



PUBLIC  
HEALTH  
FOUNDATION  
OF INDIA

# SITUATION ANALYSIS

## Antibiotic Use and Resistance in India

### Executive Summary



Global Antibiotic Resistance Partnership-India National Working Group

Dr. N. K. Ganguly, Chairman

March 2011

## **Global Antibiotic Resistance Partnership-India (GARP-India) National Working Group (NWG)**

**Dr. Nirmal K. Ganguly**, Chairman, Distinguished Professor of Biotechnology and Advisor, Translational Health Science and Technology, Department of Biotechnology, National Institute of Immunology, New Delhi

**Dr. Chand Wattal**, Chairman, Clinical Microbiology, Sir Ganga Ram Hospital, New Delhi

**Dr. Sujith J. Chandy**, Professor, Department of Pharmacology, and Head, Pharmacy, Christian Medical College, Vellore

**Dr. Sudershan K. Arora**, President, Research and Development, Ranbaxy Laboratories Ltd., Gurgaon

**Dr. Usha Gupta**, Executive Vice President, Delhi Society for Promotion of Rational Use of Drugs

**Dr. Anita Kotwani**, Associate Professor, Vallabhbhai Patel Chest Institute, University of Delhi

**Dr. Ashok Rattan**, Chief Executive, Fortis Clinical Research Ltd., Gurgaon

**Dr. Kurien Thomas**, Professor, Christian Medical College, Vellore

**Dr. Ambujam Nair Kapoor**, Deputy Director General (Senior Grade), Indian Council of Medical Research (ICMR), New Delhi

**Dr. P. C. Joshi**, Professor of Social Anthropology, University of Delhi

**Dr. Sadhna Joglekar**, Medical Director, GSK Pharmaceuticals Ltd., Mumbai

**Dr. N. K. Arora**, Executive Director, INCLIN Trust International, New Delhi

**Dr. Hanumappa Sudarshan**, President, Karuna Trust, Bangalore

**Mr. M. Mitra**, Deputy Drugs Controller, Central Drugs Standard Control Organization, Ministry of Health and Family Welfare, Government of India, New Delhi

### **GARP-India staff**

**Alice Easton**, GARP-India Country Coordinator, Center for Disease Dynamics, Economics, & Policy, New Delhi

**Hellen Gelband**, Program Fellow and Study Coordinator, Center for Disease Dynamics, Economics, & Policy, Washington, DC

**Ramanan Laxminarayan**, GARP Principal Investigator, Director, Center for Disease Dynamics, Economics, & Policy, New Delhi

## Foreword

**A**ntibiotic resistance is a stark reality across the globe, including in India. The challenges associated with controlling antibiotic resistance, particularly in India, are many and multifaceted. On one hand, antibiotics are necessary in many life-threatening cases. On the other hand, overuse of antibiotics can be disastrous in the long run. Hence, judicious use of antibiotics is required, but acceptable strategies to achieve this goal and to address the challenges must be devised and communicated.

Molecular-based detection of the drug resistance of indicator microorganisms is a challenge, as is monitoring their circulation in hospitals and in the community. An approach that integrates surveillance for drug resistant organisms in animals and humans is also a current need.

Another major challenge is the absence of a good monitoring or surveillance system for prescriptions. A rigid surveillance system for community- and hospital-based prescribing is the first step towards determining the magnitude of the problem and instituting appropriate remedial measures. Such a system would provide a window on the underlying trends in prescribing practices.

Prescription monitoring is indeed difficult, considering the vast Indian sub-continent. One feasible approach is to provide incentives to pharmacists to keep records of prescriptions dispensed and discourage their practice of dispensing antibiotics without prescriptions (especially common in suburban and rural areas) or out-of-date prescriptions. Changing the behaviour of pharmacists will be pivotal for the success of any campaign against misuse or abuse of antibiotics. They need to feel that they are part of the health system, rather than simply another business. Programs to educate the pharmacists in the critical area of drug dispensing need to be designed and implemented.

Another important issue related to drug dispensing is that many pharmacies are not owned or run by qualified pharmacists. The number of pharmacies licensed to a single pharmacist, yet run by unqualified personnel, has mushroomed. This has aggravated the problem of malpractice in drug dispensing, where the only goal is financial gains, and needs to be addressed legally.

Once a good surveillance system is in place, a national board should monitor all prescriptions. When this is in place, it should focus on physicians who inappropriately use antibiotics. As with pharmacists, changing prescribing habits is no easy

task. Sustained efforts will be required to educate and re-educate physicians about the long-term consequences of antibiotic overuse. Here, technical issues need to be highlighted so that the physicians understand and appreciate the message.

