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A STRATEGY FOR PROMOTING IMPROVED PHARMACEUTICAL USE: THE INTERNATIONAL NETWORK FOR RATIONAL USE OF DRUGS

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Abstract—Over the last decade, pharmaceutical selection, procurement, distribution, and financing have improved as a result of essential drugs programs. However, despite improved availability, pharmaceuticals are frequently used irrationally. The International Network for the Rational Use of Drugs (INRUD) has been established to help address this problem. The Network joins core groups of researchers from four African and three Asian countries with support groups in Boston, Sweden, WHO, and Australia. The activities of the Network are supported by multilateral, bilateral, foundation donors and by Management Sciences for Health.

INRUD functions as a participatory organization in which members are involved in decision-making. The primary objective of the Network is to identify through a coordinated set of country-based research projects a set of effective interventions to recommend as policy options for the promotion of rational drug use. In developing these research projects, INRUD stresses the importance of a multi-disciplinary perspective for adequately understanding the reasons underlying inappropriate use of drugs. To better enable country groups to utilize strong research methodologies and to blend the strengths of multiple disciplines effectively, a major activity of the Network thus far has been the building of local research capacity.

Key words—pharmaceutical use, developing countries, Africa, Asia, prescribing, behavior change, intervention studies

INTRODUCTION

Drugs have been used by healers in all societies throughout history, and the significance of prescribing and dispensing of drugs as part of the healing process has been well-described [1, 4]. Over the last 50 years, major advances in the formulation and administration of pharmaceuticals have occurred such that drug therapy can now be very effective. However, for a variety of reasons, appropriate therapy is not always available to patients in developing countries [5, 7], which use only about 15% of the drugs available worldwide.

Patients may lack geographical or financial access to the modern health system. Within the health system, clinically and economically appropriate drugs are often not available because of problems in product selection, procurement, financing, or distribution. Even if appropriate drugs are available, health workers may not have sufficient training in diagnosis or therapeutics to prescribe correctly, or their prescribing may be inappropriate as a result of social, cultural, or economic factors.

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Since 1981, the Action Programme on Essential Drugs (DAP) of the World Health Organization has been working to ensure the availability of essential drugs in developing countries. An Expert Committee has produced numerous revisions of a model list of essential drugs, including criteria for selection of drugs in a national program [8]; over 110 countries have now established their own lists. Many countries have also taken action to better assure drug safety and quality. Some have implemented regulations restricting drugs determined to be ineffective or dangerous. Quality control laboratories have been established at national and regional levels and the WHO has established a drug certification scheme to monitor the quality of pharmaceutical products moving in international commerce [9–11].

Because of improvements in procurement systems and shifts to increasing use of generic as opposed to patented products, the price of pharmaceuticals in countries with efficient procurement systems has declined during the last decade [5]. Efforts have been made to improve the efficiency of drug distribution and storage. Kit distribution systems have been established in some countries to ensure a regular supply of essential drugs to peripheral health units [12–15]. Considerable attention has been paid to the financing of drugs in developing countries [16–19], and a variety of programs have been established

which attempt to increase community potential to pay for drugs [20–23]. The latest effort—"The Bamako Initiative"—has sought to combine local revolving drug funds with community controls and a broadening of PHC efforts [24–26].

During this rapid expansion of essential drugs programs and related initiatives, primary emphasis has been placed upon improving pharmaceutical supply, and upon ensuring that affordable drugs are available in rough proportion to prevailing illness patterns. However, very little is known about whether such activities have improved the subsequent appropriateness of medication use. Given the importance of effective drug use for reducing unnecessary morbidity and mortality, and for maximizing the health impact of the scarce health resources applied to pharmaceuticals, questions about the appropriate utilization of drugs have begun to come to the fore.

The WHO convened a conference of experts in Nairobi in 1985 to discuss this issue. This conference brought together academics, health planners, representatives of the pharmaceutical industry, and consumer activists. With such varied participation, the report produced reflects a wide range of interests [27]. The importance of rational prescribing was agreed upon by all; however, specific proposals for how more appropriate use of drugs should be achieved were more elusive. Recommendations were made for better drug information, proper training, and continuing education, but convincing evidence to demonstrate that these strategies would significantly and cost-effectively improve prescribing is lacking.

DRUG UTILIZATION PROBLEMS IN DEVELOPING COUNTRIES

Reports exist from many countries describing patterns of drug use in a range of health settings, including hospitals, health centers, private practitioners, and pharmacies. These reports routinely highlight similar problems in drug utilization: polypharmacy, due both to multiple prescriptions and the prescribing of fixed combination drugs; too frequent use of antibiotics, and injections, or vitamins; use of incorrect medications to treat specific problems; and so forth. Examples of inappropriate treatment abound: the use of tetracycline for children, chloramphenicol for minor infections, dypyrone as an analgesic, antidiarrheal antibiotics for diarrhea where ORS will do [28–33].

Although many studies agree that inappropriate use of drugs is a common problem, few published studies address the reasons for this irrational use, or strategies for improving it, in more than a superficial way. Frequently, further education in 'rational drug use' is recommended, but little concrete information is presented about the nature and extent of deficiencies in knowledge among prescribers and dispensers, and how these differences influence drug use practices. Furthermore, drug use is affected by many factors in addition to knowledge. The influence of drug representatives and pharmaceutical company marketing practices is anecdotally reported [34–37]. The pressure from patients to prescribe certain medications such as injections or specific 'strong or hot' medicines is recognized [38–41]. Financial incentives for multiple prescribing also exist in many settings where personal or institutional revenues depend upon the sale of drugs. However, little is known about the relative importance of these factors in determining prescribing.

