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**PREVENTION AND CONTROL OF ANTIMICROBIAL RESISTANCE
IN THE AMERICAS**

Strategic Plan for Monitoring Antibiotic Resistance



**Program on Communicable Diseases
Division of Disease Prevention and Control
Pan American Health Organization**

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PREVENTION AND CONTROL OF ANTIMICROBIAL RESISTANCE IN THE AMERICAS

I. INTRODUCTION

In the Americas, as in the rest of the world, antimicrobial resistance is a serious and ever-increasing threat to public health. Drug-resistant strains of infectious agents are having a devastating impact in the fight against tuberculosis, malaria, cholera, diarrhea, and pneumonia—serious diseases which together account for over 10 million deaths in the world each year. The situation is compounded by the fact that very few new drugs are currently being produced to replace those that have lost their effectiveness.

Many of the most powerful antibiotics have lost their effectiveness against the two leading causes of death among children under 5 years of age—namely acute respiratory infections, especially pneumonia, and diarrhea. Antibiotic resistance in hospitals throughout the Region is also a growing concern and threatens to leave physicians and public health workers virtually powerless to prevent or treat many infections. For example, antibiotic-resistant bacteria cause up to 60% of the nosocomial infections that occur in the United States. Resistance means that the disease lasts longer and the risk of dying is greater, while at the same time epidemics of the same diseases continue unchecked. Moreover, with the tremendous increase in the frequency and speed of international travel, when they are abroad, people infected by resistant pathogens can introduce them into other countries, where the resistance can then spread.

In order to achieve a reduction in the frequency and repercussions of drug resistance, it is important to have a better understanding of all aspects related to the effective control of these agents. At this time there is no standardized or coordinated system in place at the global or national level for monitoring antimicrobial resistance.

The objectives of a system for the surveillance of antimicrobial resistance are:

- To help identify and apply prevention and control measures; to provide information on patterns of resistance which can serve as a basis for carefully designed promotion and education activities aimed at health providers and the general public.
- To assist health providers in making rational clinical decisions (for example, in selecting the most appropriate antibiotic to prescribe in a particular situation).
- To provide health facility directors with information on the best antibiotics to include in their formularies, taking into account both cost containment and the delivery of optimum patient care.
- To support the pharmaceutical industry in the discovery, preparation, and marketing of new drugs.

The primary factors leading to drug resistance are the uncontrolled and the inappropriate use of antimicrobial agents, including improper prescribing by the medical community and use by the general public without a prescription. It is therefore essential to promote the rational use of antibiotics.

In light of the threat to public health posed by the growing problem of drug resistance, the Pan American Health Organization (PAHO) convened an expert group meeting,

which was held in Asunción, Paraguay, on 27-29 January 1999 (see List of Participants in Annex 6). The participants drafted a three-year program for addressing this problem in the Region. The program's resources will support interventions aimed at the control and prevention of antimicrobial resistance in the following countries: Bolivia, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay, and Peru.

These countries were selected because they all have infant mortality rates in excess of 40 per 1,000 live births. They have been designated as target countries for child survival programs and are participating in the Integrated Management of Childhood Illness (IMCI) initiative. Their experience will help to give an overview of antimicrobial resistance in the Region.

At the same time, other countries in the Region that are not participating in the project directly (Argentina, Chile, etc.) will be able to strengthen their epidemiological surveillance and other systems by collaborating and participating in some of the project's activities.

Furthermore, all the countries of the Region will benefit indirectly from the information gained under this program through the role performed by PAHO in disseminating data and information related to resistance and promoting the standardization of laboratory testing methods throughout the Region.

The information gleaned on antibiotic resistance will be used as input to the regional IMCI initiative, which addresses the leading causes of mortality in infants and children under the age of 5 in the Region—namely, acute respiratory infections and diarrhea. The project will provide information specifically on the infectious agents that cause most respiratory and intestinal infections, and this information will be used to update treatment protocols and standards within the IMCI strategy and, ideally, to modify general standards for the treatment of adults.

II. BACKGROUND

A. Available Information

From a review of the literature it can be seen that there is little information available that shows the importance of antibiotic resistance as an emerging public health problem in the Americas, although a few reports do indicate that the problem can be serious and that it is on the rise.

A study conducted in Nicaragua in 1996 revealed that 29.3% of a series of *Vibrio cholerae* O1 strains were resistant to the trimethoprim-sulfamethoxazole combination and also to ampicillin.¹ In a second study,² which looked at 111 isolates collected in several different health areas of the country between July and November 1996, 77.5% of the isolates were resistant to trimethoprim-sulfamethoxazole and ampicillin. This study also showed, for the first time, variations of <0.125µg per mL in the MIC of doxycycline in strains that were susceptible at 2µg/mL. As a result of this study, the recommendations for cholera case management in Nicaragua were changed to call for the maximum dose of doxycycline in adults. As for children, who had been receiving trimethoprim-sulfamethoxazole up until the study, the regimen was

¹ López SR, Ávila J. Multiresistencia de *Vibrio cholerae* O1 a sulfametoxazol-trimetoprima y ampicilina. *Bolsa médica* (Nicaragua) 1996;36:10-11.

² López SR, Ávila J, Videá, T. Magnitud de la múltiple resistencia de *Vibrio cholerae* en Nicaragua. Nuevo patrón de susceptibilidad a sulfametoxazol-trimetoprima, ampicilina, doxiciclina y cloranfenicol *Bolsa Médica* (Nicaragua) 1997;47:18-20.

changed to include 3 days of erythromycin.

A study of *Streptococcus pneumoniae* conducted in six countries of the Region revealed high rates of resistance to trimethoprim-sulfamethoxazole, ranging from 26.0% in Colombia to 49.6% in Brazil.³

Table 1 shows country-by-country results of a study on the resistance of *S. pneumoniae* to trimethoprim-sulfamethoxazole.

Table 1. Results of a Study on the Susceptibility of *Streptococcus pneumoniae* to Trimethoprim-Sulfamethoxazole, by Country

Country	Susceptible		Intermediate		Resistant		Total
	Number	Percent	Number	Percent	Number	Percent	
Brazil	79	32.4	44	18.0	121	49.6	244
Chile	26	25.0	42	40.3	36	34.6	104
Colombia	85	56.6	26	17.4	39	26.0	150
Mexico	42	36.5	33	28.7	40	34.8	115
Uruguay	35	29.1	31	25.9	54	45.0	120
Total	267	36.4	176	24.0	290	39.6	733

Source: Report presented to the Technical Advisory Committee of the Study on the Epidemiological Monitoring of *Streptococcus pneumoniae* in Latin America (Cuernavaca, Mexico, July 1997).

