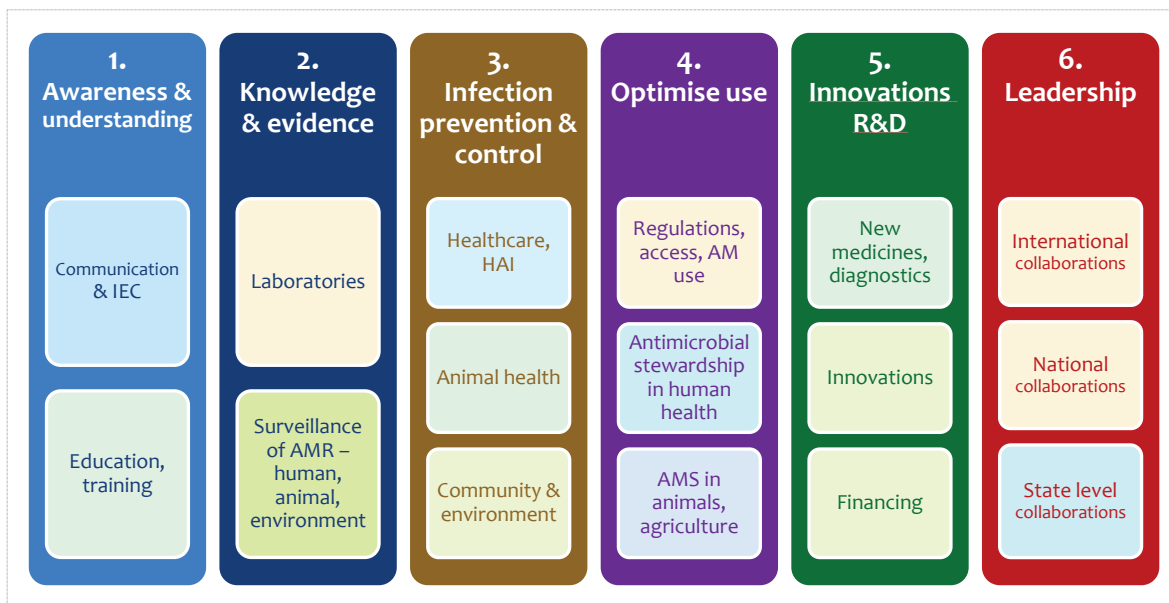


Figure 3: Focus areas of NAP-AMR strategic priorities

The National Workshop on Development of National Action Plan on AMR was organized by MoHFW, NCDC and WHO – India, on 8 – 9 December 2016 in New Delhi. The National Action Plan on AMR, revised by the sub-groups of the Core Working Group, was extensively reviewed and revised during the national workshop in December 2016. Suggestions and inputs from the Technical Advisory Group on AMR and Intersectoral Coordination Committee on AMR have also been incorporated.

3.4 National Action Plan on AMR – interventions, activities and outputs

The interventions, activities and key outputs under specific objectives of key focus areas of the strategic priorities are elaborated in the subsequent pages. Each activity has a timeline, which is classified as short term (S) with a an expected achievement in one year, medium term (M), with an expected horizon of 1-3 years and long term (L) with a 3-5 years' timeline.

Strategic priority 1

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

Awareness and communication

Objective 1.1

Increase awareness and improve communications regarding AMR in India

Strategic interventions and activities

1.1.1. Assess understanding, knowledge and awareness of antimicrobial resistance (AMR) and antimicrobial use (AMU) amongst key stakeholders/target groups

1.1.1.1. Consolidate the existing available KAP (knowledge attitude and practice) studies across general population, professionals in health, veterinary, pharmaceutical and environment, farmers and food processing sector (**ICMR, ICAR, CHEB, PHFI, MoFPI, MoCAFPD, MoEFCC**) **S**

1.1.1.2. Conduct behavioural studies and KAP surveys amongst general population (as a priority), health professionals (including AYUSH), veterinary professionals, pharmaceutical industry, environment professionals, food processing sector and farmers (**ICMR, ICAR, CHEB, PHFI, MoCF, MoFPI, MoCAFPD, MoEFCC**) **S**

Key output

- Baseline and trends in knowledge, attitude, practices and behaviour of different segments of populations on AMR and its use, in general population, farmers, professionals and industry

1.1.2. Document the existing communication and information resources and products on AMR

1.1.2.1. Identify and consolidate existing communication/information resources/products on AMR in various sectors/stakeholder groups (**CHEB, ICMR, PHFI, ICAR, MoAFW, MoEFCC, MoFPI, MoCF**) **S**

- Consolidate AMR resources (2011 onwards); identify and list national/international partners (best practices/learnings) towards consolidating the AMR database on communication

1.1.2.2. Map the expertise of stakeholders, individual and organizations (public and private) to develop communication strategy (**CHEB, ICMR, ICAR, MoAFW, MoEFCC, MoFPI, MoCF**) **S**

Key outputs

- Consolidated communication and information resources on AMR available
- Stakeholder map of communication expertise on AMR developed

1.1.3. Utilize communications to promote AMR awareness, targeting key stakeholders

1.1.3.1. Develop a cross-cutting and sustained communication programme on antimicrobial resistance and use, at national, state, district and sub-district levels

- Evidence-based communication programme with a focus on general population predominantly, followed by farmers & dairy/poultry/meat/fish suppliers and all stakeholders to promote rational use of antibiotics; focus on infection prevention through hand hygiene, clean water, sanitation, biosafety in animal farms, etc.; high impact IEC contents e.g. relatable stories from the general population in form of videos etc.; 360 degree multi-media campaign involving new as well as traditional media including mass & mid-media and inter-personal communication; incorporate awareness raising and behaviour change as essential components of any public policy; adapt and adopt features of successful AMR communication programme from other countries (individual sectors); government (centre and state) may consider a Health Cess to fund public health campaigns on AMR (Communication agency/agencies identified by **Media and Communications unit of MoHFW**, MoAFW, MoCAFPD, MoEFCC, MoIB and CHEB) **S**

1.1.3.2. Implement AMR communication programme targeting general population and key stakeholders in all sectors, through partnership & collaborative approach including NGOs and private sector (Communication agency/agencies identified by **Media and Communications unit of MoHFW**, MoAFW, MoCAFPD, MoEFCC, MoIB and CHEB) **S-M-L**

Key output

- Cross-cutting, comprehensive and sustained communication programme for AMR containment at national, state, district and peripheral level

Education and training

Objective 1.2

Improve knowledge and capacity of key stakeholders regarding AMR and related topics

Strategic interventions and activities

1.2.1. Strengthen and consolidate AMR and related topics as core components of professional education and training

- 1.2.1.1. Review and revise curricula of professionals in human health (**MCI**, DCI, PCI, INC, NBE, etc.) **S**
- 1.2.1.2. Review/revise curricula of professionals in animal health (**VCI**) **S**
- 1.2.1.3. Review/revise curricula of professionals in food industry, agriculture and environment (**VCI**, ICAR, Central Institute of Fisheries Education, MoHRD, UGC, etc.) **S**
- 1.2.1.4. Review and develop curriculum and resources for in-service training of different professionals and allied services (**MCI**, DCI, INC, PCI, VCI, NBE, CPCB, NGOs) **S-M**
 - Develop a module on AMR to bring together the segmented knowledge being imparted under different subjects (microbiology, pharmacology, medicine, PSM, etc.)