In light of the fact that many acknowledge the existence of widespread problems in drug use, there have been very few published reports from developing countries which critically evaluate interventions to improve these patterns of inappropriate care. One study in Sri Lanka reported meaningful but not statistically significant reductions in antibiotic use following provider education and the dissemination of printed materials [42]. In Yemen, a combination of training and the provision of a limited list of drugs reduced the proportion of patients receiving antibiotics, the total number of drugs prescribed, and use of injectables, though the results were less than the ideal according to standard treatment schedules [43]. Other programs in Zimbabwe using education and in Ethiopia with the use of a limited list have been reported, although few results of proven impacts are presented [44, 45]. In India, a community-based intervention that included mass education about childhood pneumonia and training in simplified case management using cotrimoxazole for all levels of health worker resulted in reductions in pneumonia-specific mortality compared to control areas [46]. A study in Nepal based exclusively on case-finding and provision of drugs by community health workers demonstrated similar reductions in mortality [47]. One limitation of the handful of studies which have been published is that differences in methodology and perspective make comparisons difficult. Very few reports provide results which can serve as the basis for generalizable policy initiatives for promoting the rational use of drugs.

Within developed countries, there have been an increasing number of research studies and review articles published about different strategies for changing prescriber behavior [48–51]. In brief, these studies show that face-to-face education, participatory prescriber reviews with feedback, structured order forms, and the cooperative development of formularies often have some effect [48, 50, 52]. The use of regulations unaccompanied by provider or consumer education, while sometimes effective at promoting intended changes in drug use, can frequently have unexpected and often undesirable results [48, 53–55]. For example, it has been shown that removing unsafe or ineffective drugs from the market will not necessarily improve quality of care,

due to increases in the use of equally irrational or unsafe substitutes [56]. Similarly an excessively low 'cap' or limit on the number of drugs patients can receive, intended to control costs and decrease excessive drug use, increased expenditures due to chronically-ill patients being admitted to nursing homes to receive needed therapies [57].

In summary, effective essential drugs are now more widely available as a result of the growth of the essential drugs concept and the establishment of national essential dugs programs. However, even essential drugs are frequently used in an irrational fashion, and it is not clear what methods might be effective in developing countries to promote more appropriate pharmaceutical use. There is also a more fundamental problem in defining 'rationality' in drug use in these environments when drugs play different culturally-determined roles [58].

CRITICAL RESEARCH METHODOLOGIES AND TOPICS

The study of pharmaceutical utilization needs to move beyond the stage of identifying and describing similar problems in different environments. In light of what is now unknown about the reasons for observed patterns of inappropriate drug use and how to modify them, two broad categories of research are indicated.

Formative behavioral research is needed to discover and explore the motivations, expectations, and incentives which underlie the drug use behaviors of providers and consumers. This research needs to draw heavily on the broad array of methodologies that have been developed in the social sciences, which are only now beginning to be applied to the study of clinical problems in drug use. These formative studies must include application in different environments of some of the more promising qualitatively-oriented techniques, such as in-depth interviewing, focus groups, or case studies to examine the cross-cultural specificity or generalizability of their findings.

Once the behavioral foundations of drug use are better understood, *applied intervention trials* are necessary to determine the relative impact of different strategies to improve drug use practices in a variety of high priority health problem areas. The behavior change interventions to be investigated might be regulatory, managerial, or educational in nature, or a mix of these strategies.

Because of the many different environments in which pharmaceuticals are recommended and used, experimental intervention programs could take a variety of forms. Candidate settings would include hospitals, health centers, private practices, pharmacies, and the community at large. To adequately address questions about the relative cost-effectiveness of different interventions, it is important to measure the magnitude and duration of changes in pharmaceutical and other service use in key populations. In addition, to achieve maximum long-term impact, the optimal interventions to test would be those designed to strengthen local institutional capability to implement similar programs on an ongoing basis within existing resources.

The specific research topics that need to be addressed will vary regionally and from country to country. However, certain important drug use problems—such as the overuse of antibiotics and antidiarrheals in the treatment of diarrhea—are common to many areas. In addition, particular strategies for improving medication use may prove to be effective in many environments. For example, in developed countries the positive impact of face-to-face educational programs for providers has been convincingly demonstrated in a variety of settings [59–63]. Although most drug education programs for the public have not been evaluated, consumers have been shown to change their drug use practices in response to warnings about drug safety, particularly when media reports have been involved, as with warnings about the role of aspirin in causing Reye's syndrome [64]. There is a pressing need to test the efficacy of similar media-based public educational strategies in developing countries where poster or radio campaigns are widely used, as well as to evaluate the impact of individual drug education for patients.

Examples of some promising areas for research, and of the types of research questions that might usefully be addressed, are presented in Table 1. This list of topics is by no means exhaustive, but rather indicates some of the more important questions that have not been adequately addressed in previous studies from developing countries.

ESTABLISHMENT OF INRUD

In this context, the International Network for the Rational Use of Drugs was established in 1989 to serve as a catalyst for the promotion of well-designed research into drug utilization problems, and to identify interventions that are the most promising for promoting rational drug use [65, 66]. Initial discussions about the idea of a multi-country effort to address the issue of inappropriate use of drugs were held in Germany in July, 1989, at a meeting of clinical pharmacologists among individuals from Asian and African countries and representatives of Management Sciences for Health (MSH), a U.S.-based nonprofit health consulting company, the Drug Policy Group of Harvard Medical School, and the Department of International Health Care Research of Karolinska Institute.