In response to the threat to public health posed by increased antimicrobial resistance, the Pan American Health Organization and the Pan American Infectious Diseases Association (API) organized a Pan American Conference on Antimicrobial Resistance under the auspices of the Ministry of Health and Social Welfare of Venezuela. The event took place on 2-4 November 1998 in Caraballeda, Venezuela.

The Conference was enriched by the active participation of professionals from the fields of microbiology, infectious diseases, public health, and other disciplines. During the three days of the meeting these participants examined issues relating to the magnitude of the problem of infectious agent resistance to antimicrobial drugs; the appropriate use of these drugs in the community and the hospital setting; the monitoring of antimicrobial resistance; and the use of information gained from surveillance in arriving at treatment-related, regulatory, and political decisions.

Other topics addressed included the added health care cost of antibiotic resistance, participation of the pharmaceutical industry in the study, solutions to the problem, and the use of antibiotics in raising livestock for consumption.

Throughout the proceedings there was strong emphasis on the importance of using antibiotics correctly, as well as on the need to establish, disseminate, and apply policies and standards relating to the use of antimicrobial agents.

With regard to laboratories, there was extensive discussion of the need for test results to

³ From a report presented by the meeting of the Technical Advisory Committee on the Epidemiological Surveillance of *Streptococcus pneumoniae* in Latin America (Cuernavaca, Mexico, July 1997).

be comparable, as well as the need to establish standardized methods to determine the susceptibility of an agent to a given antibiotic, and issues of quality control and assurance in the diagnostic process were considered.

The participants were divided into working groups, which were charged with examining the following to specific topics in detail: (a) education for health professionals on the use of antibiotics; (b) development of a Pan American network for monitoring resistance; (c) quality control and ways to achieve consistent and comparable laboratory results, and (d) clinical use and abuse of antibiotics, both in hospitals and the community.

The recommendations of the participants on each of these topics are presented in Annex 1.

B. Activities Carried Out in Connection with the Monitoring of Certain Enteric Pathogens (Salmonella, Shigella, Vibrio cholerae)

The PAHO Communicable Diseases Program has already invested more than US\$325,000 in helping some of the countries to strengthen their epidemiological and laboratory infrastructure and build the specialized knowledge needed in order to monitor the enteric pathogens that they want to combat. Under the collaborative initiative of the Canada Laboratory Center for Disease Control (LCDC), the participating countries have received assistance in building their capacity to monitor *Salmonella*, *Shigella*, and *Vibrio cholerae*, all of which are common causes of diarrheal disease. This was the first step in defining the magnitude of the problem and setting the stage for the formulation and implementation of appropriate national prevention and control programs based on:

- The identification of emerging serotypes and predominant trends in antibiotic resistance;
- The development of short- and long-term training programs for strengthening epidemiological surveillance and improving laboratory performance;
- The design and implementation of protocols for improving quality assurance and controlling the performance of tests to determine the susceptibility of certain enteric pathogens to antibiotics.

As a result of taking the foregoing steps, the countries would have the benefit of:

- Improved laboratory capacity and standardized methods for the diagnosis of *Salmonella*, *Shigella* and *Vibrio cholerae* now and *Escherichia coli* in the future;
- Improved epidemiological surveillance systems and reference data for the enteric pathogens mentioned;
- A national reference laboratory network for diagnosing the aforementioned enteric pathogens, for the purpose of achieving viable prevention and control of these agents in the Americas.

The countries that participated in this undertaking were Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, and Venezuela. Workshops were held on the standardization of techniques for determining antibiotic susceptibility, protocols for quality

assurance, monitoring of test performance, and epidemiological surveillance. The Canadian LCDC and the U.S. Centers for Disease Control and Prevention (CDC) provided training in laboratory techniques and use of the Public Health Laboratory Information System (PHLIS).

Based on a recommendation by the participants in these activities, training was also given to professionals from the Bahamas, Barbados, Saint Lucia, Jamaica, Suriname, and Trinidad and Tobago. In addition, a workshop was held on the production of antisera to identify *Salmonella* and *Shigella* serotypes. As a result of this initiative, participants from Chile, Ecuador, Mexico, Paraguay, Peru, and Venezuela were able to set up their own production systems, or, in some cases, to build up their existing capability in this area.

Another PAHO activity was the meeting which is the subject of the present report. Experts were invited to prepare a plan for promoting the correct use of antibiotics in communities and hospitals throughout the Region. The aim of the plan is to strengthen surveillance and promote the formulation of policies that will ensure the correct use of antibiotics. The plan is presented in detail in Section IV of this document, and the list of participants is given in Annex 6.

C. Needs and Aspects that Require Strengthening

1. Surveillance Systems

For the most part, surveillance data on antimicrobial resistance are not systematically compiled in the countries of the Region. Nor are physicians or laboratory staff in the public and private sectors linked to an up-to-date information system. Their incorporation into such a system would make it possible to have more accurate knowledge about the status of antimicrobial susceptibility and is regarded as essential to having a more efficient surveillance system.

Thus it is proposed, as a first step under the project, to identify information sources and establish a system for the surveillance of antimicrobial resistance in each of the target countries. The data will serve as a baseline for future comparisons to measure progress toward the development of surveillance capacity in each of the countries.

2. Strengthening of Laboratories

In order to produce adequate surveillance data that will provide the basis for changing or implementing policies, regulations, and standards, it is indispensable for the laboratories in the target countries to take part in quality control programs to ensure the correct identification of the isolates studied and the accuracy of the antibiotic susceptibility tests. At the present time not all the countries have systems of this kind.

Through the project, it is hoped to implement quality assurance for all the procedures and activities undertaken by the medical laboratories and thus to improve the quality and the clinical usefulness of laboratory test results. It will be necessary to take into account the laboratories' operational aspects, including the preparation of a manual of procedures, the training of staff, the purchase and maintenance of equipment and reagents, the analytical process itself, and the presentation and interpretation of the results.

It will also be necessary to set up a quality control system based on both internal (in each

laboratory and in each country) and external, or international, evaluation of performance. A national reference laboratory will be designated to monitor quality control within the national laboratory network. In addition, an international reference laboratory will assume responsibility for the coordination of quality control for all the participating national reference laboratories.

