Antimicrobial Resistance in Food-Animal Production

INDIA OVERVIEW

ReAct
Action on Antibiotic Resistance

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Christian Medical College, Vellore,
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Email: satyasagar@gmail.com
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ReAct - Action on Antibiotic Resistance

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Glossary

ABR	Antibiotic Resistance
AGP	Antimicrobial growth promoters
AGMARK	Agricultural Marketing Information Network
AMR	Antimicrobial resistance
CSE	Centre for Science and the Environment
CAC	Codex Alimentarius Commission
EEHP	Enterocytozoon Hepatopenaei
EIC	Export Inspection Council
FSSAI	Food Safety and Standards Authority of India
FSSR	Food Safety and Standards Regulations
FAO	Food and Agriculture Organization of the United Nations
ICMR	Indian Council of Medical Research
MPEDA	Marine Products Export Development Authority
MDR	Multidrug resistant
MRSA	Methicillin-resistant Staphylococcus Aureus
NAP	National Action Plan
NDM1	New Delhi Metallo β Lactamase
NTA	Non-therapeutic Antimicrobial
OIE	World Organisation for Animal Health
WHA	World Health Assembly
WHO	World Health Organization

Introduction

In late 2010, a study about the quality of honey being sold in Indian markets caused a stir across the country.[1]

According to the Centre for Science and the Environment (CSE), a respected New Delhi-based NGO, most honey brands sold in India contained varying amounts of antibiotics. Their consumption over time could induce resistance to antibiotics, putting people at risk of treatment failure in case of severe infections.

For the study, 12 samples were picked in Delhi, all well-known brands, including one each from Australia and Switzerland. Antibiotics found included Chloramphenicol and various broad-spectrum drugs such as Ciprofloxacin and Erythromycin.

The CSE study not only bust the myth that commercially produced honey was a 'natural' and 'pure' product, it also brought to public attention the issue of antibiotic resistance (ABR) and how its spread could be fuelled via food products.

Following the CSE study, a scientific panel set up by the Food Safety and Standards Authority of India (FSSAI) sent a recommendation that antibiotics should not be used at any stage of honey production.[2]

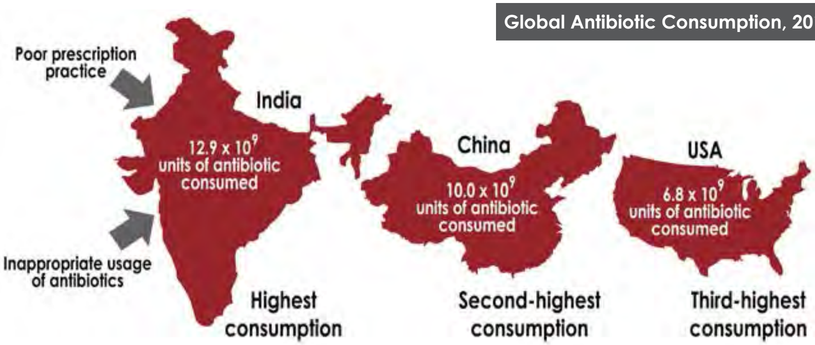
In recent years, India emerged as a global hotspot for AMR, with increasing resistance rates to most antimicrobials in common pathogens and rising number of treatment failures. The studies carried out over the last decade in the hospital and community settings indicate that resistance in important pathogens against certain antibiotics is at high levels in many parts of India.

The emergence of resistance is not only limited to the older and more frequently used classes of drugs but there has also been rapid increase in resistance to the newer and expensive drugs, for example, carbapenems.

The available data indicates rising rates of ABR, across various 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%.[3]

The ABR problem in India is compounded by the rapidly rising antibiotic consumption in the country, as the population grapples with a very high burden of infectious diseases.

Global Antibiotic Consumption, 2010[4,5]



The spread of ABR in India is alarming as the country already has a very high burden of bacterial infections. An estimated, 410,000 children aged 5 years or less die from pneumonia in India annually; accounting for almost 25% of child deaths in India.[6] Crude mortality from infectious diseases in India today is 417 per 100,000 persons.[7]

Widespread resistance to antibiotics means that infections that were once easily treatable can become deadly. For example, estimates suggest that over 30% of neonatal sepsis deaths in India—some 58,000 per year—are attributable to antibiotic resistant bacteria.[8]

Apart from the human health sector in India, an additional area of concern is the use of antimicrobials in the food-animal production sector in a rampant manner. There are few regulations governing the use of antimicrobials for cattle, chicken, and pigs raised for domestic consumption in India, with no stringent implementation protocols even when there are regulations.[9] Several studies show the use of antimicrobials as growth promoters is quite widespread. Non-therapeutic usage of antibiotics has been especially common in poultry production.[10]

Being a major producer of generic antibiotic drugs, India also faces the problem of environmental pollution from pharmaceutical production facilities.

On the positive side, in recent years, the issue of ABR has gained high profile among Indian policymakers, with the announcement of a National Action Plan, setting up of a basic surveillance system, inter-sectoral cooperation initiatives and public awareness campaigns supported by official health agencies and civil society groups. India's success in containing ABR will have a ripple effect in the entire South Asian region as many of its neighbours are likely to be guided and influenced by its record.

This booklet provides a brief round-up of the problems and suggested steps needed to reduce antimicrobial use in food-animal production in India. It is meant as a very basic introduction to this vast subject and aimed at policymakers, media, health professionals and concerned citizen groups.