It was agreed that rational use of drugs was a high priority health research issue, and that establishing multi-disciplinary groups in a limited number of developing countries working together was a promising strategy for organizing research efforts. A decision was made not to organize these groups around a single set of institutional relations within a

Table 1. Important unanswered questions for drug use research

Regulatory and Managerial Interventions
- What are the expected and unanticipated impacts on service use and outcomes of public sector policies like: limited lists, user fees, co-payment for drugs, caps on the number of drugs allowed per visit, banning of unsafe or overly expensive drugs, or limitations on the use of particular classes of drugs to providers with specific levels of training?

Drug Kit Distribution
- Has the drug kit distribution system adopted by some countries, in which a standard mix of essential drugs based on observed health problem patterns is supplied to peripheral facilities, been effective in improving the clinical appropriateness of treatments for these problems?

Standard Treatment Protocols
- How useful has the development of standard treatment protocols been in promoting the use of specific drugs and dosages for specific problems?
- What factors determine whether treatment protocols are followed especially over time?

Monitoring Prescribing Practices
- What is the best way to monitor the prescribing practices of providers in the public sector?
- Is it feasible to collect similar data on the prescribing practices of private sector providers or drug retailers?

Impact of Education
- Can face-to-face models of prescribing education, using specially trained health educators (physicians, clinical pharmacists, or other personnel) be conducted cost-effectively in developing countries?
- Are well-designed small-group or seminar-style educational programs effective in changing prescribing practices?

Retailers and Drug Sellers
- What factors underlie the recommendations of drug sellers?
- Is it possible to design educational programs to improve drug use by these important providers which acknowledge economic incentives but nevertheless promote therapeutically effective products?

Traditional Healers
- Is it possible to improve drug use by traditional healers, who in many countries have begun to rely on Western medicines for certain types of health problems? [80]

Marketing of Pharmaceuticals
- What is the impact of marketing activities aimed at prescribers and of consumer advertising on the use of drugs?
- Is it possible in countries where advertising is allowed to socially market products with particular public health value?

Microbial Resistance
- How are long-term increases in the prevalence of microbial resistance to antibiotics, antimalarials, or other essential drugs affected by programs which improve their use?

country, such as through the WHO country office or government to government bilateral organizations, but rather to link interested individuals wherever they were placed in a network arrangement. This ensured that individuals in universities, government departments, NGOs, and the private sector could be involved. It was acknowledged as a key principle of this initiative that the irrational use of drugs is a complex problem of behavioral dynamics and not caused simply by a lack of knowledge, and the importance of involving behavioral scientists in each country group was stressed. This was a major development, as prior to the initiative one common response to the problem of irrational drug use was to propose improved scientifically-based education of prescribers [26].

A Planning Committee was established of those who attended the initial meeting. The Planning Committee agreed that initial member countries should be selected on the basis of country visits, preparation of country experience papers, and development of a country action plan. Nine countries with identified individuals active in drug use research or essential drugs programs were selected for visits: Nigeria, Ghana, Sudan, Kenya, and Tanzania in Africa; Bangladesh, Nepal, Pakistan, and Indonesia in Asia. The visits, which occurred in late 1989, were undertaken by two-person teams, typically by one developing country and one developed country representative of the group who attended the Germany meeting. From these 9 countries, 6 were to be selected by a vote of the planning committee as initial members. A firm decision was made that following the selection of country members, all significant decisions would be made on a collective basis with each country group of the Network contributing to the process, but no organizational form was applied to this principle at the time. The administrative support for the Network was provided by the Network Co-ordinator employed by Management Sciences for Health.

The country visits served to introduce the concept and plans for the INRUD Network, and to invite country core groups to prepare two papers, one describing relevant experience with key policies or programs designed to promote rational drug use, and the other an action plan outlining a program of research on drug use which members of the core group would propose to undertake. Because of the emphasis on individuals rather than institutions, each country visit was different in terms of who was seen and where the visits occurred. Local support for the goals of INRUD was considerable, particularly in the academic community, but the involvement of government officials varied from country to country. Following each visit, a report was written by the visiting team outlining the experiences, perceived strengths, and weaknesses of the country groups, and this report was used in the selection process.

Planning Committee members were asked to rank the country groups, and to suggest which six countries should be included in the Network. This participatory process of selection was important in determining the future development of the Network. Different individuals used different criteria for assessing the country papers and reports, and variation in rankings occurred, but the final decision was a collective one. When the results were received there was strong support for seven countries (Nigeria, Ghana, Sudan, Tanzania, Nepal, Bangladesh, and Indonesia), and all were included in the initial group. The two country groups excluded at this stage were assured that at a future date they would be eligible for inclusion.

From the outset, one goal of INRUD has been to build a consensus among donors that funding activities to promote rational use of drugs is an important investment in health system development. Initial funding for the establishment of the Network was provided by WHO/DAP, Geneva. Core funding for

the first 2 years of Network activities was provided by Pew Charitable Trusts, with subsequent partial funding for core activities from the Danish International Development Agency (DANIDA). Support for the first Network meeting was provided by the Dutch Ministry of Foreign Affairs (NGO Aid Section), AIDAB (Australian International Development Assistance Bureau), and SIDA (Swedish International Development Authority). Support for country visits has come from UNICEF. Applications continue to be made to multilateral and bilateral agencies and to foundations for future core and project-specific funding, and to ensure communication between various funding groups.