As a part of the proposal, each participating laboratory in the target countries will commit to participating in a comprehensive quality assurance program. This program will monitor the entire diagnostic process, from taking and evaluating the samples all the way to interpreting the test results. In order to guarantee quality assurance, the manual of procedures must be used and systematically updated and internal quality control needs to be implemented for culture media, reagents, stains, and equipment.

3. Prescription of Antibiotics and Use of Drugs

The uncontrolled and inappropriate use of these drugs are among the factors that contribute most significantly to the development of antimicrobial resistance. It is necessary to put an end to improper prescribing of these drugs by the medical community, as well as to their use without prescription by the general public. In other words, it is essential to promote the correct use of antibiotics. It is a well-known fact that in many of the Latin American countries antimicrobial agents can be purchased in drug stores without a prescription, simply by asking for them. In a study carried out in Bolivia, Bartoloni et al. observed that 92% of adults and 40% of children with watery diarrhea were given antimicrobial agents inappropriately. The authors concluded that there was an urgent need for programs to increase the rational and effective use of drugs in the developing countries.⁴ In addition, it is important to promote legislation and policies that call for the rational use of antibiotics.

Yet another problem in this area is the lack of reliable data to determine the true extent to which antibiotics are being misused, and to provide a basis for planning interventions. To remedy this situation, as well as the misuse of antibiotics, PAHO intends to collaborate with individuals, organizations, universities, and other entities in each country that are in a position to influence the process.

III. RESPONSIBILITIES AND COLLABORATION

The Pan American Health Organization, working in cooperation with the ministries of health, will be responsible for overall coordination of the project. However, in order to ensure that the project achieves its aims, it is important that other partners participate both at the international level and in each of the countries. At the international level, the project will seek the collaboration of the World Health Organization, the U.S. Agency for International Development (USAID), and other institutions concerned with this matter, including, inter alia, FIOCRUZ in Brazil, the U.S. Centers for Disease Control and Prevention (CDC), the Canada Laboratory Centers for Disease Control (LCDC), the United States Department of Defense (DoD), the National Institutes of Health, other national research and public health institutions, universities, and multinational pharmaceutical companies. PAHO has long-standing relations with most of these institutions.

⁴ Bartoloni A, Cutts F, Leoni S, et al. Patterns of antimicrobial use and antimicrobial resistance among healthy children in Bolivia. *Tropical Medicine and International Health*, February 1998; 3(2):116-223.

Reform and decentralization of the health sector are bringing about changes in the role of the ministries of health in most of the countries of Latin America. The ministries are ceasing to be health care providers and turning into regulatory bodies. As a result, public health laboratories are not expected to expand their activities in the short or intermediate term. This means that the expansion of a surveillance system that is currently monitoring the antimicrobial resistance of enterobacteria (such as the one described above under “Background”) to include other species will require the creation of new partnership arrangements—for example, the involvement of associations in which professionals in the public and private sectors can interact and cooperate in establishing a sentinel surveillance system for monitoring trends and detecting and investigating susceptibility to the drugs.

The Pan American Infectious Diseases Association (API), which brings together physicians and microbiologists from the Latin American countries, has been identified as a possible partner. The API, through its members in different countries, has participated in monitoring susceptibility to antimicrobial agents since 1993. The Alliance for the Prudent Use of Antibiotics (APUA) might also collaborate. Indeed, the specific aim of APUA, which has an international network of member countries, is to promote the rational use of antibiotics and limit the development of resistance. In addition, PAHO will post the results of antimicrobial susceptibility studies on the PAHO Website. The Organization will also enlist the cooperation of appropriate scientific institutions in the Region in attaining the objectives proposed.

IV. DETAILED DESCRIPTION OF THE PROGRAM

Before any specific activities can begin, it will be necessary to undertake an evaluation to decide on the order in which the countries will be brought into the project, taking into account their existing capacity (institutional backing, human resources, readiness to participate). Some of the countries are in a position to take part in the project immediately, whereas others will have to join later when they are fully ready.

The project intends to establish a permanent sentinel surveillance system in the target countries that will monitor antimicrobial resistance in a selected sample of national laboratories in each country. A permanent mechanism will be installed for these establishments to disseminate the results of sentinel surveillance at national and regional levels. Surveillance depends on the quality of the data provided by the laboratories. Thus, the strengthening of reference laboratories and national laboratory networks through the establishment of quality assurance systems and internal and external quality control systems, described further below, is an essential component of the project.

It is also expected that changes will be introduced in the standards and regulations, as necessary, once the information on resistance to antimicrobial agents becomes available and begins to be disseminated. Some changes in policy have already been introduced, as for example in Nicaragua, where standards for the treatment of cholera were modified following a study on the resistance of *V. cholerae* O1 (see Section II above).

Execution of the project and achievement of its outcomes will depend, in the final analysis, on the countries' commitment to its objectives, the relative priority assigned to it, and availability of the necessary resources. Thus, attainment of the intermediate indicators will depend on performance at the country level.

A. Goal, Strategic Objectives, and Expected Results

1. Goal

This project will contribute to the protection of human health by reducing the incidence and spread of antimicrobial resistance, and it will therefore improve the treatment of infectious diseases and thus the outcomes of such treatment.

2. Strategic Objective

This component will have the following strategic objective: more effective execution of interventions to promote the control and prevention of antimicrobial resistance.

Indicators at the Level of the Strategic Objective

The following indicators will be used to measure progress toward attainment of the project's strategic objective:

- The number of target countries with systems established for the sentinel surveillance of antimicrobial agents;

- The number of target countries with laboratory quality control systems in place for the identification of resistant pathogens.
- The number of changes made, on the basis of sentinel surveillance data, in policies or standards relating to the prescription and use of antibiotics.

B. Results and Indicators at the Level of Results

Some of the main barriers to the implementation of interventions aimed at stemming the misuse of antibiotics appear to be the lack of adequate data on antibiotic resistance, the prevalence of inappropriate prescribing practices on the part of health providers, and the improper use of antibiotics by the general public. These aspects are addressed in the following description of results, activities, and indicators. Two primary results have been covered in this proposal (R1 and R2). R1 has been broken down into intermediate results. Figure 1 in Annex 5 summarizes the medium-term results expected from the project. In addition, a description of the intermediate results is given below, together with a summary of the activities for achieving them.