Status as per the situation analysis conducted by India with the tool and guidance of the WHO Regional Office for South-East Asia[i]

Focus Area	Exploration & Adoption	Programme Installation	Initial Implementation	Full Operation	Sustainable Operation
Development of NAP in line with GAP-AMR		✓			
AMR-related awareness-raising		✓			
National AMR Surveillance		✓			
Rational use of antimicrobials and surveillance of use/sale (community)				✓	
IPC programme and AMS programme in health-care settings			✓		
Research and innovation		✓			
One health engagement		✓			

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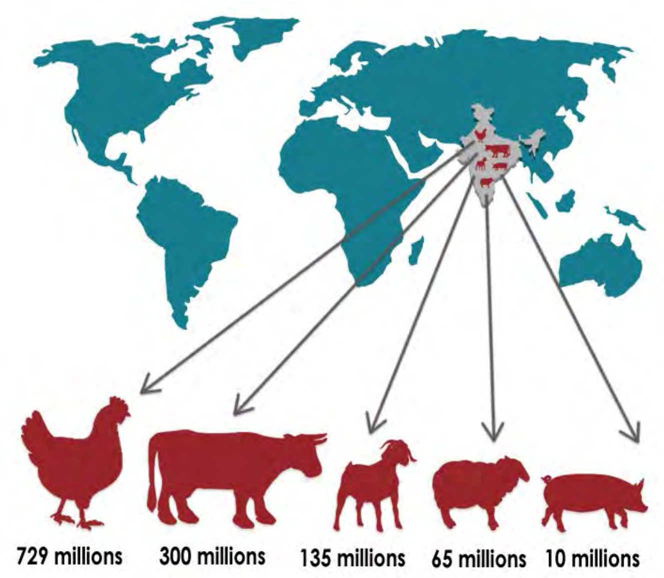
SECTION A

Food-Animal Production

Livestock Population

India's livestock sector is one of the largest in the world, accounting for 11.6% of the world's livestock population.[11]

India's Food-Animal Sector: an Overview[12,13]



Meat Production

India is the world's 5th largest meat producer, with estimated production of 7 million tonnes approximately, in 2015-16, of which 54% was red meat, the rest being poultry meat.[14]

India is also world's largest producer of milk, third-largest egg producer after China and USA and fourth-largest chicken producer after China, Brazil and USA.[15]

Meat Consumption

India has one of the lowest per capita consumptions of meat in the world. The average annual per capita meat supply (in carcass weight) remains below 5 kg in India.[16]

The majority of meats consumed in India are fish, bovine, mutton, goat, pig, and poultry. In Indian context, culture, traditions, customs, and taboos influence meat consumption to a great extent. However, urbanization has been causing a rise in demand for meat products.[17]

Chicken is the most consumed meat in India as it is cheaper than other meats and is subject to fewer religious prohibitions or cultural taboos.[18] Buffalo meat or carabeef is India's second most consumed animal protein after chicken meat due to its affordability. The annual per capita consumption of carabeef is around 2 kg, whereas for chicken it is 3.6 kg.[19]

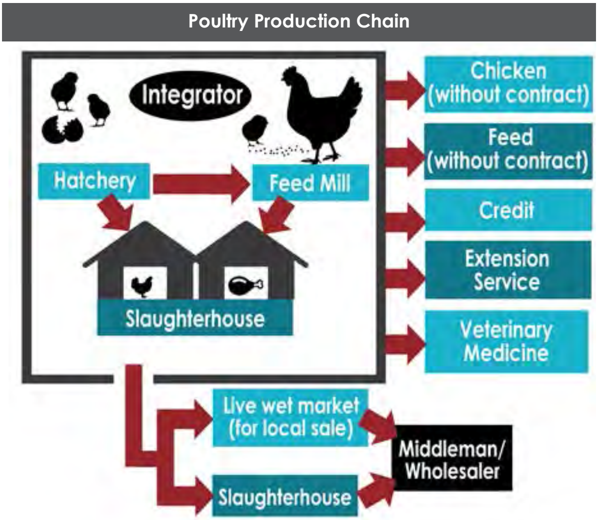
India's annual per capita fish and shrimp consumption is estimated at around 6 kg, which is low in comparison to the global average of around 18 kg.[20]

Poultry

Poultry is the most organized and rapidly growing animal agriculture sector in India. The growth is 6-8% in layers per year and 10-12% in broilers per year against the growth of agriculture as a whole, which is around 2.5%.[21]

India's per capita consumption of poultry meat is estimated at around 3.1 kg per year, which is low compared to the world average of around 17 kg per year. India's per capita consumption of eggs is estimated at about 62 eggs per year.[22]

Within the last ten years, many broiler enterprises have vertically integrated their operations (also called inte integrators), especially in southern and western India, which account for approximately 70% of total chicken meat production in the country. According to industry sources, today approximately 60-70% of all operations use this model, while the remaining are smaller backyard operations.[23]



Integrators own all the hatcheries, feed mills, and slaughter facilities, and contract with multiple small farmers (one integrator may have as many as 20,000 contracted farms). Family farms may have as many as 10,000 birds today, while 30 years ago a farm may not have raised more than 1000 birds. Some integrators also provide extension services, veterinary medicine and credits. At the end of the production cycle, the live birds either are purchased by the integrators for slaughter and further processing, or by a middleman/wholesaler, eventually arriving at a live bird wet market for local sale.

Carabeef

India has the world's largest number of cattle, water buffalo, goat and sheep population, estimated at over 300 million.

More than 50% of India's milk production is sourced from water buffaloes and the meat sector primarily uses spent dairy water buffaloes (also known as carabeef) for slaughter. Dairy farmers generally sell water buffaloes for slaughter to traders, who in turn are paid by slaughter houses based on carcass weight of the animal.

Beef and Indian buffalo meat production was estimated to reach 4.25 million tonnes carcass weight equivalent [CWE] in 2017 and increase in 2018 to 4.3 million tonnes CWE.[24,25] Carabeef production is mainly concentrated in the states of Uttar Pradesh, Andhra Pradesh, Maharashtra, and Punjab, with Uttar Pradesh having the country's largest water buffalo population.