The current level of funding does not allow for the full-time funding of Network coordination or administration. This leads to activities occurring in bursts, with gaps when the part-time Coordinator is undertaking other activities. Over time, other support group and country members are becoming more active in linking to individual country groups. As effective interventions are identified, there may be a desire to expand the Network beyond the initial member countries. Alternatively, agencies such as WHO and the World Bank may absorb the ideas and implement them on a large scale in many countries. This would change the need for a separate organization like INRUD and perhaps require a different focus.

DEVELOPMENT OF COUNTRY PAPERS

The country groups were asked to complete their country experience papers, expanding on specific areas of previous work within their countries that might be of most interest to other INRUD countries. Each paper was reviewed in detail, and revised to be presented at the first INRUD meeting. These papers describe experiences in improving drug utilization undertaken within member countries prior to the development of INRUD, and they encompass a range of relevant topics.

The Nigerian paper described the development of the modified curriculum in medicine, dentistry, and pharmacy, which incorporated the essential drugs concept [67]. The curriculum included sections on the essential drugs concept, the national drug policy, rational prescribing, pharmacokinetics, patient education and counselling, and financial management. Similar curricula have been developed for nurses and midwives.

The Ghana group described a baseline survey of five districts in four vegetational zones carried out as a baseline for implementation of the Bamako Initiative in Ghana [68]. The survey used both quantitative and qualitative methods to review health management practices in the public sector, and to inventory community resources and activities related to PHC. The combination of research techniques employed can serve as a model for other INRUD countries on how to undertake studies of this sort. The inventory of the available drugs was carried out at both public and private drug outlets. In addition, providers and clients were interviewed at each drug outlet, and a household survey was undertaken. The combination of research techniques can serve as a model for other INRUD members on how to undertake studies of this sort. The study produced interesting results related to access, choice of facility, utilization patterns, affordability and ability to pay for drugs, and information about drugs.

The Sudan country paper described how the national drug policy, and particularly limitations on the drug market, had been implemented [69]. Prior to 1983, there were 17,000 pharmaceutical products available in the country; this number has now been reduced to 4000. Low cost People's Pharmacies have been established to make drugs available at a substantially reduced cost compared to the private retail pharmacies. Despite these gains, a problem which Sudan continues to face is drug 'dumping' through donations of expired and inappropriate drugs by international assistance organizations.

The Tanzanian paper also described the development and formulation of the national drug policy [70]. The policy document specifically identifies rational drug use as an important policy area, outlining specific objectives concerning education and training, drug information, hospital pharmaceuticals and supplies committees, and advertising and promotion. A detailed time plan for the implementation of the various components of the policy is also described. In its organization and completeness, the Tanzania drug policy can serve as a resource for countries planning to revise their national policies.

The Nepal core group described the difficult logistics related to the organization of drug supplies in the country, and an innovative drug retailers training course [71]. This training program has, since 1983, provided a mechanism for drug sellers to undertake a 40–45 hr orientation course to improve their service to the public. Over 5000 participants have been trained, with 4046 successfully passing the post-training examination. The Nepalese approach of upgrading drug sellers' skills may have relevance for other countries where drug sellers are a major source of pharmaceuticals.

The Indonesian paper described a series of drug utilization studies which examined patterns of drug consumption and prescribing in the public sector [72]. A multi-institutional working group, representing the Ministry of Health, the private sector, and donor groups, looked in one study at drug expenditures and consumption in seven provinces, followed by a detailed health center prescription analysis in two provinces. The major problems identified were multiple drug prescriptions, the frequent use of injections and antibiotics, and the lack of variation in treatment across diagnoses. The paper summarized

the macro and micro approach to organizing a program of drug use research.

The Bangladesh group reported on how the well-known Bangladesh drug policy had been implemented, and some of its macroeconomic impacts [73]. Of interest, however, was a small study at local level which showed that serious problems in terms of polypharmacy and irrational drug use continue to exist. While significant policy changes can make a difference in terms of drug supply, these changes may have very little impact on drug use patterns at the village level.

In summary, the experience papers developed by the country core groups as their initial contribution to INRUD documented the unique experiences of member countries in a way that Network members and others could share and benefit from each group's experiences. The papers served as one central focus for discussion at the first INRUD workshop. In light of the overall goals of INRUD to promote multidisciplinary research, what is notable about these papers is that most tended to emphasize discussion of national policies or were descriptive studies. None related directly to learning about behavioral factors which influence drug use, or to the testing of interventions. The mix of study methodologies in the Bamako baseline study in Ghana, and the multiple sequential drug use studies with related objectives in Indonesia represent two examples of strong foundations for future intervention research.

THE INRUD WORKSHOP

The first INRUD workshop was held in Yogyakarta, Indonesia in July 1990, for two weeks. Three people from each of the Network countries were invited, and each country was encouraged to select at least one social/behavioral scientist to participate. Attenders included clinical pharmacologists, physicians, Ministry of Health officials, pharmacists, and social scientists trained in geography, sociology, anthropology, and statistics. Support group members attending the meeting included physicians, medical anthropologists, health education specialists, and health policy researchers. In addition, representatives of multilateral (WHO and UNICEF) and bilateral (USAID, Danida and SIDA) agencies attended.