Key outputs

- Professional curricula revised
- Training module developed on AMR (for in-service and pre-service trainings)

I.2.2. Introduce concept of AMR and appropriate use of antimicrobials as part of school curriculum

I.2.2.1. Develop module on AMR and appropriate use of antimicrobials for school children (CHEB, MoHRD, CBSE/ICSE/State Education Boards) **M**

Key output

- Module on AMR and antimicrobials developed for school children

I.2.3. Strengthen capability and skills of key stakeholders

I.2.3.1. Conduct Training Needs Analysis (TNA) across all sectors (NIHFW, ICMR, ICAR, CPCB, CSE) **S**

I.2.3.2. Develop training resources (including online courses) on antibiotic resistance and use for capacity development among professionals **S** Overall responsibility: **NACA**

- Human health (NIHFW, ICMR)
- Animal health (VCI)
- Food industry (FSSAI)
- Agriculture (ICAR)
- Environment (CPCB)

I.2.3.3. Implement trainings on AMR for all key stakeholders as an essential component of the phased NAP implementation **S-M** Overall responsibility: **NACA**

- IMA (clinicians)
- IAMM (microbiologists)
- National Institute of Pharmaceutical Education and Research (NIPER) (pharmacologists)
- IAPH, IAPM (public health)
- HISI (infection control, antimicrobial stewardship)
- CSE (environmental scientists)
- ICAR (veterinarians, food and agriculture scientists)
- FSSAI (food industry)
- Social & behavioural scientists (farmers, general population)
- Academic institutes (medical, nursing, dental, veterinary and environmental science)

Key output

- National training plan and information products developed for key stakeholders in human health, animal health, food industry, feed industry, agriculture, environment and pharmaceutical industry

I.2.4. Improve inter-departmental as well as intersectoral communication

I.2.4.1. Develop a strategy towards enabling the institutions to ensure communication and data sharing among their microbiologists and clinicians (antibiotic policy, etc.) (**NACA**, ICMR) **S**

I.2.4.2. Design AMR training/orientation programmes to train composite group of representatives from all sectors and stakeholders (**NACA**) **M**

I.2.4.3. Develop a strategy towards enabling communication, interaction among different sectors

influencing AMR (**NACA**, Media and Communications unit of MoHFW, MoAFW, MoCF, MoEFCC) **S**

Key output

- Mechanisms established for inter-departmental and intersectoral communication

Key stakeholders: National Authority for Containment of Antibiotic resistance (NACA), MoHFW, MoAFW, NCDC, ICAR, ICMR, Ministry of Consumer Affairs Food and Public Distribution (MoCAFPD), Ministry of Information and Broadcasting (MoIB), Ministry of Human Resource Development (MoHRD), Medical Council of India (MCI), Indian Nursing Council (INC), Veterinary Council of India (VCI), Pharmacy Council of India (PCI), Dental Council of India (DCI), National Board of Examinations (NBE), National Institute of Pharmaceutical Education and Research (NIPER), Central Health Education Bureau (CHEB), Ministry of Chemicals and Fertilizers (MoCF), Ministry of Environment Forest and Climate Change (MoEFCC), Ministry of Food Processing Industries (MoFPI), Central Pollution Control Board (CPCB), Centre for Science and Environment (CSE), University Grants Commission (UGC), WHO, FAO, OIE, ...

Strategic priority 2

Strengthen knowledge and evidence through surveillance

Laboratory capacity

Objective 2.1

Strengthen microbiology laboratory capacity for AMR surveillance in human, animal, food and environment sectors*

Strategic interventions and activities

2.1.1. Strengthen capacity for laboratory-based surveillance of AMR in humans, animals, food and environment

- 2.1.1.1. Develop national strategy based on system/lab assessments to strengthen microbiology laboratories (including private sector) for antimicrobial susceptibility testing (AST) in medical labs, ensuring SOPs, quality assurance and community data (NCDC, ICMR) **S-M**
- 2.1.1.2. Develop national strategy based on system/lab assessments to strengthen microbiology laboratories (including private sector) for antimicrobial susceptibility testing (AST) in animals, food, ensuring SOPs and quality assurance (ICAR, DADF, FSSAI) **S-M**
- 2.1.1.3. Develop national strategy based on system/lab assessments to strengthen microbiology laboratories (including private sector) for antimicrobial resistance and antimicrobial residues in the environment, including waste from farms, factories and healthcare settings (MoEFCC, CPCB, ICMR, ICAR, NCDC) **S**
- 2.1.1.4. Strengthen capacity for laboratory-based surveillance of AMR with species level identification of bacteria in humans during health and disease; surveillance labs under national network including private sector (NCDC, ICMR)
 - **S** (<1 year): 10-15 labs; **M** (1–3 years): 15-30 labs; **L** (>3 years): >30 labs
- 2.1.1.5. Strengthen capacity for laboratory-based surveillance of AMR in animals, food and environment **M**
 - Animal sector (ICAR, DADF)
 - Food sector (FSSAI)
 - Environment sector (MoEFCC, CPCB)

* Animals include food animals (i.e. terrestrial livestock such as poultry, dairy and aquatic livestock such as fisheries), pets and other large animals. Food is primarily from animal sources and includes honey, milk, eggs, meat, fish and sea food, but does not exclude agricultural produce such as cereals, fruits and vegetables.

2.1.1.6. Establish routine EQAS for all surveillance laboratories **M-L**

- Human labs (**IAMM**)
- Animal labs (**ICAR**)
- Food labs (**FSSAI**)
- Environment labs (**MoEFCC**)

2.1.1.7. Organize joint training workshops for bacterial identification, antimicrobial susceptibility testing (AST) and data harmonization **S-M**

- Humans (**NCDC, ICMR, WHO**)
- Animals (**ICAR, DADF, FAO, OIE**)
- Food (**FSSAI, FAO**)
- Environment (**MoEFCC, UNEP**)

Key outputs

- Strategic plan developed to strengthen microbiology laboratories for AMR surveillance in humans, animals, food and environment
- Training workshops held for AST in medical labs, animal and food labs and environmental labs

2.1.2. Designate national reference laboratories for AMR surveillance in humans (also in animals, food and environment sectors) as a pre-requisite for enrolment in GLASS

2.1.2.1. Identify and strengthen national reference laboratories for confirmation and detailed characterization of target pathogens and external quality assessment scheme for AMR organized in human health (**NCDC, ICMR**) **S**

2.1.2.2. Identify and strengthen national reference laboratory(ies) for confirmation and detailed characterization of target pathogens and external quality assessment scheme for AMR in animal and food sector (**ICAR, DADF, FSSAI**) **S**

2.1.2.3. India's enrolment in GLASS – Global AMR Surveillance System (**NCDC**) **S-M**

Key outputs

- National AMR reference labs designated
- India enrolled in GLASS

Surveillance of AMR

Objective 2.3

Strengthen surveillance for AMR in humans, animals, food and environment

Strategic interventions and activities

2.3.1. Establish standards and coordination mechanisms for national surveillance of AMR

2.3.1.1. Establish an intersectoral expert group on integrated AMR surveillance (**NACA, NCDC, WHO**) **S**

2.3.1.2. Define comprehensive standards for national coordination of AMR surveillance – including surveillance standards at various healthcare levels, drug-bug combinations – in a phased approach for strengthening AMR surveillance (**NACA**) **S**