India is the world's largest exporter of carabeef, which is popular in many Asian countries due to its lean meat, organic production and every competitive pricing. Carabeef exports in 2017 was projected to be 1.85 million tons CWE, an increase of 5% year on year, driven mostly by moderate increases in demand from the Middle East, Africa and Southeast Asia, including the newly opened market of Indonesia.

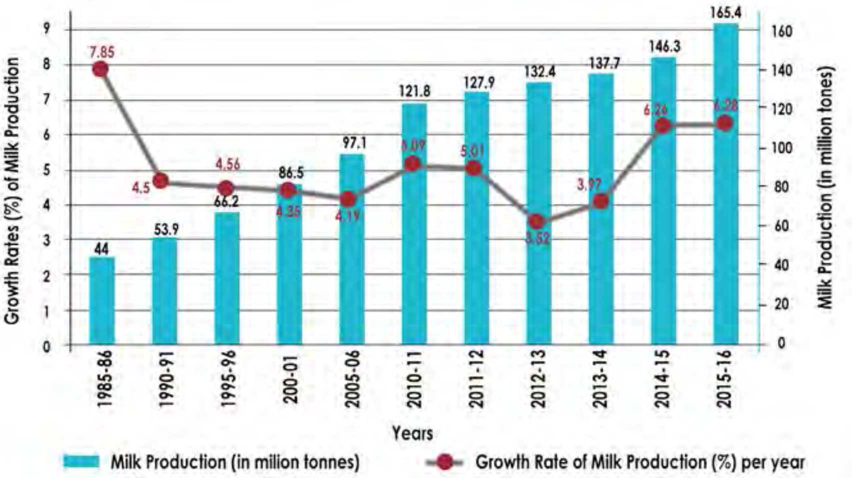
The foot-and-mouth disease (FMD) is one of the major concerns for India's carabeef trade but there were no reports of any major incidences in 2016. India implements an FMD control programme within 351 districts, across 13 states and 6 union-territories and is on the list of countries having FMD programme is endorsed by the World Organization for Animal Health (OIE).

Milk Production

India is the largest producer of milk in world. In 2015-16, the production stood at 155.5 million tonnes showing an annual growth of 6.27%.[26]

Nearly 36% of the milk production is contributed by indigenous buffaloes followed by 26% from crossbred cattle.[27]

Milk Production and Corresponding Growth Rate (%) from 1985-86 to 2015-16[ii]



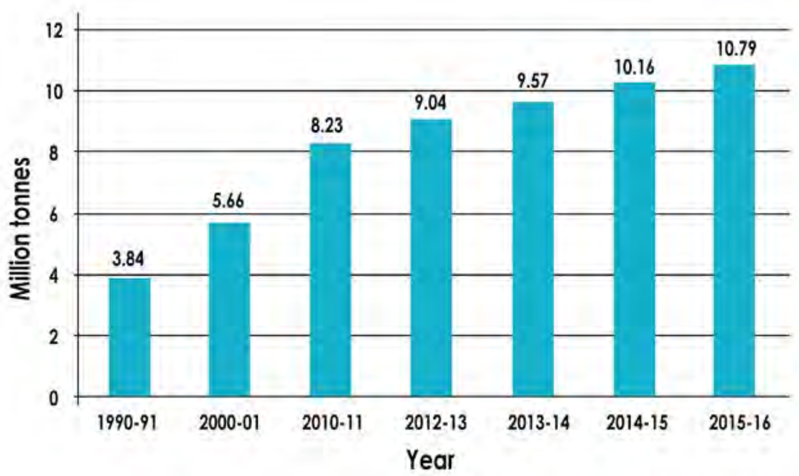
Fisheries

India is a major producer and exporter of fish and ranks second in the world after China.

In India, the annual fisheries production increased from 0.75 million tonnes in 1950-51 to 10.79 million tonnes in 2015-2016. Globally, the country now takes the second position, after China, contributing to 5.7% of global fish production.[28]

Aquaculture constituted over a third of the country's total fish production. Specifically, freshwater aquaculture experienced over a tenfold growth from 0.37 million tonnes in 1980 to 4.03 million tonnes in 2010.[29] This quantity is almost fully consumed on the domestic market, except for shrimps and freshwater prawns, which are mainly exported.[30]

Fish Production (in million tonnes)[iii]

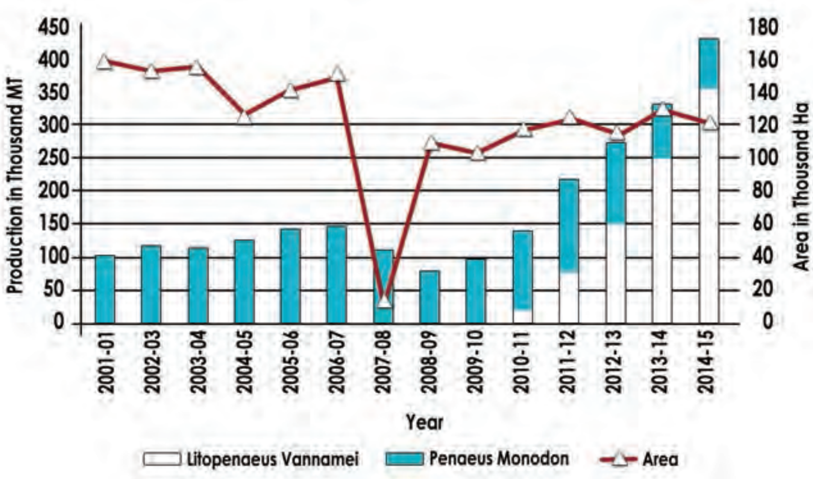


Shrimps

India's cultured shrimp production in 2014 was estimated at 426,500 MT while wild production was estimated at 450,000 MT.[31] From 2004-2014, cultured shrimp production increased at a compound annual growth rate of 13%. From 2010 to 2015, shrimp export volume increased at a compound annual growth rate of 15.8%. India's shrimp export volume reached 382,959 Tons in 2015, equivalent to US$33.19 billion.[32]