Experience sharing was achieved by both formal and informal interactions. Participants presented their country experience papers in formal sessions. The social scientists led a panel where they presented individual perspectives on their professional role in relation to drug use. Thus, a medical geographer, a psychologist, an anthropologist, and a medical sociologist all had the opportunity to suggest how their skills were relevant, which was particularly useful to clinicians whose experience in this area was limited. Participants also brought examples of descriptive and educational materials from their countries, and these were copied for use in other countries. Such materials included training materials, questionnaires, regulations, curricula, and newsletters.

Formal training sessions were held to bring participants to a similar level of knowledge. These sessions covered topics such as qualitative and quantitative research methods, educational interventions, managerial and regulatory interventions, and intervention selection. These sessions gave participants the opportunity to relate personal experiences and to discuss alternative approaches to research.

At the beginning of the second week, individuals were asked to analyze the first week's discussions in terms of *cross-cutting themes*. The themes reviewed were: impacts of national drug policy on rational use; strategies for limiting availability of drugs on the market; implementation of standard treatment guidelines; curricula on essential drugs and rational use; patient and consumer education; provider in-service education; and the relation of drug financing to rational use. This encouraged participants to think about and discuss these issues in a broad fashion, attempting to identify how different issues crossed national boundaries and continents, and how possible solutions could be adapted from other country experiences.

A major activity of the workshop was a field assessment of patterns of drug use and reasons underlying them in the area where the conference was held. This activity, described below, was very important in welding the disparate members into an INRUD collective group. By working together, defining research issues, developing data collection instruments, collecting, analyzing, and presenting data, the INRUD members gained respect for the variety of skills and experiences present in the group.

Each country group met together and with support group members to further develop and refine *short- and long-term country research plans*. These plans were presented and discussed with constructive comments being offered by other Network members, based on their own experiences. A cooperative research project, where a similar intervention protocol would be used in a number of INRUD countries, was developed at the meeting. Network plans were made for a series of inter-country visits to observe ongoing programs, or share technical expertise.

Considerable discussion occurred at the meeting on the best way the Network could be coordinated. The final decision was that a *Network Committee* would be elected, to be comprised of one person from each country and an additional social scientist from the Asian region and the African region (see Appendix). This Committee would replace the functions of the Planning Committee which had guided the development of the Network to this point. The role of the Network Committee will be to decide by consensus, at an annual meeting or by *ad hoc* polling, on all important policies related to the governing on INRUD, including which activities are to receive greater priority and how the overall growth of the

Network will proceed. All research proposals are to be reviewed and approved by at least two members of the Committee. Because of contractual needs of donors and in light of the inevitable delays in international communication, the responsibility for day-to-day decisions about communication, logistics, and expenditures is left in the hands of the Network Coordinator and the staff at the Support Office based at MSH.

FIELD METHODOLOGY FOR ASSESSING PROBLEMS IN DRUG UTILIZATION

The decisions and behaviors that determine drug use encompass a variety of actors and settings, and often a wide geographical area. Pharmaceutical supply managers, manufacturers' representatives, health providers, drug sellers, patients and their families all play a role in determining how drugs are used. In assessing problems of choice on the part of specific providers and consumers of drugs, it is both revealing and necessary to examine their behaviors in the context of these broader influences.

Although a large part of the INRUD meeting was devoted to conceptual or administrative activities, these served as a counterpoint to the field activities, which were the most important part of the meeting. This field work demonstrated and tested a methodology for rapidly examining the dynamics of drug use problems. The principal objective of this assessment methodology is to better understand a drug use problem by having a multi-disciplinary group of observers carry out a number of linked qualitative and quantitative research activities. A second objective at the meeting was to familiarize INRUD members with features of specific methodologies, in order to highlight and contrast the potential contributions of these techniques. The sequence of activities that comprised the problem assessment methodology, as they were applied at the INRUD workshop, is described in Table 2.

Individual activities were led by country or support group members familiar with a particular methodology, and with how this method can be applied quickly and simply in the field. If this assessment exercise were carried out within the context of ongoing health services or a university research program, many of the component activities would be carried out more systematically. However, it is often true that health managers have few resources and limited time to apply to this sort of activity. One of the major lessons of the assessment exercise at the INRUD meeting was that useful and often unexpected information can be discovered in a short period by allowing people with different disciplinary perspectives to observe behaviors and environments simultaneously using multiple methodologies.

The assessment team in this case consisted of the 30 individuals who attended the INRUD meeting. Most of the time, this large team was broken into smaller groups of 4–6 individuals representing different disciplines; each small group worked inde-

Table 2. Sequence of activities in the problem assessment process

Activity	Description	Time Frame
Observe Drug Use Environment	• Conduct informal observations of activities related to drug use in a number of environments, including: • District health administration • District drug warehouse • District hospital inpatient, outpatient, pharmacy • Health center services, community health programs • Private polyclinic, private practitioner • Licensed pharmacy, drug retail store, marketplace	One full day
Identify Problem Practices	• Describe behaviors and perceived problems in each location • Highlight differences in perceptions between separate teams of observers, between disciplines • Identify similarities and differences among environments that are part of the drug use system	1½–2 hr
Select a Problem for Study	• List identified cross-cutting problems in drug use worthy of further study • Establish priorities to select the focus of further study • Identify single problem to examine with multiple methods	2 hr
Develop Protocols and Methods	• Identify study methods and particular locations to be studied • Develop necessary data collection instruments • Design protocols and sampling methods	2–8 hr depending on method
Collect Data	• Implement individual research methods as planned • Describe successes and unanticipated problems in implementing the research method	3–6 hr in field, plus 1–2 hr synthesis
Analyze and Synthesize	• Process data and prepare data displays • Present findings of individual studies • Describe recommended changes in study methodology • Synthesize information on the problem studied • Synthesize lessons from study process	4–10 hr analysis, plus 4 hr reporting