- Humans, including private sector (**NCDC**, ICMR, WHO)
- Animals (**ICAR**, DADF, OIE)
- Food (**FSSAI**, FAO)
- Environment (**CPCB**, CSE, UNEP)

2.3.1.3. Organize annual consultation to strengthen AMR surveillance (**NACA**) **S-M-L**

- Humans including private sector (**NCDC**, ICMR, WHO)
- Animals (**ICAR**, DADF, FAO, OIE)
- Food (**FSSAI**, FAO)
- Environment (**CPCB**, CSE, UNEP)

2.3.1.4. Organize annual national consultation to strengthen the AMR surveillance programme in humans, animals, food and environment (**NACA**, NCDC, ICMR, ICR, DADF, FSSAI, CPCB, WHO, FAO) **S-M-L**

Key outputs

- National AMR surveillance standards established in human, animals, food and environment

2.3.2. Standardize data analysis and information management for AMR surveillance

2.3.2.1. Define mechanisms and modalities for data collection, collation & analysis and information management at central, state and district level (including urban, rural, government, private and unorganized sector) to increase health intelligence for AMR in humans (**NACA**, NCDC, ICMR, WHO) **S**

2.3.2.2. Define mechanisms and modalities for data analysis and information management at central, state and district level for AMR surveillance in animals and food (including fisheries) (**NACA**, DADF, ICAR, FSSAI, FAO) **S**

2.3.2.3. Define mechanisms and modalities for data analysis and information management at central, state and district level for AMR surveillance in environment (**NACA**, MoEFCC) **S**

Key outputs

- National mechanisms for data analysis/information management for AMR surveillance implemented in humans, animals, food and environment

2.3.3. Strengthen AMR surveillance data/information management in human, animals, food and environment

2.3.3.1. Implement mechanisms to collate and analyse AMR surveillance data into useful information and make an online database available to all stakeholders (**NACA**) **S-M-L**

- Humans, including the private sector (**NCDC**, ICMR, WHO)
- Animals (**ICAR**, DADF, OIE, FAO)
- Food (**FSSAI**, FAO)
- Environment (**MoEFCC**)

Key outputs

- AMR surveillance database available in humans, animals, food and environment
- Annual report of national AMR surveillance with data from all sectors published

2.3.4. Establish surveillance of antimicrobial residues/contaminants in food and environment

2.3.4.1. Develop national framework for surveillance of antibiotic residues and contaminants in food from animals (**FSSAI**, MoAFW, CSE) **S**

2.3.4.2. Develop national framework for surveillance of antibiotic residues and contaminants in environment including waste from farms, factories (pharmaceutical industry, making animal feed, processing meat, dairy, fish), veterinary and human health care settings (**MoEFCC**, MoCF, MoAFW, MoHFW, CSE) **M**

2.3.4.3. Develop standards for antibiotic residues in food from animals such as chicken, eggs, milk and fish (**FSSAI**) **S**

2.3.4.4. Develop standards for antibiotic residues in industrial effluents and waste from farms, human health care and veterinary care settings (**CPCB**, MoEFCC) **M**

2.3.4.5. Collate and analyse antibiotic residue surveillance data from food into useful information (**ICAR**, DADF, FSSAI) **M**

2.3.4.6. Collate and analyse antibiotic residue surveillance data from environment into useful information (**CPCB**, MoEFCC, ICMR, ICAR) **M**

Key outputs

- Standards for antibiotic residues, national framework and results of surveillance of antibiotic residues in food and linkages with AMR developed and published
- Standards for antibiotic residues, national framework and results of surveillance of antibiotic residues in environment and linkages with AMR developed and published

Key stakeholders: NACA, NCDC, ICMR, DADF, ICAR, FSSAI, MoEFCC, Ministry of Drinking Water and Sanitation (MoDWS), Bureau of Indian Standards (BIS), Central Pollution Control Board (CPCB), Indian Association of Medical Microbiologists (IAMM), Centre for Science and Environment (CSE), WHO, FAO, OIE, UNEP, ...

Strategic priority 3

Reduce the incidence of infection through effective infection prevention and control

Infection prevention and control (IPC) in healthcare

Objective 3.1

Develop and establish a stratified national plan for IPC in health care

Strategic intervention and activities

3.1.1. Ensure development and implementation of infection prevention and control policies and strategies across all tiers of healthcare system

3.1.1.1. Define terms of reference and scope and establish **National Coordinating Unit (NCU)** for infection prevention and control (**NACA**, Patient Safety Unit, MoHFW) **S**

3.1.1.2. Define core elements of IPC, and establish standardized definitions for these elements at different tiers of health care settings in public and private facilities (**NCU**, MoHFW, WHO) **S**

3.1.1.3. Conduct IPC assessments and gap analyses at different levels and all categories of health care settings (**NCU**) **S-M**

3.1.1.4. Streamline hand hygiene and sanitation as components of performance monitoring/performance payment within different schemes or quality programmes like **Swachh Bharat Abhiyaan**, **Kayakalp** and **Swachh Swasth Sarvatra** initiatives (**MoDWS**, MoHFW) **S**

3.1.1.5. Develop national IPC standards and targets in different tiers of healthcare settings, and a phased implementation plan based upon risk and need based matrix, patient and healthcare worker/ professionals/attendants/vendors and community safety, designing interventions, including reuse of single use devices (**NCU**) **S**

3.1.1.6. Develop national IPC implementation plan (in a phased approach) based upon risk and need based matrix, patient and healthcare worker/ professionals/attendants/vendors and community safety with clearly defined interventions (**NCU**) **S**

3.1.1.7. Establish a standardized surveillance program on health care associated infections (HCAIs) in a tiered network that utilizes uniform case definitions, methodologies, and reporting mechanisms (**NCU**) **M-L**

3.1.1.8. Develop capacity – infrastructure and skilled human resources with adequate financial resources to implement the national IPC plan (**NCU**) **S-M-L**

3.1.1.9. Develop monitoring and evaluation framework to assess the phased implementation of national IPC plan (**NCU**) **S-M**

3.1.1.10. Incorporate IPC in curricula for education and training of professionals in human health (**NCU**) **S-M**

Key outputs

- IPC national coordinating unit established and its scope defined
- Core elements of IPC for different tiers of health care settings established
- National IPC standards developed and targets defined
- National IPC plan with M&E framework endorsed and implemented
- National HAI surveillance established in identified facilities

Infection prevention in animal health

Objective 3.2

Establish IPC programmes in veterinary settings and animal husbandry

Strategic intervention and activities

3.2.1. Ensure development and implementation of infection prevention and control programme in animal and food sector

3.2.1.1. Include biosafety, biosecurity, hygiene and infection prevention and control in curricula for education and training of animal health and food professionals and workers (**VCI**, **DADF**, **MoAFW**, **MoHRD**, **CPCB**) **M**

3.2.1.2. Establish IPC coordinating unit within MoAFW (at centre and state levels), with designated staff and defined terms of reference (**MoAFW**, **CPCB**) **S**

3.2.1.3. Train staff in KVK and village level for biosafety and biosecurity principles and practices (**DADF**, **MoAFW**) **M-L**

3.2.1.4. Increase awareness in community for good production practices (proper hygiene/sanitation/practices of IPC); demonstrate profitability in various production systems (Extension services – **Krishi Vigyan Kendra** [KVK], **MoAFW**, **Pashumitra**) **S-M-L**

3.2.1.5. Develop, implement and monitor the national plan for IPC in animal and food sector (**DADF**, **MoFPI**, **CPCB**) **M**