With the rapid growth and demand for aquaculture, the industry faces challenges in the form of diseases such as white spot virus, *enterocytozoon hepatopenaei* (EHP) running mortality syndrome, and white feces. Any small disease to the species might result in the loss of the complete culture. So as a preventive measure farmers started using 'antibiotics', and found good results after using this and finally this resulted in over usage of antibiotics out of which few are unapproved antibiotics.[33]

Cultured Shrimp Production Rising[iv]



As a result of antibiotic residues being found in shrimp exports from India are banned in 4 countries. The Food and Drug Administration of United States also announced that they would increase the testing for aquaculture products.[34]

The EU has also expressed concern over the use of antibiotics in Indian shrimps and shown its dissatisfaction with the response it got from the Indian authorities. In 2016, the EU changed the necessary number of fish exports inspected from 10% to 50%, among other actions taken, to control the export of antibiotic-contaminated shrimp to the EU.[35] EU, which is the third-largest market for Indian seafood exporters, has regularly been complaining about the presence of antibiotics in Indian shipments and rejected a few Indian seafood consignments on quality issues.

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SECTION B

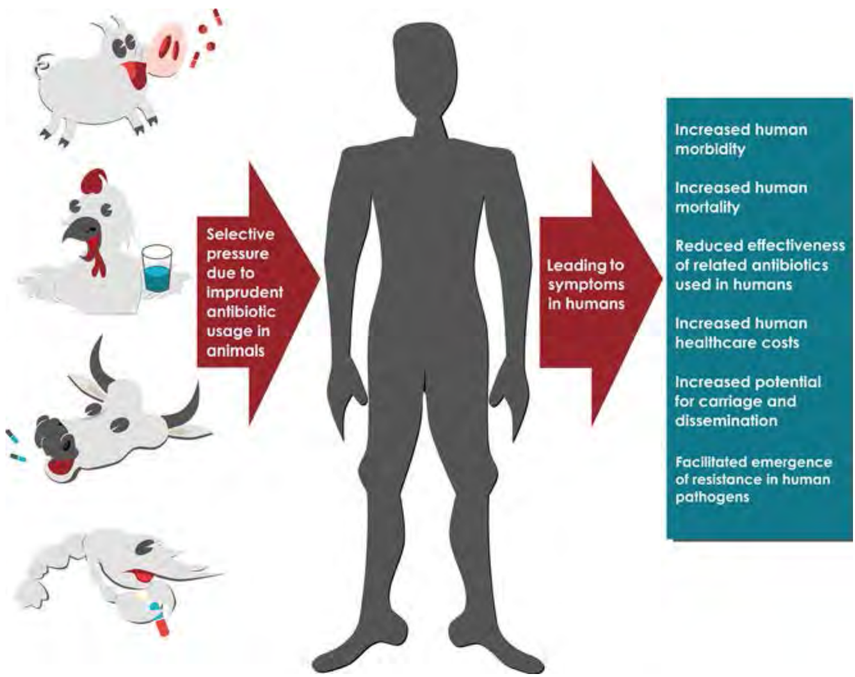
The Emergence of Antimicrobial Resistance

Antibiotic Use in Animals

A bulk of the world's antibiotics are used in the animal and food farming sector from where antimicrobial resistance finds its way into the human health sector. The three broad purposes for which antibiotics are used in animal production are for treatment of disease, i.e., therapeutic use; for prevention of disease, i.e., prophylaxis and metaphylaxis; and for 'growth promotion'.

Currently, there is little accurate data available in India on antimicrobial use in food animals or resistant infections linked to animals and its impact on public health.[36]

Antibiotic residues transferred from animals to humans and its effects



It is accepted though, that there is widespread use of antibiotics in food animals for prevention, treatment of infection[37] as well as growth promoters. In particular, non-therapeutic usage of antibiotics has been especially common in poultry production and aquaculture.

A recent study estimating global antibiotic use in poultry, swine and cattle in 2010 indicates that India accounts for 3% of global consumption and is among the top consumers worldwide, along with China, the United States, Brazil and Germany.[38] Projections for 2030 estimate an overall increase of about two-thirds in animal antibiotic consumption worldwide.

The use of antibiotics in animal feed, the study said, will increase by 82% in India by 2030, such use in chickens, in particular, is expected to triple in India by 2030.[39] The study found that globally penicillins, tetracyclines and quinolones are some of the most widely used antibiotics, with the use of these antibiotics higher in countries with meat-heavy diets.

ABR in Food Animals

Given that there are few regulations against the use of antibiotics for non-therapeutic purposes in India, and poor implementation protocols, the emergence of ABR from antibiotic overuse in the animal sector is still poorly documented.

A number of researchers though have isolated bacteria from animals or seafood and tested them for resistance to common antibiotics. The levels of resistance reported are consistently high in food animals including livestock, poultry, fish, and shellfish.

Box 1: Economic Impact of Lowering Antimicrobial Use

There has been opposition to banning the use of antibiotics as growth promoters in many countries due to the potential negative economic impact. A recent assessment estimates that the impact would be marginal in countries where farm production systems are already optimized, and more significant in countries with non-optimized systems.[40] In India, projected production losses were estimated at about 1% to 3% of annual meat production, or US$1 110–2 599 million. Commercial poultry farmers account for one half to three quarters of total production in India, and would face the greatest impact.