pendently of the other small groups. This style of multi-disciplinary rapid assessment could be undertaken with a smaller assessment team, but for the INRUD meeting, having a number of small groups allowed the different components of the exercise to be carried out in a relatively brief time span. One reason for organizing the assessment process around small working groups was to avoid overwhelming the individuals from or about whom data were being collected any more than necessary. The exception was a short, formal presentation by the district medical officer to all the assembled study groups to orient them to the demography, health problems, and health services of the district studied.

The support of district administration and of individuals at each of the locations studied is essential if the rapid assessment process is to be both practical and informative. Because the process is intended to be brief and focused, an effort is made to minimize the administrative burden to these individuals. Although studies of work behavior are often threatening, especially ones sanctioned by higher levels of the political or medical administration, the breadth of the process and the valuable input of behavioral scientists helped to make these investigations acceptable to those observed.

At an initial planning session, the large study team met to define the goals of the assessment process. This was followed by a day-long field visit, during which each small group observed three locations involved in the supply or use of drugs (listed in Table 2). Following these observations, the large group reconvened to describe what they had seen, and to give an opportunity for each small group to present their perspectives on factors encouraging and discouraging rational use of drugs in these environments. The study team then selected a common drug use issue to be addressed by the smaller working groups. Because of its importance as the major source of visits to the health system in Indonesia, acute respiratory infection was selected as the topic for study.

Each small group was responsible for applying a single methodology to the study of problems of drug use in ARI; for example, one group designed and carried out a focus group for mothers on this topic. The variety of techniques used in the assessment process

Table 3. Research methods used for drug use problem assessment

Method	Study units	Description	Characteristics measured
Review data on drug consumption and morbidity	• Records at district office	• Compilation and review of data on morbidity patterns and drug consumption for target health problem(s)	• Reported morbidity profile and drugs consumed • Problem patterns for particular health facilities, health problems, or drugs
Audit of prescriptions	• Hospital outpatient clinic records • Health center registers or prescription records	• Retrospective review of records in one or more health facilities • Data elements: age, diagnosis, drug and quantity prescribed, type of prescriber, quantity dispensed	• Usual treatment practices for target conditions • Key features of inappropriate drug use for target conditions • Particular health facilities or types of prescribers with problem practices
Patient interviews	• Patients attending health facilities	• Short structured questionnaire interviews with patients arriving at or exiting health facilities • Exit interviews can be restricted to patients with a particular complaint	• Health complaints of patients • Number and types of drugs prescribed and dispensed • Patient understanding about health problem or drugs • Reported satisfaction with services provided
Observation of health care process	• Patients presenting for care at health centre with target conditions	• Observation of the process of care for a small sample of patients from an anthropological or clinical perspective • Venues include patient waiting area, clinical examination room, drug dispensary	• Quality of care from the patient perspective • Adequacy of examination, diagnosis, drug dispensing • Constraints on performance by prescribers or dispensers • Quality of communication between patients and care-givers
Focus groups	• Physicians or other providers • Patients or mothers of children with target condition	• Group discussions guided by a trained moderator on a defined set of topics among a small, homogeneous group of participants	• Beliefs motivations, imagery, incentives related to topics discussed • Contrast of the perspectives of prescribers and consumers of drugs
In-depth interviews	• Physicians or other prescribers • Patients presenting at health facility for target conditions	• Extended open-ended interview on a defined set of topics between key informant(s) and trained observer	• Beliefs, motivations, imagery, incentives related to topics discussed • Contrast the perspectives of prescribers and consumers of drugs

are listed in Table 3. In each small working group, disciplines and professional backgrounds were mixed in order to encourage contrasting perspectives. The small groups independently identified their own specific study questions, planned the field methods for each research technique, and collected, processed and analyzed their own data. Following these independent analyses of field data, the large group met a last time to hear a description and critique of the methods and findings of the individual studies, to discuss general conclusions relevant to the understanding and treatment of ARI, and to integrate their separate experiences and findings.

DEVELOPMENT OF DRUG USE INDICATORS

In order to promote more generalizable and reliable drug use research, participants at the first INRUD workshop took the first steps towards the development of a draft set of indicators related to appropriate drug use. The intention is that these indicators be used as consistent measures of important aspects of drug use when surveys or studies are undertaken. An effort was made to select indicators which would mean the same in different countries, yet which might also be expected to be able to change over time as a result of interventions designed to improve drug use policies and practices. The indicators covered five areas: prescribing, patient care, drug supply, marketing, and policy. Brief descriptions of these draft indicators, as they were proposed at the meeting, are given in Table 4.

In order to ensure the comparability of meaning of these indicators across countries and over time, a standardized methodology is being developed to collect the data necessary to measure them in either a retrospective or prospective manner. A number of the member countries will test this methodology as part of their country action plan. Field tests have already been undertaken in Indonesia, Bangladesh, Nepal, Nigeria and Tanzania with the support of WHO. To standardize the data collection methodologies, and as another vehicle for building local research capacity in member countries, the field tests have been led by INRUD members with specific experience in this type of data collection travelling between the different participating countries.