Key outputs

- IPC programme for animal and food sector implemented and monitored at national and sub-national level

Hygiene, sanitation and infection prevention in the community

Objective 3.3

Strengthen infection prevention outside healthcare settings to limit the development and spread of AMR

Strategic interventions and activities

3.3.1. Promote personal hygiene through behavioural change activities

3.3.1.1. Assess knowledge and practices of personal hygiene in different social groups (**NCU**, **MoDWS**) **S**

3.3.1.2. Develop behaviour change communication and social mobilization campaigns to promote IPC (**NCU**, hired professional experts) **M**

3.3.1.3. Implement sustained IPC campaigns that are socially and culturally acceptable in local context, under the aegis of **Swachh Bharat Abhiyaan** and **Kayakalp program** in collaboration with academic organizations and communication experts (**NCU**, MoHFW, MoDWS) **M**

3.3.1.4. Ensure engagement of mass media and new IT tools (mobile technology etc.) (**NCU**, UNICEF) **S**

3.3.1.5. Ensure appropriate immunization against VPDs (**Immunization Division**, MoHFW) **M**

3.3.1.6. Involve community leaders in media campaigns, information, education, communication at village level, schools, showcase importance in the community (**MoDWS**, UNICEF, NGOs) **S**

Key output

- Behaviour change communication and social mobilization campaign developed and implemented

3.3.2. Strengthen infection prevention and hand hygiene compliance, in different social groups

3.3.2.1. Assess knowledge, attitude & practice of IPC (with emphasis on hand hygiene) in different social groups in community (**NCU**, MoDWS, UNICEF, NGOs) **S**

3.3.2.2. Develop national hand hygiene campaign in alignment with Global Hand Hygiene Day (**NCU**, MoDWS, UNICEF, HISI, NGOs) **M**

3.3.2.3. Implement IPC campaign under the aegis of **Swachh Bharat Abhiyaan** and **Kayakalp program** in collaboration with academic organizations (**NCU**, MoDWS, UNICEF, HISI, NGOs) **S**

3.3.2.4. Reinforce behaviour change through IEC and social mobilization campaigns to promote personal hygiene including patient attendants (**NCU**, MoDWS, UNICEF, NGOs) **M-L**

3.3.2.5. Educate and train children about importance of hand hygiene at school level (**NCU**, MoHRD, UNICEF) **S**

3.3.2.6. Enhance awareness of IPC and hand hygiene amongst farmers and fishermen (**Krishi Vigyan Kendras/Pashumitras**) **S-M-L**

Key outputs

- Documentation of KAP study on IPC practices, emphasis on hand hygiene
- Hand hygiene campaign implemented

Objective 3.4

Align healthcare support industry with infection prevention and control

Strategic intervention and activities

3.4.1. Develop and strengthen alliances for IPC

3.4.1.1 Identify area of collaboration keeping healthcare need, patients and healthcare workers' safety and long-term industry perspective in alignment (**NCU**) **S-M**

3.4.1.2. Collaborate with other Government bodies and ministries, regulatory and industry

partners as needed (NCU) **S-M-L**

3.4.1.3. Establish a board for IPC professionals in public and private healthcare institutions, to review devices or modalities in healthcare, to review infection prevention and control mechanisms and adequacy (NCU) **M-L**

3.4.1.4. Align health care support industry to manufacture single-use devices (SUDs) in line with the **Make in India** initiative (NCU) **S-M**

Reduce environmental spread of AMR

Objective 3.5

Reduce environmental contamination with resistant genes, resistant pathogens and antimicrobial residues

Strategic intervention and activities

3.5.1. Develop strategic interventions to reduce impact of AMR on the environment

3.5.1.1. Develop policy on registration of farms, factories, slaughter houses, wet markets, aquaculture units, food processing units, feed manufacturers, health care facilities, veterinary care facilities (NACA, MoEFCC, MoAFW, MoHFW, MoFPI, CDSCO) **M-L**

3.5.1.2. Based on environment risk assessment develop guidelines for locating farms, factories, slaughter houses, wet markets, processing units, feed manufacturers, health care facilities, veterinary care facilities; ensuring compliance by strengthening existing guidelines and enforcement strategies related to payments, benefits, etc. (MoEFCC, MoHFW, MoAFW, MoFPI) **M-L**

3.5.1.3. Develop policy & implementation mechanisms on extended producers responsibility for expired/unused antibiotics (CDSCO, DoP/MoCF) **M-L**

3.5.1.4. Develop and implement a strategy and operational plan to reduce environmental impact on AMR (NACA, MoEFCC, CPCB) **S-M-L**

- Define standards and monitor antibiotic residues and bacterial load in effluents (**S-M-L**); disinfection at treatment plant to remove bacteria (**S**); using waste from unorganized sector to generate biogas (**M**); develop necessary legislation, awareness & incentives; develop tool for environment risk assessment; develop SOPs and implement best practices (**S-M-L**)
- Include biosecurity in farmer-field school curriculum (**S**); sector-specific manuals and guidelines to improve environmental management of AMR (**M**)

Key output

- National plan to reduce environmental impact of AMR developed and implemented

Key stakeholders: NACA, MoHFW, MoAFW, MoEFCC, MoDWS, Ministry of Food Processing Industries, NCDC, DADF, ICAR, ICMR, HISI, CSE, CPCB, SPCB, WHO, FAO, UNEP, ...

Strategic priority 4

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

Regulated access to high-quality antimicrobials

Objective 4.1

Ensure uninterrupted access to high-quality antimicrobial medicines

Strategic intervention and activities

4.1.1. Strengthen national regulatory authorities for improved quality, safety and efficacy of antimicrobials

4.1.1.1. Review and strengthen national regulatory authority and regulations regarding use and access to antimicrobials, as per levels of healthcare (**NACA, CDSCO, MoHFW, DoP, WHO**)

S-M-L

- Regulatory enforcement to prohibit sale of antimicrobials as OTC under Drugs & Cosmetics Act, and Rules; identify unlicensed pharmacies and unqualified medical practitioners and prescribers; organize studies on antibiotic sales to understand incentives to sell or buy antibiotics; review categorization of high end antimicrobials as well as new antibiotics in Schedule X/HI of national regulations; create a focal point for networking for information exchange among states, and establish an online forum on use and access as per level of healthcare; expedite regulatory processes to ensure uninterrupted supply of quality assured antimicrobials; regulate the availability of probiotics without resistance determinants

4.1.1.2. Strengthen and enforce regulations to minimise substandard, spurious, falsely labelled and falsified antimicrobials (**CDSCO**) **S-M-L**

4.1.1.3. Establish a quality management system for supply chain management of antimicrobials (**Department of Pharmaceuticals/MoCF, MoHFW**) **S-M-L**

- Strengthen governance to ensure uninterrupted supply of quality antimicrobials
- Monitor safety of new antimicrobials through pharmacovigilance and strengthen regulations to eliminate substandard and spurious antimicrobials

Key outputs

- National regulatory authority strengthened and regulations implemented
- Quality management system implemented for supply chain management of antimicrobials

4.1.2. Create/develop and enforce enabling regulatory framework and intersectoral coordination for regulations on use of antimicrobials in animals and food safety