Exacerbating this problem is the stagnation of the pharmaceutical industry in the development of new antibiotics. The lack of antimicrobial advances has led to the introduction of only one new class of antibiotics—the oxazolidinones—in the past three decades. One would think that knowing that the antibiotic armamentarium is on the verge of exhaustion would convince physicians to think twice before prescribing antibiotics.

While addressing the immediate concerns regarding antibiotic resistance should remain a priority, long-term goals should also be kept in mind. These include formulating strategies and incentives to kick-start new antimicrobial research and development by the pharmaceutical industry. Instituting effective public-private-partnerships may be crucial to initiate and sustain a strong antimicrobial drug pipeline over the long term. Again, all the foregoing efforts should occur simultaneously, in order to check misuse, abuse, or overuse of antibiotics.

Initiatives, such as the Global Antibiotic Resistance Partnership (GARP), should stimulate critical thinking and take the issue forward, so that the challenges are adequately addressed and, eventually, stabilization or even reversal of the antibiotic resistance pattern occurs—first regionally, then globally.

**Professor N. K. Ganguly**

*Chair, National Working Group, GARP-India*

*Distinguished Biotechnology Fellow and Adviser, National Institute of Immunology*

*Adviser, Minister of Health and Family Welfare*

*President, Jawaharlal Institute of Postgraduate Medical Education & Research*

*Former Director General, Indian Council of Medical Research*

## Executive Summary

The infectious disease burden in India is among the highest in the world. A large amount of antibiotics are consumed in fighting infections, some of them saving lives, but every use adding to antibiotic resistance in bacteria. Antibiotic use is increasing steadily (table 1), particularly certain antibiotic classes (beta-lactam antibacterials), most notably in the more prosperous states. Resistance follows in lockstep.

As a marker of disease burden, more than 5 million Indian children under the age of five years get pneumonia or sepsis, and 215,000 children die annually from infections from two bacterial pathogens, *Streptococcus pneumoniae* (*S. pneumoniae*) and *Haemophilus influenzae type b* (Hib)—both of which can be prevented with vaccines. Indian mortality rates are high, although not as high as some African countries and Afghanistan. Because India is so populous, it contributes more cases of infection and deaths to the global total than any other country. Preventing even a portion of these cases and deaths would be a boon to public health. The concomitant reduction in antibiotic demand would translate directly to considerably less antibiotic use and slower growth of antibiotic resistance.

### Lack of Access and Overuse of Antibiotics in India

As is the case with other resources, antibiotic effectiveness can be ‘used up’. When this happens, people will be forced to pay more for new drugs that replace inexpensive standard antibiotics or they will forego treatment because they cannot afford it. The eventual loss of current antibiotics is inevitable, but it can hap-

Table I. Outpatient antibiotic purchases from retail outlets in India

Year	2005	2006	2007	2008	2009
Antibiotic purchases in crore rupees (INR)	3,763	4,484	5,075	5,886	6,414

Notes: One crore equals 100 lakhs, equals 10 million

Source: Personal communication of IMS Health Information and Consulting Services-India data from Burzin Bharuch (Pfizer) to Ramanan Laxminarayan on July 30, 2009.

pen more quickly (years) or more slowly (decades), depending upon actions taken now. The Global Antibiotic Resistance Partnership (GARP) is developing policy alternatives to manage antibiotic effectiveness to the greatest benefit of the people in India Kenya, South Africa, and Viet Nam. This situation analysis is a preliminary report, designed to support in-depth policy evaluation that will result in final policy recommendations to address both lack of access to antibiotics and unnecessary use of antibiotics in India

A common response to slowing antibiotic resistance is to look for ways to limit antibiotic use, for example, by enforcing ‘prescription only’ laws for antibiotic sales. In Delhi, no prescription was presented for one-fifth of the antibiotics purchased recently. Yet, the situation is not so simple. In India, one is confronted with evidence of both overuse and underuse. In 2005–2006, a large portion of infant and childhood deaths from pneumonia would not have occurred if the children had been properly treated with antibiotics. Medical advice was sought for just under one-third of children with symptoms of pneumonia, and only about 13 percent of them were treated with an antibiotic. Not surprisingly, access is related to socio-economic status, although the reasons may not be directly financial—low education levels, lack of nearby healthcare facilities, and few available medical practitioners also contribute.

Drug prices in India are generally low because of competition among generic manufacturers, although some analysts believe that the government should mandate lower prices for essential drugs because their cost may still be prohibitive for some. If access to antibiotics without prescriptions were cut off by government-mandated reforms, would more people go untreated and die? Despite a wealth of research in India, this question cannot be answered.