IMPACT OF THE FIRST INRUD MEETING

The INRUD workshop had three major effects: country research teams and proposed plans were strengthened; multi-disciplinary research was encouraged through both technical presentations and field experiences; an organizational structure for the Network and a framework for cross-country collaboration was developed. Following the meeting, a range of activities were undertaken. These included visits to member countries by other members to share technical experiences and skills, development of research proposals, undertaking multi-disciplinary field research, and the field testing of drug use indicators described below.

Table 4. Draft drug use indicators proposed at INRUD meeting

Prescribing Indicators
- Average number of drugs prescribed at primary care level at each visit.
- Proportion of primary care outpatient cases receiving antibiotics.
- Proportion of primary care outpatient cases receiving an injection.
- Percentage of children under 5 with diarrhea receiving ORS.
- Percentage of children under 5 with diarrhea receiving antidiarrheal drugs.
- Percentage of cases who receive treatment according to the national or institutional standard treatment schedules.
- Percentage of patients leaving a primary care unit without a drug being prescribed.
- Percentage of drugs prescribed in generic form.
- Percentage of drugs prescribed in a fixed dose combination form.

Patient Care Indicators
- Percentage of patients leaving a unit at defined level able to report the correct dosing schedule.
- Percentage of patients attending a primary care unit who receive a minimal basic examination, e.g. temperature, pulse.
- Average consultaton time period with a prescriber.
- Percentage of penicillin resistant infections at primary level.

Drug Supply System Indicators
- Per capita consumption of specific indicator drugs (g. per capita).
- Per capita expenditure on drugs.
- Percentage of total expenditure on antibiotics.
- Percentage of total expenditure on injectables.
- Percentage of drugs in a facility not on the essential drug list or formulary.
- Availability of drugs for treating the 5 most common conditions.

Marketing Indicators
- Number of drug representatives employed compared to number of physicians registered.
- Number of breaches of IFPMA marketing code.

Policy-related Indicators
- Presence of a national essential drug list.
- Percentage of prescribers with access to impartial pharmaceutical information.
- Are antibiotics, steroids, or psychotropic drugs available without a prescription?

Many of the first round of studies undertaken by the core groups were reported at the International Conference on Social and Cultural Aspects of Pharmaceuticals in Developing Countries, held in the Netherlands in October 1991. At this meeting, attended by twelve INRUD members, six papers were presented by INRUD country members based on research sponsored by INRUD. These included an assessment, using retrospective analysis of prescribing and focus groups, of the impact of in-service training for medical assistants on the clinical management of malaria in Ghana [74]; an observational and interview study of drugs as an element of the interaction between patients and physicians in both public and private practice in Bangladesh [75]; a report on two community studies of ethno-medicine in Nepal [76]; a focus group study of mothers examining the socio-cultural aspects of the use of drugs in the treatment of childhood diarrhea in Nigeria [77]; and a study in Indonesia, also using focus groups, investigating indigenous beliefs about drug use in Indonesia, which is part of the formative phase of a controlled intervention comparing the efficacy of different types of provider education in changing diarrhea treatment practice [78].

In comparison to the work reported at the first INRUD meeting one year previously, what was noticeable about these papers was the use of a variety of different methodologies, particularly more qualitative ones emphasized during the field assessment of drug utilization in Yogyakarta. Also notable is a stronger emphasis on action-oriented research as the countries build toward the testing of interventions.

The Amsterdam Conference on Social and Cultural Aspects of Pharmaceuticals was immediately preceded by a smaller meeting of members of the INRUD committee, support groups, and country social scientists. In contrast to earlier meetings the Network members were able to participate confidently in discussions and argue a shared perspective due in part to their joint field experience in Indonesia, and to the development of a common understanding about key issues and approaches that has occurred with the visits and research undertaken thus far.

In evaluating an experience such as the first INRUD workshop, outcome criteria are difficult to define. If one criterion is, "Has the work undertaken since the workshop been significantly better?", the country experience papers can be compared with the papers presented in the Netherlands. Clearly there is a consistent improvement in terms of the range of techniques used, the orientation to action, and the emphasis on behavioral aspects of drug use.

One element which contributed to the relative success of the meeting was the process by which participants worked together to learn common lessons. This process of data collection, analysis, and reporting was more significant in many ways than the actual results. However, one weakness of this approach was that substantial time during the meeting was spent on introductory methodological presentations and on later field work and data analysis, and inadequate time was left for intensive development of future proposals. This has meant that significant delays occurred after the meeting in finalizing and obtaining funds for later research activities. INRUD has funded a number of small research projects, including some of those presented in the Netherlands, while WHO and the USAID Applied Diarrheal Disease Research Project have agreed to fund larger projects in Nepal and Indonesia.

THE ROLE OF ONGOING INRUD ACTIVITIES

Country and support group members contribute to a number of ongoing activities in order to advance INRUD's primary objective of promoting applied intervention research. These activities are intended to promote effective communication among members and with other interested individuals; to increase support for related activities among donors and government agencies; and to increase local capacity for designing, conducting, analyzing, and disseminating the results of drug use research.

The Network Coordinator, based at MSH, produces a semiannual *newsletter* as a primary mechanism for communication, and also as a tool for promoting ideas about how drug use could be improved in developing countries. This publication, with a current circulation of 2000, includes news about member countries and their ongoing activities, reviews of relevant recent articles, material on important topics in drug use, commentary contributed by interested readers, and notices about future activities. As an indication of its success in stimulating interest, there have been over 800 responses, from 69 countries, to the first three issues of the newsletter.