- 4.1.2.1. Establish independent veterinary regulatory authority (**NACA, MoAFW, FSSAI**) **S-M**
- 4.1.2.2. Restrict and phase-out non-therapeutic use of antimicrobials such as their use as growth promoters and disease prevention in animals (**Veterinary Regulatory Authority, CDSCO**) **S-M-L**
- 4.1.2.3. Foster development of antimicrobial policies and evidence-based standard treatment guidelines for food animals (**ICAR, MoAFW**) **S-M**
- 4.1.2.4. Restrict and gradually eliminate the use of restricted antibiotics, which are critically important for humans in non-human sectors especially food-producing animals (**Veterinary Regulatory Authority, FSSAI, CDSCO**) **M-L**
- 4.1.2.5. Restrict antibiotics in animal feed, feed premix; ensure registration and use of registered products only; regulate their importation, direct distribution and online marketing; ensure appropriate labelling (**Veterinary Regulatory Authority, BIS, CDSCO, ICAR, DADF**) **S**
- 4.1.2.6. Ensure prescription sale of antibiotics and their use under supervision; regulate bulk selling, importation and labelling for species-specific use (**CDSCO**) **S**
- 4.1.2.7. Ensure labelling of food from animals produced with or without routine use of antibiotics (**FSSAI**) **S**
- 4.1.2.8. Develop policy for freshwater/inland fisheries to regulate freshwater/inland fisheries (**FSSAI**) **S**
- 4.1.2.9. Fast track implementation of the Codex Alimentarius and OIE guidelines on antimicrobial resistance (**DADF, Veterinary Regulatory Authority, FAO, OIE**) **S-M-L**

Key output

- Regulatory authority established for rational use of antibiotics in food and animal sector

Surveillance of antimicrobial use

Objective 4.2

Establish the national surveillance system for antimicrobial use

Strategic intervention and activities

4.2.1. Institutionalise national surveillance system for antimicrobial use (AMU) in humans, animals, agriculture & food sectors

- 4.2.1.1. Develop methodology to estimate national consumption of antibiotics through an expert consultation (**NACA, MoHFW, MoAFW, WHO, FAO**) **S**
- 4.2.1.2. Use AMC tool to measure consumption of antibiotics at healthcare facilities (**MoHFW, WHO**) **S-M-L**
- 4.2.1.3. Ensure registration of and data collection from manufacturers, sellers, prescribers and bulk users (farmers and feed manufactures) of antibiotics (**CDSCO, DADF**) **S**
- 4.2.1.4. Standardise tools to measure consumption of antibiotics in animal health facilities, food and

agriculture (**MoAFW**, FAO, CDSCO, NPPA) **S-M**

4.2.1.5. Organise training workshops to develop capacity to measure consumption and use of antibiotics (**MoHFW**, MoAFW, WHO, FAO) **S-M-L**

4.2.1.6. Organize national consultation to strengthen AMU surveillance programme in human, animal and food sectors (**NACA**, **MoHFW**, CDSCO, MoAFW) **S-M-L**

4.2.2. Establish a monitoring system to assess antimicrobial consumption in humans, animals & food sectors

4.2.2.1. Develop monitoring framework to estimate national consumption of antimicrobials through an expert consultation (**NACA**, **MoHFW**, MoAFW, WHO, FAO) **M-L**

4.2.3. Foster optimal use of antimicrobials

4.2.3.1. Ensure capacity development of institutions for antibiotic audits and feedback to ensure optimal use (**MoHFW**, WHO) **S-M-L**

4.2.3.2. Regulate the establishment of committees to develop and update hospital formularies and STGs; provide training, CME, establish system for audits and review (**MoHFW**, CDSCO, WHO) **M-L**

4.2.3.3. Implement systems to ensure compliance with standard treatment guidelines (STGs) (**MoHFW**, DME) **M-L**

Key outputs

- National surveillance for antimicrobial use established in human, animal and food sectors
- Feedback mechanism established for all stakeholders
- Annual national AMU surveillance report published and disseminated

Antimicrobial stewardship in human health

Objective 4.3

Improve appropriate use of antimicrobials in healthcare

Strategic interventions and activities

4.3.1. Establish antimicrobial stewardship programmes in healthcare facilities

4.3.1.1. Harmonize and regularly update national antimicrobial use guidelines; encourage development and use of similar guidelines at regional, and district level facilities (**NCDC**) **S**

4.3.1.2. Ratification and dissemination of national guidelines from stakeholders (**NCDC** & professional associations – IMA, IDA, API, FOGSI, IAP, HISI, ASI, etc.) **S**

4.3.1.3. Define terms of reference for multidisciplinary antimicrobial stewardship committees and teams at various levels of healthcare facilities, with M&E framework (**NCDC**) **S**

- Expert consultation to develop the terms of reference for antimicrobial stewardship (AMS) committees/teams at various levels of health care facilities

4.3.1.4. Develop resources for AMS programmes and implement trainings in a phased manner (**Hospital division** – MoHFW, professional associations) **S**

- Identify a diverse pool of technical experts for collecting and collating evidence for national AMSP; and creating training packages and resources

- Engage or identify centre(s) with capability for providing e-training and e-resources for self-learning and refresher trainings
- 4.3.1.5. Establish M&E framework for antimicrobial stewardship (**Hospital division – MoHFW**) **S**
- Expert consultation to develop M&E framework for AMS programmes at different levels of healthcare facilities
- 4.3.1.6. Develop operational plan to implement facility-based AMS programmes at different levels of healthcare; identify and strengthen capacities of 6-8 institutions in different parts of country with functional AMSP who are willing to be future nodal centres for regional trainings (**Hospital division – MoHFW**) **M**
- 4.3.1.7. Implement the operational plan at selected tertiary care hospitals, district hospitals, sub-district and primary healthcare facilities in a phased manner (**Hospital division – MoHFW**) **M**
- 4.3.1.8. Develop robust data management systems for AMS programmes that also facilitate the generation of facility-level specific or regional antibiograms (**Hospital division – MoHFW**) **M**
- 4.3.1.9. Streamline antibiotic use in various central and state schemes by introducing quality indicators linked to performance monitoring/appraisal and innovative financial mechanisms (**Hospital division – MoHFW**) **M**

Key outputs

- Antimicrobial stewardship programmes implemented in selected health facilities in a phased manner
- Regular review of AMS programmes done

Objective 4.4

Improve appropriate use of antimicrobials in the community

Strategic interventions and activities

4.4.1. Increase awareness of appropriate antimicrobial use among provider, dispenser, and consumer populations

- 4.4.1.1. Develop awareness campaigns targeted at prescribers, providers and dispensers regarding existing rules/law and appropriate use of antimicrobials (**NACA, MoHFW, NIHFW, CHEB, UNICEF, WHO, NGOs**) **S-M-L**
- 4.4.1.2. Develop awareness campaigns targeted at consumers and community, including schools and colleges, regarding patient risks of inappropriate antibiotic use (**NACA, MoHFW, NIHFW, UNICEF, MoHRD, CBSE, NGOs**) **S-M-L**

4.4.2. Monitor antimicrobial use in community settings

- 4.4.2.1. Use AMC tool to measure antimicrobial use in community settings, including standalone clinics and pharmacies (**MoHFW**) **S-M-L**
- 4.4.2.2. Initiate surveillance to measure antimicrobial use in selected community settings (**MoHFW**) **S-M-L**

Objective 4.5**Strengthen the legislation regarding various facets of antimicrobials***Strategic intervention and activities***4.5.1. Strengthen legislation to regulate prescription and dispensing of antimicrobials**