Poultry

The Center for Science and the Environment has done several studies, which found significant amounts[41] of antibiotic residues in poultry sold in Indian markets and multi-drug resistant bacteria in and around poultry farms.[42]

These studies have increased public awareness about the hazards of using antibiotics, many also important in human health, for production of food animals.

For example, a 2017 CSE study titled – 'Antibiotic Resistance in Poultry Environment' – collected samples of litter and soil from in and around 12 randomly selected poultry farms in four key poultry-producing states in north India – Uttar Pradesh, Haryana, Rajasthan and Punjab.

A total of 217 isolates of three types of bacteria – *E. coli*, *Klebsiella pneumoniae* and *Staphylococcus lentus* – were extracted and tested for resistance against 16 antibiotics.

Ten of these antibiotics have been declared Critically Important (CI) for humans by World Health Organization (WHO).

The study found that antibiotics were being used in these poultry farms, and that the litter was used as manure in neighbouring agricultural lands. As a control the study also collected 12 soil samples at a distance of 10 to 20 kilometers from the respective farms, where the litter was not being used as manure.

The study found that 100% of the *E. coli*, 92% of *K. pneumoniae* and 78% of *S. lentus* isolated from the poultry environment were multi-drug resistant. About 40% of *E. coli* and 30% of *K. pneumoniae* isolates were resistant to at least 10 out of 13 antibiotics against which these bacteria were tested for resistance.

Both *E. coli* and *K. pneumoniae* had very high resistance to antibiotics such as penicillins, fluoroquinolones, third and fourth generation cephalosporins and carbapenems, which is a last resort antibiotic used in hospitals.

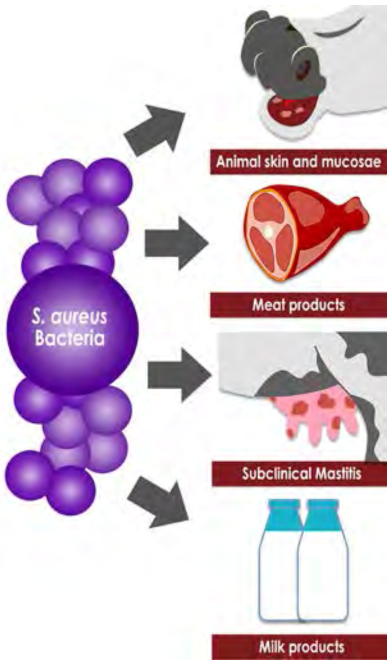
Overall, the study found high degree of resistance to all critically important classes of antibiotics. Of the critically important antibiotics used in the study, 5 belonged to the 'highest priority' category and the rest were 'high priority'.

The CSE study also found strong similarity in the resistance pattern of *E. coli* from the litter and from agricultural soil in the surrounding areas where the litter was used as manure. This indicated that the multi-drug resistant *E. coli* being created in the poultry farms was entering the environment through litter.

Milk

Presence of antimicrobial residues in milk has been reported from different parts of India, indicating wide antimicrobial use in food animal production in India.[43] One of the most common clinical issues encountered in the dairy farms is mastitis and milk from cows and buffaloes, affected by the disease, have been shown to contain 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.[44]

S. aureus is one among the leading causes of food-borne illnesses. Milk and dairy products are often contaminated with strains of *S. aureus*. Therefore, a survey report on occurrence of S. aureus in meat and dairy products indicated around 68.8% strains resistant to at least one antibiotic tested. Usually, *S. aureus* is present on the skin and mucosae of various animals, as well as frequently associated with subclinical mastitis, which leads to its entry into milk chain.[45]



Milk samples collected from several regions of Bihar were found to contain residues of tetracycline, oxytetracycline, sulfadimidine and sulfamethoxazole.[46] This indicates use of such antibiotics as growth promoters or for treatment of cows with infections.

Overall, however, there is little data on use of antimicrobials in dairy farms due to lack of maintenance of the antibiotic treatment records; low dependence on the veterinarian's advice; and administration of medicines by the owners themselves.

Fisheries

A survey in freshwater fish hatcheries of West Bengal was conducted in 2010–11 and the susceptibility of hatchery bacterial flora to selected antibiotics were studied.[47] Various aquadrugs such as oxytetracycline, althrocin, ampicillin, sparfloxacin, enrofloxacin, acriflavine, formalin, potassium permanganate, malachite green, tannic acid and herbal extracts were found to be used at varying levels for prophylactic as well as curative purposes. The farmers also reported using drugs like ciprofloxacin, enrofloxacin, and other drugs in a few hatcheries to improve larval survival.

In 2012, Salmonella isolates from fish and shellfish from markets and fish-landing centers in Mangalore were tested for nine antibiotics. Two-thirds were resistant to at least two antibiotics, and a quarter of the isolates were resistant to three drugs or more.[48]

Vibrio parahaemolyticus bacteria isolated from fish in Cochin showed a high level of resistance to ampicillin (89%) and streptomycin (89%). More than half were also resistant to the antibiotics carbenicillin, cefpodoxime, cephalothin, colistin, and amoxycillin. Most of the isolates remained susceptible to tetracycline, nalidixic acid, and tetracycline.[49]

A study of commercial catch operations in West Bengal found significant levels of resistance to ampicillin in the gills and intestines of fish sampled, indicating that wild-caught fish may also act as reservoirs of resistant bacteria.[50]

Occurrence of multidrug-resistance to several antibiotics has also been detected in indigenous bacteria such as *Bacillus pumilus* and *B. flexus* from shrimp farm effluents.[51]

Industrial Pollution

With its large domestic pharmaceutical industry, India is also facing the problem of pollution from antibiotics manufacturing facilities in different parts of the country. Antibiotics, when released into water bodies and the environment, are capable of stimulating bacterial resistance that is then transferred to human commensal and pathogenic bacteria.[52]

In 2007, Swedish researchers reported very high emissions of pharmaceuticals from drug manufacturers at an industrial estate in Patancheru, near Hyderabad, India that had around 90 manufacturing units. The treatment plant from the estate released drugs in its effluent water at levels sometimes equivalent to high doses that are given therapeutically.[53] In particular, high levels of several broad-spectrum fluoroquinolone antibiotics were documented in both effluent and surface water, with ciprofloxacin being the most abundant.

