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ANTIMICROBIAL RESISTANCE IN INDIA: EXTENT, STATISTICS

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УСТОЙЧИВОСТЬ К ПРОТИВОМИКРОБНЫМ ПРЕПАРАТАМ В ИНДИИ: МАСШТАБЫ, СТАТИСТИКА

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Abstract. AMR represents a public health challenge in India associated with the overuse of antibiotics transmission through the food chain inadequate regulatory enforcement and environmental pollution. Likewise India bears a large share of resistant infections significantly adding to worldwide illness and death caused by AMR. This article provides a review of the AMR burden and data in India; analyzes antibiotic misuse, in people and livestock outlines food-related transmission routes assesses legal and policy frameworks and explores existing prevention approaches and obstacles. The assessment emphasizes the need for unified and cross-sectoral efforts, within the One Health approach.

Аннотация. Устойчивость к противомикробным препаратам (УПП) представляет собой серьезную проблему общественного здравоохранения в Индии, связанную с чрезмерным использованием антибиотиков, передачей инфекции через пищевую цепочку, недостаточным регулированием и загрязнением окружающей среды. Аналогичным образом, Индия несет на себе значительную долю инфекций, вызванных устойчивыми к антибиотикам микроорганизмами, что существенно увеличивает заболеваемость и смертность от УПП во всем мире. Представлен обзор данных по Индии; анализируется злоупотребление антибиотиками у людей и животных, описываются пути передачи инфекции через пищевые продукты, оцениваются правовые и политические рамки, а также исследуются существующие подходы к профилактике и препятствия. Оценка подчеркивает необходимость согласованных и межсекторальных усилий в рамках подхода «Единое здоровье».

Keywords: antimicrobial resistance, India, antibiotic overuse, multidrug-resistant organisms.

Ключевые слова: устойчивость к противомикробным препаратам, Индия, использование антибиотиков, мультирезистентные микроорганизмы.

Antimicrobial resistance occurs when microbes such as bacteria, viruses, fungi and parasites evolve strategies that render antimicrobial medications ineffective. Due to antibiotic use India faces

a particularly severe issue with AMR attributed to its large population, significant infectious disease load, easy access, to antibiotics extensive food-animal farming and environmental antibiotic pollution. Furthermore AMR endangers not the control of infectious diseases but also the safety of surgical procedures cancer treatments, neonatal healthcare and organ transplants. If unchecked AMR could undo decades of progress, in India.

Extent and Statistics of AMR in India. Mortality and Disease Burden.

-Globally India ranks among the countries with the death tolls linked to AMR: it is estimated that there are approximately 300,000 direct fatalities annually and, over a million related deaths.

-Neonatal sepsis due to bacteria is estimated to cause, over 58,000 infant fatalities each year primarily in resource-limited environments.

-Should the pattern persist AMR could be responsible for 2 million fatalities annually in India, by 2050. Resistance Trends in Key Pathogens.

PATHOGEN RESISTANCE PATTERN IN INDIA

<i>E. coli</i>	Highly ESBL producing (>70%); increasing resistance to carbapenems
<i>Klebsiella pneumoniae</i>	Carbapenem resistance >50%
<i>Acinetobacter baumannii</i>	Resistance to carbapenem is >90%
<i>Salmonella typhi</i>	>95% fluoroquinolone resistance
Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)	40-65% prevalence in tertiary hospitals

The occurrence, in hospitals is estimated to fall within the range of 40 to 65%. These resistance levels are significantly greater, than those observed in high-income nations and indicate both improper usage and inadequate infection management. Overuse and Abuse of Antibiotics in India. Human Healthcare Sector. India ranks among the consumers of antibiotics globally. The primary sources are: Over-the-counter availability without prescription (Empirical use of broad-spectrum antibiotics; Antibiotic prescribing for viral infections; Incomplete courses of treatment; Lack of diagnostic stewardship). Reports indicate that over 70% of outpatients, in countries receive antibiotic prescriptions and their use is frequently inappropriate. Hospital-based Overuse (Highly using third-generation cephalosporins, fluoroquinolones, and carbapenems; Poor implementing policies of antimicrobial stewardship programs; Hospitals, with patient loads where transmission of resistant organisms occurs more readily).