4.5.1.1. Organize a consultation with regulatory bodies to review current legislations on antimicrobial prescription and feasibility to strengthen existing legislations and introduce new legislations (**NACA, CDSCO, MoHFW, FSSAI**) **S-M**

4.5.1.2. Identify additional regulatory interventions or support needed to effectively implement Schedule H1 and X restrictions (**NACA, CDSCO, MoHFW**) **S-M-L**

Key output

- Legislation and regulations strengthened and implemented to optimise use of antibiotics

Objective 4.6**Improve knowledge and skills of prescribers, dispensers and medical trainees***Strategic intervention and activity***4.6.1. Develop structured (and mandatory) training programmes on optimal antimicrobial use**

4.6.1.1. Collaborate with regulatory bodies to mandate periodic training to optimise antibiotic use through pre-service and in-service trainings (**NACA, MoHFW, MCI, PCI, DCI, INC**) **S-M-L**

4.6.1.2. Promote measures for overall health improvement and service delivery (Maternal/child health and Immunization division, NHM, MoHFW) **M**

- Detect and treat malnutrition at an early stage
- Ensure up-to-date vaccination
- Prevent sexually transmitted diseases
- Early diagnosis of malaria and viral infections to reduce antibiotic use

4.6.1.3. Develop strategies to improve efficacy and broaden coverage of existing vaccines and their usage, especially by at-risk population e.g. Haemophilus influenza type b (Hib), Influenza, pneumococcal and typhoid vaccines (Immunization division, MoHFW)

Key output

- Collaborations forged for improving knowledge and skills relating to antimicrobial use

Antimicrobial stewardship and policies in animal husbandry and food**Objective 4.7****Improve and ensure appropriate use of antimicrobials in animals***Strategic intervention and activities***4.7.1. Establish antimicrobial stewardship programmes for rational use of antimicrobials in animal facilities, agriculture, and food processing units**

4.7.1.1. Develop and implement operational plan for antimicrobial stewardship (AMS) in animal

facilities, with a One Health approach (**DADF**, MoAFW, MoFPI, MoEFCC, FAO) **M-L**

- Support small and mid-size poultry, dairy and fish farmers to reduce use of antibiotics, avoid non-therapeutic use and move to safer alternatives; issue “pond health cards” to promote the health of fish farms through a systematic farm-specific assessment and feedback mechanism; develop and implement biosecurity practices across food animal production sectors and support small-and-medium scale farmers

Key output

- Antimicrobial stewardship programmes implemented in animal facilities

4.7.2. Establish and implement national policies on use of antimicrobial agents in animals and agriculture

4.7.2.1. Develop national plan on restricting (ban/phase off) use of critically important antibiotics (**NACA**, MoAFW, CDSCO, CSE, ICAR, VCI, DADF) **S-M**

- Evidence-based policy guided by data generated from well implemented antimicrobial stewardship programmes across various sectors

4.7.2.2. Implement and monitor national plan to restrict use of critically important antibiotics in animals/agriculture (**NACA**, MoAFW, CDSCO) **M-L**

- Existing advisory on use of antibiotics in food producing animals 2014, should be updated clearly stating a plan for implementation, backed up by strong legislative support; develop national level monitoring targets and indicators for critically important antibiotics in animals/agriculture

Key output

- System established and implemented to restrict use of critically important antibiotics in animals and agriculture

Key stakeholders: NACA, MoHFW, CDSCO, MoAFW, NCDC, ICAR, ICMR, CDSCO, CSE, FAO, OIE, WHO, ...

Strategic priority 5

Promote investments for AMR activities, research and innovations

Financing for AMR

Objective 5.1

Prepare the economic case for sustainable investments for AMR interventions

Strategic intervention and activities

5.1.1. Strategize to secure sustainable funds for implementation of the NAP-AMR

- 5.1.1.1. Assess impact of AMR – morbidity, mortality and cost of AMR in India (**NACA**, IEG, PHFI, ICMR, WHO) **S**
- 5.1.1.2. Develop the operational plan (with costs) of the plan to implement NAP-AMR (**NCDC**, **NACA**, MoHFW, WHO) **S**
- 5.1.1.3. Estimate the investment gap for NAP-AMR, and develop resource mobilization plan for sustainable action against AMR (**NACA**, MoF) **S**
- 5.1.1.4. Define centre-state & other stakeholders' roles in implementation & financing (**NACA**, NITI Aayog) **S**
- 5.1.1.5. Develop a long term resource mobilization plan with clear roles of different stakeholders (**NACA**, all ministries) **S-M**

Key outputs

- Impact of AMR and cost-benefit analysis documented
- Resource mobilization plan endorsed and implemented

Research and innovations

Objective 5.2

Identify priorities for basic and operational research to optimize use of antimicrobials and improve infection prevention and control in human and animal health

5.2.1. Foster research and innovations to tackle AMR

- 5.2.1.1. Review need for new medicines, vaccines and diagnostics as well as other innovations (**ICMR**, ICAR, DBT, CSIR, AYUSH Research Council, MoST)
- 5.2.1.2. Define research priorities for AMR innovations (**ICMR**, ICAR, DBT, CSIR, AYUSH Research Council) **S**
- 5.2.1.3. Innovations and research interventions in respect of developing alternatives to antimicrobials and adjuvant remedies for infectious diseases (**AYUSH Research Council**, MoST) **S-M-L**
- 5.2.1.4. Develop and implement strategy/plan to promote/fast-track research for innovations to

tackle AMR (**ICMR**, ICAR, DBT, CSIR, MoST) **S-M-L**

Key outputs

- National research priorities for AMR defined and published
- National strategy/plan developed to foster research and innovations to tackle AMR
- Development of new antibiotics, alternative tools and diagnostics supported

5.2.2. Prepare a national operational research agenda

5.2.2.1. Organize expert consultation to identify current gaps in knowledge and priority topics for research (**ICMR**, ICAR, DBT, CSIR) **S**

5.2.2.2. Publish the national research agenda for AMR (**ICMR**, ICAR, DBT, CSIR) **S-M-L**

Key output

- Annual publication of operational research agenda on AMR

5.2.3. Encourage research for evidence-informed policy-making

5.2.3.1. Coordinate basic research projects in humans, animals, food and environment sectors (**ICMR**, ICAR, DBT, CSIR) **S-M-L**

5.2.3.2. Fund and pilot basic and operational research projects in humans, animals, food and environment (**ICMR**, ICAR, DBT, CSIR) **S-M-L**

Key output

- Evidence generated based on AMR research

Key stakeholders: NACA, MoHFW, MoAFW, AYUSH Research Council, ICAR, ICMR, DoP, CSIR, DBT, PHFI, Ministry of Finance (MoF), Ministry of Science and Technology (MoST), FAO, OIE, WHO, ...