Result 1 (R1): Improved surveillance capacity in the target countries for assessing the extent and impact of antimicrobial resistance

Indicator

- Number of target countries that have quality (sensitive and specific) data on antimicrobial resistance

One of the first steps toward achieving result R1 will be to compile data in every target country in order to determine the sources of information on antimicrobial resistance and develop a database with current information on the problem. The data will serve as a baseline for measuring progress toward the ultimate availability of complete and useful information for decision-making in regard to standards, policies, and regulations on the prescription and correct use of antibiotics.

Monitoring under the project should cover the following pathogens:

<i>Enterococcus spp.</i>	<i>Salmonella spp.</i>
<i>Enterococcus faecalis</i>	<i>Shigella spp.</i>
<i>Enterobacter cloacae</i>	<i>Vibrio cholerae</i> O1 and O139
<i>Klesbsiella pneumoniae</i>	Uropathogenic <i>Escherichia coli</i>
<i>Serratia marcescens</i>	<i>Neisseria meningitidis</i>
<i>Acinetobacter spp.</i>	<i>Streptococcus pneumoniae</i>
<i>Proteus spp.</i>	<i>Haemophilus influenzae</i>
<i>Pseudomonas aeruginosa</i>	<i>Neisseria gonorrhoeae</i>
<i>Staphylococcus aureus</i>	

The following intermediate results (RI) are envisaged under R1:

RI 1.1: High-quality data will be available on the antimicrobial resistance of infectious agents in hospitals and the community in the target countries.

The activities for achieving RI 1.1 should be carried out simultaneously with those aimed at achieving RI 1.2 and RI 1.3, because the production of high-quality data depends to a great extent on the availability of trained laboratory staff and the quality control of laboratory tests.

Indicator

- Number of target countries with databases in place for monitoring antimicrobial resistance

RI 1.2: Laboratory staff will be trained in bacterial identification, testing for antibiotic susceptibility, and procedures for reporting and managing data.

For the attainment of RI 1.2, it will be incumbent on PAHO to produce and distribute training materials on the identification of bacteria, microbial susceptibility, and quality control (prepared by the World Health Organization, the National Committee for Clinical Laboratory Standards, and others).

PAHO will also organize and hold training-the-trainer workshops on such topics as bacterial identification, microbial susceptibility, and quality control. PAHO will utilize the project's resources to procure the necessary materials and supplies for these workshops. Training will be given using the CDC Public Health Laboratory Information System (PHLIS) and WHONET. Computer software will be also be provided.

Indicators

- Number of subregional workshops given on laboratory technology in the target countries;
- Total number of laboratories in each of the target countries using the correct technology for identifying bacteria and testing susceptibility to antibiotics

RI 1.3: Permanent quality control systems will be in place in all the target countries for testing antibiotic susceptibility.

As mentioned elsewhere in this document, PAHO has had considerable experience with technical cooperation in the establishment or strengthening of quality control systems for the laboratory detection of blood-borne pathogens in blood banks. Although quality control systems for testing susceptibility to antibiotics are much more complex than the systems used in blood banks, the latter type of experience provides the necessary basis for achieving the proposed strategic objective. In time, the proposed system will acquire the characteristics of quality assurance and internal and external control that have been described above.

The work related to this aspect of R1 will emphasize training to improve quality control in laboratory testing and the management of laboratory data, along with the development and implementation of a permanent system for evaluating the performance of participating laboratories (production, distribution, analysis of samples).

Indicators

- Number of target countries with quality control systems in place for testing susceptibility to antimicrobial agents and identifying the agents isolated;

- Number of target countries with a permanent system in place for evaluating the performance of participating laboratories (production, distribution, analysis of samples)

RI 1.4: There will be increased national capacity in the analysis, interpretation, and utilization of data for the application of effective measures.

Surveillance data, by definition, is the information needed in order to take action. This is especially true in the case of data on antimicrobial resistance. In order to achieve the strategic result, PAHO will promote the training of epidemiologists, program coordinators, and technical staff in the analysis, interpretation, and utilization of data on antimicrobial resistance. Health providers will be trained to spot abnormal events based on surveillance data and to identify outbreaks, as well as to take appropriate steps in response to such events. As the final result, the target countries will have a reporting system in place for monitoring antimicrobial resistance, with well-defined sources of data and mechanisms for communication, reporting, and feedback.

Some of these activities are already in the startup phase. Training materials have been prepared for responding to outbreaks, and an Internet-based reporting system has been developed and is currently being implemented. This Region-wide system will provide an electronic platform that all the countries can use to report their surveillance data.

Indicators

- Number of target countries with a system for the surveillance of antimicrobial resistance that is fully established and being used to take appropriate action;
- Number of target countries with a reporting system in place for monitoring antimicrobial resistance

RI 1.5: Information on drug resistance will be being analyzed and distributed to all the target countries and the rest of the Region of the Americas.

The role of PAHO in this regard will be to compile, organize, analyze, and disseminate the data collected from all the target countries and retransmit this information throughout the Region. A system has already been implemented in which data are being compiled and disseminated in selected countries via the PAHO Website.

This outcome will entail expanding the current PAHO database to include the data obtained under result RI 1.1; to provide for the analysis and broad dissemination of the data at the regional level; and to offer an E-mail system for feedback on the data. The system will be established in all the target countries and the data will be being shared with the rest of the countries in the Americas.

Indicators

- Number of target countries that regularly report data on antimicrobial resistance to PAHO;
- Distribution of biennial regional reports to all the target countries and the rest of the countries in the Region of the Americas

Result 2 (R2): *Improved capability in the target countries to implement strategies that address antimicrobial resistance*

With a view to achieving this result, the PAHO Program on Essential Drugs and Technology will assist in organizing the proposed activities. The following intermediate results (RI) are envisaged under R2:

RI 2.1: The data available in the target countries on existing policies, regulations, and standards regarding the prescribing practices of health providers and the use being made of these drugs by the general public will have been compared and analyzed.

Since one of the aims of the project is to promote changes, if and when they are needed, in the policy instruments that regulate the prescribing and use of antibiotic drugs, it is essential to set up a database that contains information on existing policies, regulations, and standards regarding prescribing practices. A national database on policies, regulations, and standards will have been created in each target country and, whenever possible, it will include information on how the policies are enforced. The data will be analyzed in terms of how they have affected policies on antimicrobial resistance (i.e., whether they have helped to promote or prevent resistance) with a view to recommending their implementation or review, as appropriate, in each of the target countries.