In another study of the effluents released from the Patancheru effluent treatment facility at three sites downstream of the plant, researchers – using a DNA sequencing technique called ‘shotgun metagenomics’ to test effluent - found that resistance genes made up almost 2% of the DNA samples taken there.[54]

The analysis identified high levels of several classes of resistance genes as well as elements for horizontal gene transfer, including integrons, transposons and plasmids which are bits of genetic material that let resistance genes jump from one bacteria to another. The study also found significant presence of two previously uncharacterized resistance plasmids.

An investigative report commissioned by Nordea Investment Management, one of the world's largest investment funds, accused some of the world's biggest pharmaceutical companies of ignoring "disturbing" environmental damage caused by the manufacturing they outsource to India.[55]

The Nordea report said that water pollution caused by drug manufacturers in India, which supply many of the world's largest pharmaceutical companies, is having a harmful impact on local communities, leading to skin diseases and killing fish.

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SECTION C

Responding to Antimicrobial Resistance

Overview of Policies

As one of the countries most affected by ABR, India is now taking strides to address the growing problem.

In 2017, Indian health authorities released their National Action Plan on Antimicrobial Resistance (NAP-AMR) 2017–2021, that outlines the various challenges that need to be tackled to manage the phenomenon.[56]

There are six key areas that the NAP-AMR has identified as being strategic priorities for Indian health authorities to take action on. These include:

- Improved awareness of AMR through effective communication;
- Strengthening knowledge and evidence through surveillance;
- Reducing the incidence of infection through effective infection prevention and control;
- Optimizing the use of antimicrobial agents in health, animals and food;
- Promoting investments for AMR activities, research and innovations; and
- Strengthening India's commitment and collaborations on AMR at international, national and sub-national levels.

Significantly, all the strategic priority areas identified by India's NAP-AMR clearly mention the animal, food and environment sectors as priority areas for strengthened surveillance, prevention of disease, regulation and an optimizing use of antimicrobials. The NAP-AMR further promotes the One Health perspective of integrating human and animal health sectors.

Laws in India

Despite the new, comprehensive National Action Plan, in practice there have been few steps taken to implement the plan. For example, there is no money allocated yet specifically for implementation of India's multi-year National Action Plan on Antimicrobial Resistance (AMR).[57]

The fact remains that India also does not have a stringently framed and implemented regulatory framework to limit the use of antimicrobials in livestock and food animals. The lack of regulations is particularly glaring when it comes to use of antimicrobials for non-therapeutic purposes, like growth promotion, or for routine prevention, both of which have been the drivers of antibiotic overuse at the farm level. Most existing standards for the amount of antibiotic residues permissible in food products relate to only seafood products, meant for export.

Different state agencies however, from time to time, have issued guidelines on use of antimicrobials in food-animal production or recommended standards for permissible levels of antibiotic residues in food products. Some of these include:

- The Second Amendment of the Drugs and Cosmetics Rules (2006) contains a list of 536 drugs that fall under Schedule H, which means they can be sold only based on the prescription of a Registered Medical Practitioner.[58]
- In 2007, poultry feed specification from the Bureau of Indian Standards recommended that antibiotics with systemic action not be used as growth promoters, and phasing out of antibiotics that act in the gut in five years.
- In January 2012, the Central Drugs Standard Control Organization under the Ministry of Health and Family Welfare introduced a new norm in the country's Drugs and Cosmetics Rule that specifies the withdrawal period, or the timeframe for poultry, livestock and marine products to keep antibiotics off before they enter the food chain.[59] As per new insertion, eggs and milk products will have to be off antibiotics. This has to be maintained for seven days before the eggs and milk enter the food chain. The corresponding figure for poultry and livestock items will be 28 days.
- In 2013, a new category of H1 drugs was added through an amendment to the Drugs and Cosmetics Rules.[60] Use of these drugs now, including several important antibiotics, requires a prescription. Pharmacists must provide separate prescription documentation subject to review, and non-compliance with the regulations can incur penalties.
- In 2014, a circular was issued by the Department of Animal Husbandry, Dairying and Fisheries to its officials across India, advising them to use antibiotics judiciously for treatment of all food producing animals and animal feeding.[61] It also advised that the use of all antibiotics and hormones in animal feed should be stopped immediately. Another directive issued in January 2015 by the Food Safety and Standards Authority of India outlines certain principles including limiting the use of antibiotics in livestock rearing.

New Standards

The FSSAI, which defined standards for fisheries products through the Food Safety and Standards Regulations (FSSR 2011) has amended this regulation in 2017 to include standards for all food-animal products.[62]

Under the proposed Food Safety and Standards (Contaminants, Toxins and Residues) Amendment Regulation 2017 the tolerance limit of antibiotics and pharmacology active substances in food of animal origin will be clearly specified to ensure antibiotic residue in food from animals does not threaten human health.[63] The amended regulation states that for a list of 21 antibiotics the tolerance limit, used in human beings and animals will be 0.01mg/kg for the following types of foods namely:

(i) All edible animal tissue;
(ii) Fats derived from animal tissues; and
(iii) Milk.