Strategic priority 6

Strengthen India's commitment and collaborations on AMR at international, national and sub-national levels

International role

Objective 6.1

Strengthen India's commitment on AMR through collaborations

Strategic intervention and activities

6.1.1. Strengthen intersectoral coordination of AMR activities

6.1.1.1. Establish and strengthen cross-cutting intersectoral coordinating mechanisms on AMR, for oversight of India's multi-sector AMR initiatives/response at the highest level (by HFM and PMO) (NACA, MoHFW, NITI Aayog) **S**

6.1.1.2. Review India's existing collaborations on AMR and identify priority areas of action to strengthen the coordination mechanisms (NACA, MoHFW, WHO) **S**

Objective 6.2

Strengthen international collaborations to promote India's contribution towards tackling AMR

Strategic intervention and activities

6.2.1. Strengthen and streamline international collaborations on AMR and with donors and partners

6.2.1.1. Review India's existing collaborations on AMR and identify priority areas as well as coordination mechanisms (NACA, MoHFW, WHO) **S**

6.2.1.2. Establish an annual forum on AMR for donors and partners to share information and facilitate coordinated mobilization of resources for prioritized AMR activities (NACA, MoHFW, WHO) **S-M-L**

6.2.1.3. Collaborate with other countries to combat AMR (NACA, MoHFW, NCDC, ICMR, DADF, ICAR) **S-M-L**

Key output

- International collaborations strengthened and established

National role

Objective 6.3

Strengthen national collaborations to tackle AMR with disease control programmes

Strategic intervention and activities

6.3.1. Strengthen drug resistance containment activities & linkages

6.3.1.1. Strengthen HIV/STI resistance activities (NACO, NACP) **S-M-L**

6.3.1.2. Strengthen MDR/XDR-TB activities (CTD, RNTCP) **S-M-L**

6.3.1.3. Strengthen drug resistance activities for malaria (NVBDCP) **S-M-L**

6.3.1.4. Strengthen drug resistance activities in Leprosy and NTDs (NLP) **S-M-L**

6.3.1.5. Strengthen IDSP's AMR activities (IDSP) **S-M-L**

6.3.1.6. Establish linkages to share best practices and information amongst vertical disease programmes and national AMR programme (NACA, MoHFW) **S-M-L**

Key output

- Integrated AMR containment in alignment with vertical disease programmes

Sub-national role

Objective 6.4

Strengthen sub-national collaborations to tackle AMR

Strategic interventions and activities

6.4.1. Establish AMR as a state-level priority

6.4.1.1. Convene state-level advocacy meetings to prioritise action against AMR with One Health approach (NACA, MoHFW, MoAFW, National Health Mission (NHM), MoEFCC, MoDWS, WHO, FAO) **S-M-L**

6.4.2. Develop State Action Plans on Containment of Antibiotic Resistance (SAP-CAR) aligned to NAP-AMR

6.4.2.1. Convene regional stakeholder workshops to develop SAP-CAR (NACA, MoHFW, MoAFW, MoEFCC, MoDWS, WHO, FAO) **S-M-L**

6.4.2.2. Organize a stakeholder consultation on SAP-CAR in selected states (in first phase) (State Governments) **S**

Key output

- SAP-CAR developed – in 5 selected states in first phase – and subsequently in all States/UTs

Key stakeholders: NACA, MoHFW, MoAFW, MoEA, NCDC, CWG-AMR, ICMR, MoF, donors and partners, key officials/AMR stakeholders in states, NITI Aayog, PMO office, NACO, CTD, NVBDCP, NLEP, IDSP, WHO, ...

3.5 Monitoring and evaluation plan

Monitoring and evaluation (M&E) is an integral part of the national action plan on AMR to ensure objective review and monitoring of the implementation progress. The M&E framework shall be finalised based on the final national action plan, and shall be developed according to the draft outline below.

Planning element (activity linked to the NAP-AMR)	Indicator	Type and purpose	Value (calculation)	Frequency of data collection	Data source	Method	Baseline	Target
Measure awareness and knowledge of AMR in different social and professional groups	Level of awareness by target group	Assessment, baseline survey, monitoring and evaluation of outcome	Awareness scores stratified by target group (composite indicator)	Baseline, and periodic (based on schedule of awareness campaigns)	Baseline survey, post-intervention survey reports	Awareness survey; knowledge-attitude-practice (KAP) studies	Measured in baseline survey	50% increase over baseline score
Awareness/behaviour change communication campaign on AMR and AMU	Number of IEC resources developed	Monitoring and evaluation of output	IEC resources stratified by stakeholders	Annually	Baseline, post-campaign	Awareness campaign report	None	Based on NAP
Review and consolidate AMR in curricula for health professionals	Revised curricula available for target professional groups	M&E of input	Yes/No No. of curricula / No. of professional groups targeted	Annually	Key informant at MoHFW	Key informant interview	...	Revised curricula with AMR
Review and consolidate AMR in curricula for professionals in animal health, food industry and agriculture	Revised curricula for target professional groups	M&E of input	Yes/No No. of curricula / No. of professional groups to target	Annually	Key informant at MoAFW, MoEFCC	Key informant interviews	...	Revised curricula with AMR

Planning element (activity linked to the NAP-AMR)	Indicator	Type and purpose	Value (calculation)	Frequency of data collection	Data source	Method	Baseline	Target
Write and approve terms of reference for a national coordinating centre for AMR surveillance	National coordinating centre terms of reference approved	M&E of input	Yes/No	Annually	Key informant at MoHFW	AMR surveillance programme implementation report	No terms of reference for national coordinating centre	Defined ToR for national coordinating centre
Write and approve terms of reference for national reference laboratory(ies) (NRL[s])	National reference lab terms of reference written and approved	M&E of input	Yes/No	Annually	Key informant at MoHFW	AMR surveillance programme implementation report	No terms of reference for NRL	Defined terms of reference for NRL
Write and approve terms of reference for a national infection prevention and control coordinating unit	IPC unit terms of reference written and approved	M&E of input	Yes/No	Annually	Key informant at MoHFW	IPC programme implementation report	No terms of reference for IPC unit	Defined terms of reference for IPC unit
Establish a quality management system for the medicines supply chain	QMS established and introduced	M&E of input	Yes/No	Annually	Key informant Department of Pharmaceuticals, CDSCO	Key informant interview	No quality management system	Quality management system implemented
Write generic terms of reference (ToR) for multidisciplinary antimicrobial stewardship committees and teams	Antimicrobial stewardship committees ToR written and approved	M&E of input	Yes/No	Annually	Key informant at MoHFW	Key informant interview	No terms of reference for antimicrobial stewardship committees	Defined ToR for AMS committees
Engage relevant experts to identify research topics on AMR	Draft research agenda prepared	M&E of input	Yes/No	Annually	Key informant at MoHFW	Key informant interview	No research agenda	Defined AMR research agenda

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Annex I: Governance committees/groups for AMR

Intersectoral Coordination Committee on AMR (ICC-AMR)

The purpose of the Intersectoral Coordination Committee on Antimicrobial Resistance is to oversee and coordinate policy decisions for activities related to antimicrobial resistance in all sectors in alignment with AMR-related public health goals.

Terms of reference

- Lead and facilitate the coordination of the national (along with sub-national and international) response to the threat of AMR;
- Ensure information sharing to reinforce AMR-related activities amongst all sectors;
- Review and revise terms of reference of the technical advisory group on AMR;
- Ensure coordination of the health system and other sectors to achieve the AMR-related public health goals;
- Facilitate and synergise existing and new initiatives to achieve the goal of combating AMR in India;
- Facilitate collaboration with internal and external agencies and organizations for AMR-related activities;
- Endorse national action plan on AMR, and ensure adequate logistic and resource mobilization to cover any funding gap; and
- Oversee progress of NAP-AMR and ensure programme planning and implementation.