Indicators

- Number of target countries that are implementing policies and strategies to promote the correct use of antimicrobial agents;
- Number of target countries that have data available on policies and standards in effect and provide information on whether or not they are being implemented or enforced and how they are being applied

RI 2.2: Policies, regulations, and standards on the prescription and appropriate use of antibiotics will have been drafted on the basis of accurate information on antimicrobial resistance and will have been applied in the target countries.

In order to attain this result, it will be incumbent on PAHO to develop or adapt policies and standards regarding the prescription and appropriate use of antibiotics.

To achieve this result, the activities to be carried out include visits to the national health authorities to enlist their support in changing current policies and regulations. The visits will help national authorities become aware of the consequences of the incorrect use of antibiotics and the advantages to be gained by regulating their use. PAHO will also offer direct technical cooperation for officials responsible for formulating policies and will assist national authorities in developing national plans and strategies for introducing and implementing these changes.

Indicator

- Number of target countries with operative strategies and plans of operation for introducing and implementing new policies or standards to control resistance and the appropriate use of antimicrobial agents.

RI 2.3: there will be increased knowledge and awareness on the part of health professionals, policymakers, and the general public about the risks of antimicrobial resistance and related preventive practices.

Once support for the changes in policy has been mobilized, orientation workshops will provide detailed information for policymakers and health sector leaders (for example, professional associations concerned with the risks of antimicrobial resistance) on the need to take preventive measures. Subregional workshops will also be held for this purpose, and additional support will be provided for national workshops to disseminate knowledge on the subject in all the target countries.

Indicators

- Surveys conducted among health workers who have basic knowledge about the appropriate use of antimicrobial agents;
- Changes in prescribing practices in the health services (information regarding this indicator obtained through surveys or meetings of focus groups on the subject)

RI 2.4: Strategies will have been developed and adopted for promoting the rational use of antimicrobial agents, and they will be tested in the target countries.

Once the Representatives in the target countries have received all the necessary information (regarding R2.2 and R2.3), technical assistance will be provided in each country so that national plans can be developed to implement strategies for the control of antimicrobial resistance.

Technical cooperation will also be provided on the design of mass media campaigns and continuing education programs for health workers. PAHO already has experience in the preparation and testing of culturally appropriate messages for mass media dissemination, and the resources of the Organization's Office of Public Information will be enlisted for this purpose.

Indicators

- Surveys of health providers conducted and yielding essential information to patients or their caregivers (for example, parents) on the use of antimicrobial agents;
- Number of regional specialists trained (under the auspices MSH/RPM);
- Number of intervention proposals completed on the use of antimicrobial agents (under the auspices of MSH/RPM)⁵

RI 2.5: Practices and standards will have improved, having been compared, analyzed, and disseminated in the target countries and the rest of the Region of the Americas.

As with RI 2.1, the goal of the activities directed toward this result will be to establish a database of updated regulations, policies, and standards designed to promote and enforce practices aimed at controlling antimicrobial resistance in the target countries. The data will be shared among the participating countries and also those that have not been included in the project.

Indicators

- Development of models for analyzing, comparing, and disseminating data on the appearance and spread of antimicrobial resistance;

⁵ Intermediate result 2.4 will depend on the availability of future funding for MSH.

- Publication and dissemination of policies, standards, practices, and regulations on the PAHO Website;
- Dissemination of documents on the impact at the national level of implementing policies and standards on the rational use of antibiotics

V. ACTIVITIES (A) CORRESPONDING TO INTERMEDIATE RESULTS (RI)

In order to achieve proposed result R1—namely, improved monitoring capacity in the target countries for determining the magnitude and impact of antimicrobial resistance—including the intermediate results (RI) proposed for R1 above, it will be necessary to carry out the activities described below.

Activities for Achieving R1 Intermediate Results

Activity and Timetable

First Year

Objectives: Training, project startup

1. Identify the participating national reference laboratory (NRL) and laboratory network in each country.
2. Conduct a survey of human resources (training, number), basic equipment, and volume of work in each laboratory (see Annex 2).
3. Provide manuals on the necessary procedures to test for antimicrobial susceptibility (Kirby Bauer), ensure biosafety, and control the calibration of laboratory instruments.
4. Conduct a subregional training workshop (with the participation of two microbiologists from the reference laboratory in each country) to decide on standardized procedures for serotyping *Salmonella*, *Shigella*, and *Vibrio cholerae*, and testing for antimicrobial susceptibility.
5. In each NRL, implement the techniques decided on in activity 4, together with procedures for internal quality control.
6. Conduct a national workshop for laboratory network personnel for the purpose of updating and sharing information on laboratory methods.
7. Launch an external quality control program for the national reference laboratory (first survey; see Annex 1).
8. Launch an external quality control program for the laboratory network (first survey).
9. Hold a national workshop for microbiologists, epidemiologists, and infectious disease specialists to provide training on information processing as it applies to the collection and analysis of data.
10. Undertake external quality control of the NRL and the laboratory network (second survey).
11. Evaluate the attainment of objectives during the first year.

By the end of the first year, an organization chart similar to the one proposed in Annex 3,

showing organizational relationships and the flow of information, should be being implemented in each of the participating countries.

Second and Third Year

Objectives: Collection, analysis, and dissemination of reliable data

1. Every month, collect and analyze data on bacteriological typing and susceptibility testing in each of the network laboratories and send the results to the NRL.
2. At the level of the NRL, analyze the results from the network, working in collaboration with epidemiologists and infectious disease specialists.
3. Report the laboratory network results to the national health system and PAHO.
4. Assess the attainment of objectives.
5. Strengthen the networks in the rest of the countries of the Region and promote joint activities with epidemiologists, infectious disease specialists, and specialists from other disciplines in order to maximize prevention and control efforts.

At the same time, in order to achieve proposed outcome R2—namely, improved capacity in the target countries to implement strategies that address antimicrobial resistance—including the intermediate outcomes (RI) proposed under R2 above, it will be necessary to carry out the following activities.

Activities for Achieving R2 Intermediate Results

1. Create a database on the existing policies and standards in each country and how they are being applied.

These policies, standards, and regulations will be developed with the participation of governments, health institutions, professional associations, universities, other nongovernmental organizations, and consumer groups. Annex 4 contains a guide for this activity.

The data should refer specifically to antibiotics and should be uniform and consistent. There should be collaboration with such organizations as the Association for the Prudent Use of Antibiotics (APUA), the Pan American Infectious Diseases Association (API), and similar bodies. A survey will be designed and distributed to the countries by March 1999 at the latest, and the preliminary results from this survey will be reported at the annual meeting of the API, to be held in Guatemala in May 1999.