Antibiotics are also overused in treating patients with coughs and colds that do not require antibiotic treatment—which wastes their effectiveness. This practice is common among people who seek healthcare from a doctor or other practitioner, not just those purchasing antibiotics without prescriptions. Studies from India have uncovered an array of possible reasons for this overuse, similar to other countries:

- Lack of microbiology facilities
- Doctors prescribing antibiotics to any patients with a fever, taking it as a sign of bacterial infection

- Patient expectations
- Desire of pharmacists and some doctors to make a profit from drug sales
- The public's lack of knowledge about the (in)appropriate use of antibiotics

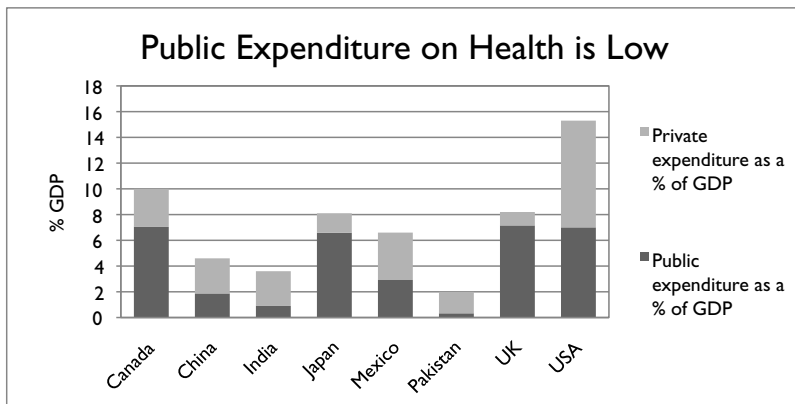
If it were just a matter of spending money ineffectively, that is a waste, but indiscriminate use of antibiotics begets resistance. Regardless whether antibiotic treatment is appropriate, the bacteria inhabiting the gut and other parts of the body are affected by antibiotics and will evolve genetic material coding for resistance that they pass on to other—even unrelated—bacteria. Stopping use of certain antibiotics can reverse some trends, but in other cases, even after a drug has not been used for years, the common bacteria remain resistant.

Access to antibiotic treatment is difficult to define, but it plays an important role in people's healthcare decisions, including decisions about antibiotics. For some, the only realistic access to healthcare is through a pharmacy or shop because there are not enough public facilities to provide care for everyone. Where public healthcare facilities do exist, the buildings may be crumbling, equipment may not work, and the clinic may be out of drugs because of inconsistent supply from the government. Care and drugs may also cost more than the official rates because extra payments are required in many cases. It should be no surprise that 80 percent of healthcare visits are to private sector practitioners, many of whom are poorly trained and unlicensed.

Patients who do go to hospitals often arrive with serious infections, but in many places in India microbiology services are limited or non-existent. In this situation, the infecting organism cannot be identified nor can its antibiotic resistance profile be determined (if the infection is bacterial). Common treatment (particularly in private hospitals) is with an advanced, broad-spectrum antibiotic, which begins to erode the effectiveness of these drugs. Better matching of pathogens with antibiotics could avert some of this loss.

Who pays for antibiotics, vaccines, and healthcare in general is important. In India, spending on healthcare is 4–5 percent of gross domestic product (GDP), but the lion's share—80 percent—is out-of-pocket spending, mostly for medicine. The government pays about 20 percent (1:4), but in most industrialized countries, spending is 6–8 percent or more of GDP (roughly 1:3, public to private expens-

Figure 1. Public/Private Spending on Healthcare in India and Other Countries



Source: WHO (2009).

es, respectively), meaning that other governments pay a much larger proportion (figure 1). This affects public and private decisions about what to buy and what not to buy. Even for an intervention that is relatively cost-effective—or even cost-saving—such as many vaccines, shifting costs from the private to the public sector may not be an immediately attractive option. The economics of such policies are usually not fully worked out, and nowhere in the world is the cost of antibiotic resistance factored in.

India is gradually improving access to healthcare for a greater proportion of its population by filling in some of the gaps in service. If it also shifted the balance so that government pays a somewhat larger share and if out-of-pocket expenditures decrease, people would be more likely to take advantage of available health services. Recognizing that such change may not happen for years, policies on antibiotic use still can make progress under current conditions.