This results in the rapid selection of multidrug-resistant organisms, a process also known as MDRO. This is the point at which automation boosts efficiency in the development process.

AMR Through Food and the Food Chain. Antibiotic Use in Food Animals. Antibiotics are widely utilized in Poultry, Dairy farming, Aquaculture, Livestock.

These frequently serve to: Growth promotion; Encouraging disease prevention, in patients, which is also referred to as prophylaxis; Non-therapeutic purposes.

This method favors bacteria that're resistant when they infect the human population.

Food-Borne Transmission Pathways. The methods through which AMR is transmitted to humans include: Consumption of undercooked meat; Contaminated milk and dairy products; Vegetables watered with water; Handling of raw animal products.

In India resistant bacteria such, as Salmonella, Campylobacter and E. Coli are frequently found in food samples. Pollution of the Environment. Diverse pollutants and minute quantities of elements, in drinking water can arise from sources, including the following: Antibiotic residues from pharmaceutical industries; Animal waste used as manure; Hospital effluents reaching water bodies.

These form environmental "hotspots" for resistance gene exchange. It originated from the Philosophical Society. Commenced during the initial week of June, 1820.

Acts of Prevention, Legal Frameworks, and Regulatory Measures. Drugs and Cosmetics Act, 1940: Controls the production and distribution of antibiotics; Introduced Schedule H and H1 restricting the sale of antibiotic without prescription; Enforcement continues to be irregular.

Regulation of Schedule H1: Contains the antibiotics that're most essential including carbapenems and third-generation cephalosporins. Requires: Prescription compulsory: Record maintenance by pharmacists; Limited compliance because of weak monitoring. Food Safety and Standards Act (FSSA), 2006: Controls the presence of residues, in food items; There are standards, but there is not enough surveillance and enforcement. Measures Undertaken: National and State Levels. National Action Plan on AMR (NAP-AMR). India possesses a National Action Plan, on AMR for 2017-2021 prolonged to 2025-2029 which was synchronized with WHO goals: Improve awareness and understanding; Enhancing surveillance

3. Reduce incidence of infection; Optimize the use of antimicrobials; Promote research and innovation.

ICMR Antimicrobial Resistance Surveillance Network (AMRSN): Monitors resistance patterns across the country; Offers national data; Guides policies, for treatment.

State Action Plans (SAPCAR). Multiple states have adopted tailored AMR approaches and tackle: Prescription audits; Infection control; Public education; Veterinary Antibiotic Oversight.

Prevention Strategies for AMR in India. Antimicrobial Stewardship Programs: Rational antibiotic prescribing; De-escalation therapy; Antibiotic "time-outs"; Antibiotic policies in hospitals.

Prevention and Control of Infection: Hand hygiene; Sterilization; Hospital surveillance; Isolation of the MDR cases.

Food and Agriculture Interventions: Prohibition of antibiotic growth enhancers; Veterinary prescription enforcement; Improved farm hygiene; Monitoring antibiotic residues.

Public Awareness and Education: Campaigns on the rational use of antibiotics. Discourage self-medication; As a rule, education of farmers and pharmacists.

Finally, devise an expression for the ideal voltage transfer characteristic. India-Specific Obstacles and Prospective Strategies The AMR issue in India arises from linked human, animal, food and environmental networks. Although robust policy structures are in place, incomplete execution, poor enforcement and insufficient diagnostics obstruct advancement. The gap, between rural areas exacerbates the proliferation of resistance. What is necessary is a One Health approach that integrates health, veterinary care, agriculture and environmental management. The upcoming vital actions involve expanding laboratory capabilities, managing waste and encouraging the development of new antibiotics. Antimicrobial resistance represents a complicated public health crisis that is quickly worsening in India. The widespread presence of microbes their spread via the food supply, improper antibiotic use and environmental contamination all endanger the effectiveness of current medical treatments. While India has implemented legal and policy measures, effective enforcement, community engagement and collaboration, across multiple sectors are urgently required to control AMR and safeguard future healthcare results.

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