2. Analyze and disseminate the information obtained on existing policies and standards, and promote the application or modification of this information, as appropriate, in each of the target countries.

This information should be specific for each country and will be used to prepare a consolidated report for the entire Region. The information can be disseminated using established conduits such as the APUA bulletins and publications of the American Society for

Microbiology, the API, and others. In addition, a report will be prepared for the ministries of health in the Region.

3. Develop or adapt policies and guidelines on the correct prescription and use of antimicrobial agents. Such policies and guidelines should include a reserve list of antibiotics.

It is expected that all the countries will form a multidisciplinary committee in order to carry out this activity. PAHO can provide technical cooperation in this management.

4. Make promotional visits to national authorities to enlist their support for the development of new guidelines and regulations.
5. Collaborate with national authorities and managers on the development of national plans and strategies for introducing and implementing new policies and standards.
6. Train representatives of the public and private sectors to promote policies for the prevention and control of antimicrobial resistance in the target countries.

The training should be tailored to the specific groups. To achieve the best results, it should initially take the form of a pilot project in a country where the impact of the intervention can be measured. The training should be geared to decision makers, health care providers, and consumers.

7. Provide information on the risks of antimicrobial resistance and preventive practices to health authorities, academic personnel (in schools of medicine, veterinary medicine, public health, and other related disciplines), service providers, and the general public.
8. As in the case above, this activity should be tailored to the particular target group. The interventions might consist of impact surveys, announcements in the media, workshops, clinical briefings, continuing education programs, or information brochures, to mention a few possibilities.
9. Establish or strengthen institutional pharmacology and treatment committees. Technical cooperation will be provided on training the trainers and monitoring of the activities undertaken to prevent the development of antibiotic resistance.
10. Provide technical cooperation for the development of national plans to control resistance. This activity can be undertaken by multidisciplinary committees in each country.
11. Create a database featuring the most effective policies and standards currently in existence so that this information can be shared with all the countries in the Region. The information should be centralized in order to facilitate access and quality control.
12. Disseminate information on policies and guidelines, and analyze the impact of their application on antimicrobial resistance in the Americas. This information will be disseminated through PAHO, professional associations, Websites, newsletters, and other means, including meetings and conferences of health professionals.

Recommendations of the Pan American Conference on Antimicrobial Resistance in the Americas

Caraballeda, Venezuela, 2-4 November 1998

A. *Education on the Appropriate Use of Antibiotics for Health Professionals*

1. Improve the orientation and basic education provided to students so that they can recognize appropriate situations for the use of an antimicrobial agent based on knowledge about resistance to the drug, its spectrum and cost, and other factors. This training should be given at all stages of the health worker career, and the concepts should be incorporated into curricula in courses on microbiology, tropical medicine, pharmacology, clinical medicine, infectious diseases, social and preventive medicine, and other related disciplines.
2. Regularly update the medical and other faculty who teach the courses mentioned in the previous paragraph.
3. Encourage the pharmaceutical industry to promote antimicrobial agents responsibly. This effort should include the proper training of sales personnel and the adoption of a code of ethics governing the behavior of sales representatives and their interaction with physicians.
4. Establish continuing education programs.
5. Cooperate in the dissemination of information on bacterial resistance to antibiotics. The information should reach not only health workers and the community but also veterinarians and workers in the livestock and poultry industry.
6. Working in collaboration with teaching institutions, control and orient the access of sales representatives to hospitals, with a view to reasonable and mutually beneficial interaction.
7. In each hospital, establish an infection committee that will be responsible for setting criteria on when to initiate empirical antibiotic treatment in the case of the most common infectious diseases and developing recommendations for the management of infections when treating outpatients in the community.
8. Design and carry out educational campaigns aimed at mothers and children with a view to modifying antibiotic self-medication behavior patterns.
9. Establish multidisciplinary committees on antimicrobial use, to include surgeons, internists, orthopedists, bacteriologists and pediatricians.

10. Secure a commitment from the Pan American Health Organization to support these objectives through its work with national and regional authorities, including officials from the ministries of health, educators, and members of medical associations, scientific societies, and other groups of health professionals. The ultimate objective of this collaboration will be to get legislation enforced so that antibiotics will only be sold with a medical prescription.
11. Urge the participants in this event to disseminate the present recommendations in their respective countries via appropriate mass media (press, radio, television).
12. Request PAHO to mobilize resources to support the application of standardized research protocols for Latin America so that data will be comparable from one country to another for analytical and evaluation purposes. Ensure that the findings from this research are disseminated to physicians and other health professionals, industry personnel, government officials, and the general public.
13. Promote research on antibiotic consumption habits, self-medication, and the cost-benefit of treatment with these drugs.

B. Development of a Pan American Network for Monitoring Antibiotic Resistance

In the discussions of the working group that dealt with this topic, it was determined that it will definitely be feasible to establish a Latin American network for monitoring antimicrobial resistance. The following elements will need to be taken into account:

- Strengthening of existing networks;
- Formation of new networks in the countries where they do not exist;
- Promotion of the analysis and appropriate use of information;
- Establishment of a Regional registry to support studies of resistance in new phenotypes;
- Creation of a Website by PAHO that will serve as a channel of communication among participants in the network and a conduit for the distribution of information on the activities of the network.

The group also established the conditions that should be required of the institutions participating in the surveillance network:

- They should be permanent entities;
- They should have institutional or official support;
- They should have adequate internal and external quality control programs;
- They should have access to support by a local or regional reference laboratory.

In addition, it was recommended that microbiologists, infectious disease specialists, and epidemiologists be encouraged to coordinate their efforts by means of the following actions:

- Training of personnel through seminars, workshops, and other relevant activities;
- Joint analysis of data;

- Identification of unusual profiles of bacterial resistance;
- Preparation of local recommendations.

With regard to the role of professional associations in monitoring resistance, it was pointed out that they can provide technical and economic support and assist in the dissemination of information. It was also considered necessary to establish national information centers, as well as channels of communication between the various centers in each country.

With regard to the mechanisms and the financing of intercountry and regional coordination for evaluating the information and formulating recommendations, it was considered that the Pan American Health Organization would be the appropriate agency to assume this role.