The amendments prescribe the maximum permissible limits of 21 antibiotics and 77 other veterinary drugs for use in food-animal production. The ministry invited stake-holder objections and suggestions, which will be placed before the FSSAI scientific panel on residues of pesticides and antibiotics. The panel's recommendations will be considered by the scientific committee and then the food authority for approval, following which it will be notified in the Gazette of India.[64]

Unfortunately, none of these recommendations have been formalized as laws so far. According to a critique of the situation even where there are rules prescribed there are no specifics, no timelines and no punitive measures mentioned, making them ineffective in practice.[65]

Aquaculture

Compared to other food animal production sectors, there are many more rules and standards governing antimicrobial use in aquaculture production, especially because they are meant for exports.

The Government of India's Marine Products Export Development Authority (MPEDA) regulates aquaculture production, which includes shrimp. Through a variety of policies and activities, MPEDA supports aquaculture production, development of processing infrastructure and value addition, and establishing standards for quality control and market promotion.

MPEDA set up 19 ELISA-screening laboratories at various centers in the maritime states of India to conduct pre-harvest testing/screening of the aquaculture products (shrimp/fish) for the presence of antibiotics residues like chloramphenicol & nitrofuran metabolites before the produce is harvested.

The MPEDA's list of 20 antibiotics and pharmacologically active substances banned for use in aquaculture include:

1. Chloramphenicol
2. Nitrofurans including: Furaltadone, Furazolidone, Furylfuramide, Nifuratel, Nifuroxime, Nifurprazine, Nitrofurantoin, Nitrofurazone
3. Neomycin
4. Nalidixic acid
5. Sulphamethoxazole
6. Aristolochia spp and preparations thereof
7. Chloroform
8. Chlorpromazine
9. Colchicine
10. Dapsone
11. Dimetridazole
12. Metronidazole
13. Ronidazole
14. Ipronidazole
15. Other nitroimidazoles
16. Clenbuterol
17. Diethylstilbestrol (DES)
18. Sulfonamide drugs (except approved Sulfadimethoxine, Sulfabromomethazine and Sulfaethoxypyridazine)
19. Fluroquinolones
20. Glycopeptides

Export-Related Rules

The veterinary health certificate required for exports is issued by Government of India's Export Inspection Council (EIC) under Ministry of Commerce and Industry. The EIC regulates establishments that process fish and fishery products meant for export and also regulates traceability and antibiotic residue for shrimp products. The Council also monitors antibiotic residues in eggs, honey, milk and poultry meat, meant for export.

In 2002, new restrictions were placed for antibiotic residue levels in fresh, frozen, and processed fish and fishery products intended for export.[66] The amendment includes maximum residue limits for tetracycline, oxytetracycline, trimethoprim, and oxolinic acid, and it prohibits the use of certain antibiotics in units processing all types of seafood.

In 2003, through an amendment to an existing law regulations were introduced on antibiotic residues in eggs and egg products. Maximum Residue Limits (MRL) for antibiotics in food products consider an acceptable daily intake, based on an assumed average daily intake, with a margin of safety.

In addition, this order bans the following antibiotics from feed, treatment, or use in any stage of production of egg powder for export: chloramphenicol, dimetridazole, metronidazole, nitrofurans, including metabolites of furazolidone and nitrofurazone.

Monitoring

The Ministry of Health and the Drug Controller General of India have responsibility for enforcing regulations related to food safety and the quality and use of antibiotics for both humans and animals in India.

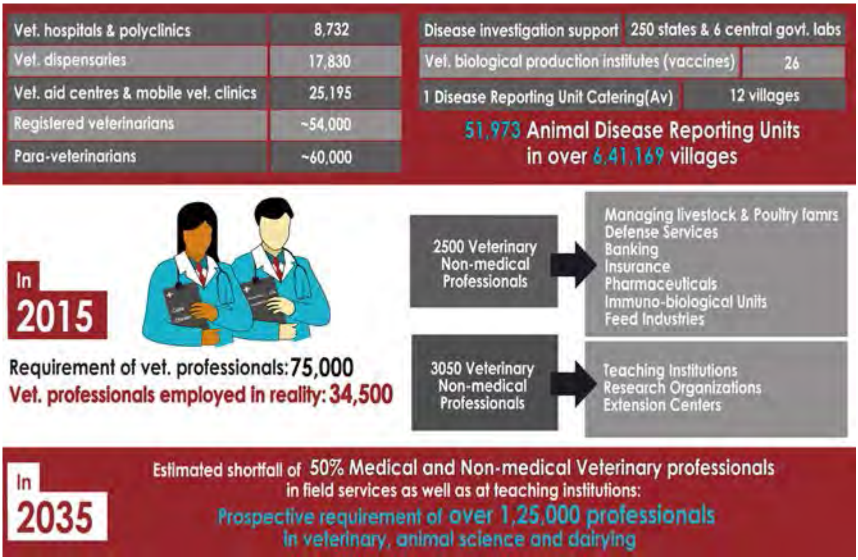
State Drug Controllers also have some responsibilities. However, the absence of uniform regulations for dairy and poultry farming in India poses a serious challenge to the enforcement of rational use of antibiotics.

Anecdotal evidence also suggests a general lack of awareness in India about regulations for antibiotic use and an absence of routine testing, making it likely that consumers are receiving products with more than the maximum permissible level of antibiotic residues.

Within the Ministry of Agriculture, the Directorate of Marketing & Inspection runs the Agricultural Marketing Information Network (AGMARK).[67] This organization certifies manufacturers of selected products, including eggs and chilled or frozen raw meat. In the early 2000s, AGMARK began upgrading some of its laboratories to measure antibiotic residues in animal products. However, limits on antibiotic residues in animal products are not yet widely established as a part of AGMARK certification.