## Poor Surveillance and Increasing Resistance to Antibiotics

Surveillance for antibiotic resistance is a low priority—lower even than microbiology services for patient care—in most low- and middle-income countries, and

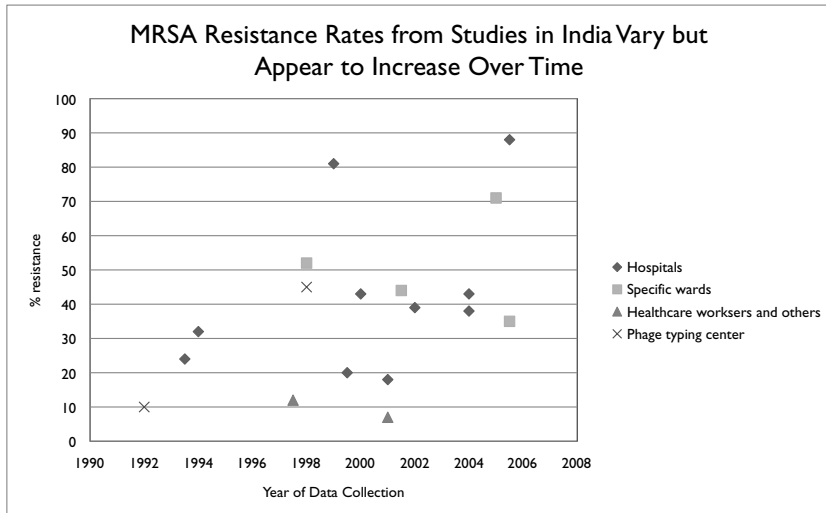


India is no exception. The Invasive Bacterial Infection Surveillance (IBIS) project has produced valuable information, but is limited in scope. Evidence of high and increasing resistance levels is sparse and generally biased upward because samples are tested only when patients fail to respond to common treatments. Still, the levels of consumption, the cautionary data contained in this report, and experience elsewhere in the world leave no doubt that antibiotic resistance is rising (figure 2) and will become an ever-greater problem in India, as it has in other countries.

## Antibiotic Use in Animal Husbandry

Surprisingly little is known about the use of antibiotics in animal husbandry in India. Many drugs commonly used for people are also used for farm animals to treat illnesses and probably curb contagion. Whether antibiotics are also added to feed to promote growth (as in the United States, but no longer in Europe) is not well known. No government regulations exist to control antibiotic use in domestic

Figure 2. MRSA (Methicillin-Resistant *Staphylococcus aureus*) Resistance Rates in India



Source: Data from all studies described in the section on MRSA in India, excluding those that did not specify when data was collected.

animals in India. The precise impact of agricultural antibiotic use on resistance levels in the general population is not known anywhere, but the evidence points to a link. As with human use, reducing demand, for example, by improving sanitation and limiting use to instances where antibiotics can be effective are options that deserve to be explored.

## Policy Responses

India could introduce various policies based on interventions that have proven effective in other countries, aimed at hospitals, clinics and other facilities, and communities. High on the list would be adoption of two infant vaccines, recommended by the World Health Organization (WHO), to prevent *H. influenzae type b* (Hib) and *S. pneumoniae*, which cause most of the infant deaths from pneumonia. Proven hospital infection-control measures (as simple as increasing the rate of hand washing by doctors and nurses) are not systematically employed. Other measures, such as public and professional education, about antibiotics are more country and context specific. Small-scale programs have been tried in India and elsewhere to encourage more rational antibiotic use and once further developed, these will likely be implemented more widely. Although India has successfully deployed economic incentives for better healthcare (e.g., promoting childbirth in hospitals), such innovations have yet to be developed for antibiotics.

The final GARP-India report (to be released in 2011) will consider all available options, each analysed in light of the information presented in this situation analysis and other pertinent factors.

## ABOUT CDDEP

The Center for Disease Dynamics, Economics & Policy (CDDEP) was founded with the objective of using research to support better decision-making in health policy. The CDDEP team employs a range of expertise—including economics, epidemiology, disease modeling, risk analysis, and statistics—to produce actionable, policy-oriented studies on malaria, antibiotic resistance, disease control priorities, environmental health, alcohol and tobacco, and various other diseases.

Many CDDEP projects are global in scope, spanning Africa, Asia, and North America. The strength of CDDEP derives from its researchers' experience in addressing country and region-specific health problems, as well as truly global challenges, while recognizing the circumstances in which the answers must fit. The outcomes of individual projects go beyond the usual models to inspire new strategies for analysis, and innovative approaches are shared through publications and presentations focusing specifically on methodology.

Founded in 2009 as a center of Resources for the Future, CDDEP is an independent non-profit organization. With headquarters in Washington D.C. and New Delhi, CDDEP currently employs full-time staff members in India, Kenya, and the United States, and relies on a distinguished team of academics and policy analysts around the world.

**The full report and Executive Summary are available at  
[www.resistancestrategies.org](http://www.resistancestrategies.org)**