C. Quality Control and Means of Achieving Consistent and Comparable Laboratory Results

The discussion of this topic focused on the reasons why there was still no way to ensure that the results of laboratory tests are consistent and comparable. A series of problems contributing to the poor quality of some of the data were reviewed, including:

- Lack of standardized laboratory procedures owing to the absence of standardized methods, techniques, and manuals and the lack of quality control;
- Lack of integration, coordination, and common standards among the laboratories that comprise each country's network;
- Inadequate external quality control programs in most of the laboratories in the Region.
- Difficulties in some of the countries in obtaining reagents and good quality materials.
- Scarcity of economic resources.
- Shortage of information because of problems in accessing up-to-date information from other countries; information not available in the language of the country; difficulties relating to the dissemination of information; or absence of a responsible coordinating entity to receive and disseminate information, either nationally or internationally.

Other drawbacks identified were the absence of clear objectives for the monitoring of antimicrobial resistance, lack of training in laboratory testing methods, and the need for training in the use of computer programs to analyze the data produced by the monitoring exercise.

In view of the deficiencies and difficulties cited in the paragraphs above, the working group on quality control made the following recommendations:

1. Designate a coordinating or reference center on antimicrobial susceptibility in each country (with or without regional centers) that would be responsible, inter alia, for coordinating the action taken, training human resources, defining the functions of each component of the system, integrating and disseminating the information, and coordinating an external quality control program for the laboratories in the network. The coordinating center would also be responsible for guaranteeing the continuity and sustainability of the program over time.
2. Define similar national standards in all the countries of Latin America for the purpose of obtaining comparable data. Once the standards have been developed, they should be sent to all the laboratories in the area, and their application should be regulated in each country.

3. Increase the collaboration between the countries of the Region with a view to taking maximum advantage of national experiences in subjects of training, the development of laboratory and monitoring networks, and the production of reagents.
4. Under the auspices of the Pan American Health Organization, establish an external advisory committee for Latin America.
5. Collaborate with the pharmaceutical industry and professional societies in implementing pertinent standards that will be mutually beneficial to all.
6. Encourage epidemiologists, infectious disease specialists, and public health professionals to work together as a team in setting clear objectives and applying the information gained through surveillance.
7. Establish a timetable of actions to be taken.

D. Clinical Use and Abuse of Antibiotics

This group analyzed the factors that lead to the abuse and inappropriate use of antibiotics both in hospitals and the community. It made the following recommendations:

In the Hospital Setting

1. Develop and apply standards for controlling the mass use of antibiotics, which not only has a financial and economic impact but has contributed to the modification of flora and the appearance of drug resistance.
2. Establish procedures in all hospitals for evaluating the status of bacterial resistance to antibiotics, bearing in mind that only local data can serve as the basis for sustainable standards relating to clinical and microbiological information.

As a mechanism for this purpose, the members of the working group suggested that on infection and antibiotics committees be established and entrusted with the development of standards. The membership of the committee should include a professional from the clinical area (an infectious disease specialist), one from the laboratory area (a microbiologist), an epidemiologist (a university-level nurse or an epidemiologist with a medical degree), and a representative of hospital management.

Based on their use, the antibiotics should be classified as prophylactic, empirical, or specific (therapeutic). The committee should also be responsible for epidemiological surveillance and the monitoring of antimicrobial resistance; the development of guidelines and policies on the use of antibiotics; and ongoing staff training in the rational use of antibiotics. In addition, it should facilitate relations between personnel in the laboratory and clinical areas.

3. In regard to the use of antibiotics, the group found that:
 - The use of antibiotics should be restricted, especially in Latin America, where the abuse of these drugs has led to the appearance of resistance and other consequences.

- It is essential that physicians utilize the report from the microbiology laboratory as a tool to guide them in making treatment decisions.
 - Physicians writing prescriptions in the hospitals should use a form that calls for data to identify the patient, including geographical location, and also the indication for using the drug, the diagnosis, the type of antibiotic, and the dose.
 - Every hospital should prepare a list of restricted antibiotics whose use must be authorized by a skilled professional—ideally, an infectious disease specialist. The decision to restrict the use of a drug will take into account any cost factors, its potential for becoming resistant, its toxicity, and the patterns of susceptibility. In addition, the group recommended that hospitals have a system for controlling the duration of prophylactic and therapeutic treatment. This could take different forms, depending on the situation in the particular hospital and its degree of complexity:
 - Standard criteria for automatic suspension (for example, suspension of antibiotics used for prophylaxis at 24 h and those used for treatment at day 7 or 10);
 - Automatic suspension based on an automated system in the pharmacy, which could be overridden only by a specific order from the attending physician to continue administration of the antibiotic;
 - Supervision of prescriptions by the antibiotics committees.
 - These measures should be monitored through periodic evaluation, ideally every quarter; prevalence studies (surveillance of antimicrobial resistance over time); and the analysis of information from any databases that are available.
 - The surveillance of bacterial resistance should be strengthened in the hospital as a whole and in each area within the hospital so that it will be possible to make decisions on the use of antibiotics based on the particular prevailing patterns. Each area of the hospital should do a periodic assessment of the impact of policies on the use of antibiotics, with special attention to their cost, cost-benefit, and degree of resistance.
 - In addition, validated and reproducible instruments should be developed for assessing the impact of the measures recommended above. The existence of standards or guidelines on the administration of antibiotics in hospitals, applied by the infections committee should be an element that is taken into account in the accreditation of hospitals.
4. Caution is advised in regard to interaction with the pharmaceutical industry. At the same time, however, it is recommended, as a matter of mutual interest, to work with the industry on ethical principles in such areas as the information on antibiotics provided to physicians in hospitals, clinical trials, and continuing education. Each institution should standardize this recommendation.

The Community

The group that examined the use of antibiotics in the community recommended the following measures to stem the progress of antimicrobial resistance:

1. Review current legislation in the different countries with regard to the registration, prescription, dispensing, and consumption of antibiotics.
2. Promote the development, application, and compliance with policies in these areas. The group emphasized that it was important not to register antibiotics with other drugs—for example,

other antimicrobial, antiinflammatory, or mucolytic agents. It also cautioned that the sale of antibiotics should be promoted only when they are prescribed by responsible health professionals.