Constitution of the ICC-AMR

- | | |
|---|------------------|
| • Secretary (Health & Family Welfare), MoHFW | Chair |
| • Secretary, Department of Animal Husbandry, Dairying and Fisheries | Member |
| • Secretary, Department of Health Research and DG, ICMR | Member |
| • Secretary, Department of Biotechnology | Member |
| • Secretary, CSIR | Member |
| • Director General of Health Services, MoHFW | Member |
| • Special DGHS, Ministry of Health and Family Welfare | Member |
| • Additional Secretary, Ministry of Health and Family Welfare | Member |
| • Joint Secretary, DADF | Member |
| • Joint Secretary, Ministry of Food Processing Industries | Member |
| • Joint Secretary, Ministry of Environment, Forest and Climate change | Member |
| • Joint Secretary, Department of Pharmaceuticals | Member |
| • Joint Secretary, Ministry of Information and Broadcasting | Member |
| • Joint Secretary, Ministry of Finance | Member |
| • Joint Secretary, Ministry of Health and Family Welfare | Member-Secretary |

Frequency of meetings

- It is proposed that the ICC-AMR shall meet at least once every quarter.
- The frequency of meetings shall be decided in the first meeting of the ICC-AMR.

Technical Advisory Group on AMR (TAG-AMR)

The purpose of the Technical Advisory Group on Antimicrobial Resistance shall be to review the approach and initiatives for combating AMR in India and make recommendations on technical issues.

Terms of reference

- Provide technical advice and reports to the Inter-Sectoral Coordination Committee on Antimicrobial Resistance (ICC-AMR);
- Technically review and revise the draft NAP-AMR;
- Provide technical oversight for initiatives to combat AMR in India; and
- Review and revise the terms of reference of the core working group on AMR.

Constitution of TAG-AMR

- | | |
|--|-------------|
| • Director General of Health Services, MoHFW | Joint Chair |
| • Secretary, Department of Health Research and DG, ICMR | Joint Chair |
| • Special DGHS, Ministry of Health and Family Welfare | Member |
| • Drug Controller General of India (DCGI) | Member |
| • Commissioner, Department of Animal Husbandry | Member |
| • Director, CSIR | Member |
| • Representative, Food Safety and Standards Authority of India (FSSAI) | Member |
| • Representative, Ministry of Environment, Forest and Climate Change | Member |
| • Representative, DADF | Member |
| • Representative, Department of Agricultural Research and Education | Member |
| • Representative, Department of AYUSH | Member |
| • Representative, Ministry of Information and Broadcasting | Member |
| • Representative, Department of Biotechnology | Member |
| • Representative, Department of Pharmaceuticals | Member |
| • Representative, National Health Mission | Member |
| • President, Medical Council of India | Member |
| • President, Pharmacy Council of India | Member |
| • National President, Indian Medical Association | Member |
| • WHO Representative to India | Member |
| • Visiting Professor of Eminence | Member |
| • Director, JIPMER, Puducherry | Member |
| • Head, Pediatrics, KSCH & LHMC | Member |

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| • Addl. DG, MS RML Hospital & Director PGIMER | Member |
| • Prof. and Head, Pulmonary Medicine and Sleep Disorder, AIIMS | Member |
| • Senior Consultant, Microbiology, Medanta, Gurgaon | Member |
| • National Emeritus Professor | Member |
| • Secretary, Hospital Infection Society – India | Member |
| • Secretary, Indian Association of Medical Microbiologists | Member |
| • Senior Microbiologist, PD Hinduja Hospital, Mumbai | Member |
| • Consultant, Infectious diseases, Apollo Hospital, Chennai | Member |
| • Associate Professor, Pharmacology, VPCI, New Delhi | Member |
| • Representative, Delhi Society for Promotion of Rational Use of Drugs | Member |
| • Addl. Director & Head, Department of Microbiology, NCDC | Member |
| • Director, National Centre for Disease Control | Member-Secretary |

Frequency of meetings

- TAG-AMR shall meet at least once every quarter.

Core Working Group on AMR (CWG-AMR)

The Core Working Group on Antimicrobial Resistance shall provide technical and operational inputs to the designated national coordinating centre for AMR in India i.e. National Centre for Disease Control (NCDC) to develop and implement the National Action Plan on Antimicrobial Resistance (NAP-AMR).

Terms of reference

- Identify and map stakeholders for AMR-related activities;
- Lead the development of the national action plan on AMR in India with active engagement of all key stakeholders;
- Ensure regular data collection and information sharing through effective communication and coordination amongst all stakeholders;
- Coordinate national activities for establishing/strengthening/linking surveillance systems for AMR, antimicrobial use and HAIs;
- Develop and disseminate national AMR reports annually; and
- Facilitate and monitor/evaluate the overall implementation of NAP-AMR.

Constitution of CWG-AMR

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| • Director, National Centre for Disease Control | Chair |
| • Deputy Drug Controller, DCGI | Member |
| • Senior Scientist, ICMR | Member |
| • Director, FSSAI | Member |

• Head, Microbiology, Safdarjang Hospital, Delhi	Member
• Chairman, Microbiology, Sir Ganga Ram Hospital, Delhi	Member
• Assistant Director, Microbiology, NCDC, Delhi	Member
• Associate Professor, Pharmacology, VPCI, Delhi	Member
• Head, Pharmacology, Maulana Azad Medical College, Delhi	Member
• Head, Microbiology, Indraprastha Apollo Hospitals, Delhi	Member
• Consultant, Medicine, Safdarjang Hospital, Delhi	Member
• Associate Professor, Medicine, SSKH & LHMC, Delhi	Member
• Director-Prof, Surgery, GTB Hospital, Delhi	Member
• Consultant Pediatrics, Safdarjang Hospital	Member
• Consultant, Pulmonary Medicine & Critical Care, Safdarjang Hospital	Member
• Assistant Commissioner, Department of Animal husbandry	Member
• Environment expert	Member
• Food expert	Member
• Finance/budget expert	Member
• Communication expert	Member
• WHO expert	Member
• CDC expert	Member
• IMA representative	Member
• DSPRUD representative	Member
• Independent expert	Member
• Addl. Director & Head, Microbiology, NCDC, Delhi	Member-Secretary

Frequency of meetings

- The CWG-AMR shall meet at frequent intervals; it is proposed that it meet at least once every month during the initial phase.

The technical advisory group and core working group are governance mechanisms specific to the human health sector. Similar groups may be needed in other sectors to coordinate their response in tackling AMR.

Annex 2: Operational plan and budget (template)

The operational plan and budget shall be developed after the strategic priorities are finalised, as per national financial rules and regulations, and shall be added based on finalised priorities/activities, as per template below.

Sub-activity	Unit	Quantity	Date	Location	Responsible entity	Cost (INR)	Source of funding	Indicator
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Strategic intervention 1

Activity 1.1								
Sub-activity 1.1.1
Sub-activity 1.1.2
...								

Strategic intervention 2

Activity 2.1								
Sub-activity 2.1.1	...	...	...	...	...	...	...	...
Sub-activity 2.1.2	...	...	...	...	...	...	...	...
...								

Sub-activity	Unit	Quantity	Date	Location	Responsible entity	Cost (INR)	Source of funding	Indicator
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Strategic intervention 3

Activity 3.1

Sub-activity 3.1.1
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Sub-activity 3.1.2
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Activity 3.2

Sub-activity 3.2.1
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Sub-activity 3.2.2
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Strategic intervention 4

Activity 4.1

Sub-activity 4.1.1
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Sub-activity 4.1.2
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