Veterinary Capacity

Network of approximately 2,87,000 kinds of veterinary services in India[68, 69, 70]



Surveillance Capacity

For a long time, antimicrobial/antibiotic resistance surveillance was limited to small-scale efforts by the state-funded Indian Council of Medical Research (ICMR) and some private agencies on a pilot basis. There was no systematic, national-level surveillance for ABR among the human pathogens such as *Salmonella*, *Shigella*, *Staphylococcus*, *Klebsiella*, *Acinetobacter* etc. There was surveillance, however, of disease-specific pathogens as part of different national disease control programmes for tuberculosis, HIV, leprosy and kala-azar.

As part of the 'National Programme for Containment of AMR' (2012–2017), a laboratory based surveillance system was to be established by strengthening the laboratories for ABR in the country and to generate quality data on antimicrobial resistance for pathogens of public health importance.

The ICMR's Antimicrobial Resistance Surveillance and Research Network (AMRSN) is currently carrying out surveillance with a network of ten laboratories across the country. A total of 30 labs in state medical colleges are planned to be strengthened in a phased manner to carry out surveillance.[71]

However, in the case of ABR in animals and food or antibiotics there is very limited surveillance. There are isolated studies, which have indicated high levels of ABR across animal commodities and systems, but they are yet to be unified under a nationally scaled programme.

While the Indian National Action Plan on ABR emphasizes a One Health approach, on the ground there is no such coordination in collection of data between the human and animal health sectors. Another weakness of the existing surveillance systems for ABR in India is that they do not account for antibiotic use.

The absence of a surveillance system that can establish the relationship between the antibiotic consumption patterns and emergence of ABR prevents the designing and evaluation of effective interventions. If such a link is established, then tracking antibiotic use or consumption data could also be used as a surrogate marker for the risk of potential ABR emergence.

56 https://www.cseindia.org/cse-slams-indian-poultry-industry-for-using-its-name-to-misrepresentfacts-8497 (accessed on 22 March 2018).
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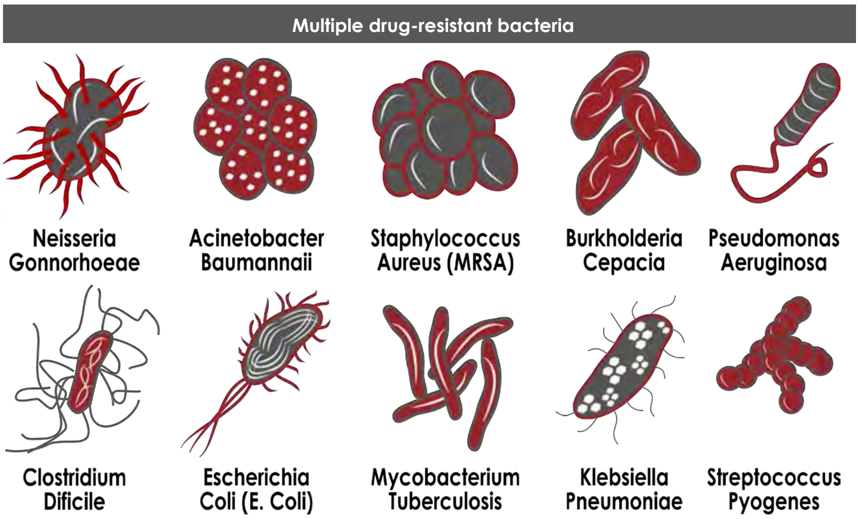
SECTION D

What Can Be Done

What is to be done?

Groups of health professionals such as the signatories of the Chennai Declaration and civil society organizations, like Center for Science and the Environment working on ABR have made recommendations on controlling the use of antimicrobials in the food-animal production sector, fisheries, aquaculture and to limit pollution of the environment.[72] While they accept the appropriate use of antimicrobials for treatment of bacterial infections in animals as being legitimate they point out that their use purely as growth promoters and for some prophylactic purposes is both unnecessary and avoidable.



Their recommendations are aimed at reducing use of antibiotics without causing harm to either human or animal health.

Some of the recommendations include:

- Allocation of appropriate funds to implement India's National Action Plan on AMR 2017–2021.
- Studies to understand the economic, medical and social factors that are propelling the use of antimicrobials in food-animal production.
- Track rates of veterinary antibiotic use, resistance, and residues through a nationwide surveillance and a monitoring system.
- Change incentives to discourage unnecessary antibiotic use in animals.
- Educate farmers, veterinarians, and consumers on the dangers of antimicrobial resistance.
- Phase out the non-therapeutic use of antibiotics in animals.
- Ban the use of critically important antibiotics in food-animal production.
- Set antibiotic residue limits for food products of animal origin.
- Implement washout periods between the use of antibiotics and animal slaughter.
- Frame biosecurity guidelines for the food-animal producers.
- Promote alternative growth promoters wherever possible.
- Reduce overall demand for antibiotics, by improving sanitation and limiting use to instances where antibiotics can be effective.

72 http://chennaideclaration.org/ (accessed on 18 March 2018).

Ever since they were discovered over eight decades ago, antimicrobials, especially antibiotics, have saved countless lives from infectious diseases and transformed modern medical procedures, including surgery, organ transplantation and cancer treatment. However, over the years, the slow but steady spread of antimicrobial resistance — whereby the bacteria turn antimicrobial drugs ineffective — threatens to undo these important gains.

While a significant role in the spread of such resistance has been due to growing use of antimicrobials in the human health sector, there is now recognition that widespread use of these miracle drugs in food-animal production is also a major factor.

This booklet gives a brief introduction to the problems, solutions and challenges involved with the use of antimicrobials in food-animal production. It is meant for policy makers, health professionals and concerned civil society groups interested in initiating action on this important issue.