3. Educate the population regarding the appropriate vs. the inappropriate use of antimicrobial agents, especially in the case of viral respiratory illnesses, as well as the risks of self-medication (adverse reactions, bacterial resistance), through television and radio campaigns, graphic media, and information pamphlets, depending on the situation in the particular area.
4. Engage in joint activities with scientific societies—for example, the preparation and dissemination of guidelines and recommendations. The guidelines should take into account local patterns of resistance and use of the drug.
5. The working group also called for a series of studies to gain more information on consumption habits and their determinants in Latin America. The following specific research topics were suggested:
 - Joint quantitative and qualitative studies on antibiotic consumption. In addition, it was recommended to extend the utilization study conducted in Argentina, Chile, and Uruguay⁶ to the rest of the countries. It was suggested that number of defined daily doses consumed be taken as the basis for drawing comparisons and evaluating the long-term effects of interventions;
 - Indications for the prescription of antibiotics with upper respiratory infections;
 - The incidence of over-the-counter self-medication, to determine the drugs used, why and where they were purchased, the doses, and the estimated duration of treatment;
 - Indications for the prescription of antibiotics in emergency rooms and outpatient treatment facilities in public and private institutions;
 - The use of antibiotics in livestock and agricultural production.
6. The group also suggested that the impact of the proposed interventions be assessed over time based on studies of consumption. It may be necessary to modify the interventions in keeping with the particular local situation and results to date.

⁶ Levy G, Savio E, Beaver, JL, Calmaggi, TO, González MA and Clara L. *Estudio de Consumo of Antibiotics in Argentina and Uruguay* (Published in this same issue of the Pan American Journal of Infectious Diseases).

Form for Gathering Information on the Laboratory Network

1) Identification of the laboratory

Country: _____ City: _____

1.1 Hospital Name: _____
 Address: _____
 Telephone and fax: _____

1.2 Laboratory Name: _____
 Address: _____
 Telephone and fax: _____
 E-mail: _____

1.3 Responsible official Name: _____
 Address: _____
 Telephone and fax: _____
 Academic training: _____
 E-mail: _____

1.4 Is the laboratory devoted exclusively to microbiology? Yes ___ No___
 If not, what other work does it do?

1.5 Laboratory's place in the administrative structure:

1.6 Source of funding
 State ___ Self-financed ___ Total ___
 Private ___ Partial ___
 Other ___

2. Human resources

2.1

Type of staff	Number	Hours/week in the microbiology laboratory
Professional		
Technical		
Auxiliary		
Administrative		
Other		

2.2 Training

2.2.1 Courses taken in the past 5 years

Subject	Number of staff trained

2.2.2 Courses felt to be needed for laboratory staff:

Subject	Number of staff needing the training

3. Material resources available

3.1 Physical plant

Area occupied by the laboratory (in m²) _____

Does it need any repairs? Yes _____ No _____

If there are any separate areas (e.g., for the preparation of culture media, sterilization, processing of samples, etc.), identify them and indicate the area they occupy.

Separate areas	m ²

3.2. Equipment

Basic equipment	Quantity	Technical status			Quality control
		Good	Fair	Poor	
Autoclave					
Sterilization ovens-stoves					
Culture oven					
CO ₂ stove					
Refrigerators					
Freezer -20°C					
Freezer -70°C					
Optic microscope					
Fluorescence microscope					
Darkfield microscope					
Phase-contrast microscope					
Non-cooled centrifuge					
Cooled centrifuge					
pH meter					
Water bath					
Water distiller					
Class II cabinet					
ELISA reader					
Analytical scales					
Precision scales					
Pipette cleaner					
Automatic pipettes					
Computer and printer					
Lyophilizer					
Other microbiology equipment					

3.3 Does it have manual of procedures for equipment control?

Yes ___ No ___

4. Studies conducted by the laboratory

4.1

	Microscopic examination (1)	Isolation (2)	Rapid diagnosis (3)	Biochem. identification (1)	Serotyping (1)	Antibiogram (1)	Serology (3)	Number of samples per year
Fecal cultures								
Urea cultures								
Hemocultures								
CSF								
Pus and secretions								
Vaginal swabs								
Urethral specimens								
Nasopharyngeal swabs								
Sterile fluids								
Other								

(1) Answer YES or NO

(2) Indicate the microorganisms investigated for each type of sample

(3) Indicate the technique used

If is necessary, add more space in the table.

4.2 Does the laboratory have manuals of operations and procedures?

Yes ____ No ____

If so, indicate what kind and the last date revised.

4.3 Antibigrams

Does the laboratory do antibigrams? Yes ____ No ____

What technique does it uses? KB ____ MIC ____

If KB, indicate the origin of the disks: _____

Indicate the media utilized for antibigrams: _____

Control strains used: list them and indicate who provides them:

Origin of the interpretation tables used (date published): _____

4.4 Serotyping Yes ____ No ____

If yes, indicate the origin of the antisera for each group of microorganisms

4.5 Receipt of samples and reports

Is there a form used for the receipt of samples?

Yes ____ No ____ If so, please attach it.

Does the laboratory issue periodic reports? To whom are they addressed? Please attach a copy.

5. Quality control

Does the laboratory have internal quality control? Describe the procedure.

Does it participate in any program for external quality control? Which one?

6. Computers

Does the laboratory have a computer? Describe it and indicate the software used.

7. Current status of participation in a laboratory network

Is there a local laboratory network in place? Yes ___ No ___

Laboratories with which it maintains links

Institution/ Hospital	Name of responsible official	Address/ Telephone/ Fax

Are isolates sent to another laboratory to complete their characterization? Yes ___ No ___

If so, indicate the name, responsible official, telephone, and fax of the laboratory.

8. Principal difficulties:

9. Remarks

External quality
control

Regional
laboratories

**Characteristics of the Database on National Policies and Standards
for Antimicrobial Agents**

Sector	Policy	Norms	Regulations
Government	Who prescribes the drugs? How are antibiotics dispensed? -- By dose? By duration of the treatment? How are new antibiotics approved?	Guidelines for the use of antibiotics; information aimed at patients on adherence to and completion of the treatment	Restriction of the communications media (radio, TV, press) regarding the promotion of antibiotics; Continuing education for physicians
Professional organizations		Committees on drug control, infections, etc.; guidelines for the use of antibiotics	Restriction of antibiotics for specific medical specialties
Professional associations and universities	Include the correct use of antibiotics in the medical curriculum	Guidelines for the use of antibiotics	
Nongovernmental organizations and consumers			

**MEETING ON THE DEVELOPMENT OF A STRATEGIC PLAN FOR THE
SURVEILLANCE OF ANTIBIOTIC RESISTANCE**

**27-29 January 1999
Asunción, Paraguay**

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