Frequently, researchers and government officials in developing countries do not have access to modern journals or even abstract services. Without such access, it is difficult to avoid situations where useful methodologies are not standardized, and where interventions which already have been proven ineffective are repeated. To partially address this need, a *bibliography* of over 1450 references on drug use in developing countries has been created, combining material from bibliographies produced by WHO/DAP, University of Amsterdam, and Harvard Medical School. A regular MEDLINE search on key topics in drug use is carried out to update the database. Bibliographic software has been supplied to Network members and the support groups (Reference Manager 5.0 [79]), to enable them to have access to relevant information quickly and efficiently, and complete copies of referenced articles are provided to members on request. A text copy of the current bibliography is supplied to anyone requesting it for the cost of copying (about $10.00).

The *research proposal development and review process* is an area where developing country professionals are often at a competitive disadvantage as compared to developed country researchers. Communication with donors about funding possibilities and with colleagues about potential research topics is more difficult, and opportunities for training in proposal development skills are limited. Once an initial research proposal has been developed by a country group, it is reviewed by two Network members, one from a country group and one from a support group, with an eye toward strengthening its focus and methods. Whenever possible, country group members with similar interests are requested to comment. This facilitates constructive input, informs the reviewers of the proposed work, and may give them ideas to use in their own work. Based on these reviews, limited funding can be provided directly from INRUD resources, or the proposal is forwarded to an external funding agency with high likelihood of interest in the proposed topic. In time, the hope is that multi-country intervention studies will be undertaken to validate on a larger scale the most effective policies for countries to follow.

One of the major ways that INRUD hopes to promote the sharing of ideas and the transfer of technical skills is through the support of *inter-country visits* of two types. First, there are visits by one country member to another country to share experiences, communicate or learn skills, and broaden knowledge. For example network members from Bangladesh and Sudan visited Ghana to examine the work that had been done concerning the 'Bamako Initiative'. The second form of visit is by support group members with specific technical skills to assist country members in the development or conduct of research. Such a series of visits have been undertaken by an Indonesian INRUD member to Bangladesh, Nepal and Nigeria to introduce the Drug Use Indicator methodology. These visits have also proven useful in developing the feeling of a common INRUD identity in the different member countries and a common approach to drug use research issues.

In conclusion, INRUD is a cooperative international venture to address in an innovative way the problem of the inappropriate use of drugs. Over the last decade there have been major improvements in the selection, procurement, distribution, and financing of drug supply. But the critical element in the process, not yet successfully addressed, is that of promoting the rational use of drugs. By approaching this problem with an interdisciplinary perspective crossing national and regional boundaries, it is hoped that realistic policy and program options will be identified. By using a network approach and avoiding specific institutional affiliations, an attempt has been made to build on the strengths, expertise, and enthusiasm of the many varied individual members. The measure of the success of this effort will be whether the local capacity in member countries to design and conduct relevant, methodologically-sound research increases consistently over time, and most importantly, whether effective interventions to improve drug use can be identified and widely disseminated.

REFERENCES

1. Mitchell M. F. Popular medical concepts in Jamaica and their impact on drug use. *West. J. Med.* **139,** 841–847, 1983.
2. Kleinman A. *Patients and Healers in the Context of Culture.* University of California Press, California, 1980.
3. van der Geest S. Anthropology and pharmaceuticals in developing countries. *Med. Anthropol. Q.* **15,** 59–90, 1984.
4. Bledsoe C. H. and Goubaud M. F. The reinterpretation of Western pharmaceuticals among the Mende of Sierra Leone. *Soc. Sci. Med.* **21,** 275–282, 1985.
5. World Health Organization. *The World Drug Situation.* World Health Organization, Geneva, 1988.
6. Fabricant S. J. and Hirschhorn N. Deranged distribution, perverse prescription, unprotected use: the irrationality of pharmaceuticals in the developing world. *Hlth Policy Plan.* **2,** 204–213, 1987.
7. Foster S. Supply and use of essential drugs in Sub-Saharan Africa: some issues and possible solutions. *Soc. Sci. Med.* **32,** 1201–1218, 1991.
8. World Health Organization. *The Use of Essential Drugs Model List,* 6th revision. Technical Report Series 796. World Health Organization, Geneva, 1990.
9. Dunne J. Fore-warned is fore-armed. *Wld Hlth,* pp. 26–27, 1985.
10. Anonymous. Quality control of drugs: Certification scheme on the quality of pharmaceutical products moving in international commerce. Participating countries—supplementary list 3. *WHO Chron.* **36,** 107–113, 1982.
11. Summers R. S. Quality control of pharmaceutical preparations and the Third World. *Cent. Afr. J. Med.* **29,** 247–249, 1983.
12. Moore G. D. Essential drugs for Kenya's rural population. *Wld Hlth Forum* **3,** 196–199, 1982.
13. Anonymous. Essential drug kits for rural Kenya: an interview with Dr Wilfred Koinange. *WHO Chron.* **40,** 57–60, 1986.
14. Hogerzeil H. V. Standardized supply of essential drugs in Ghana. Unpublished, 1990.
15. Commonwealth Pharmaceutical Association. GMP and quality control in developing countries. *Pharm. J.* **238,** 436–438, 1987.
16. Carrin G. Community financing of drugs in sub-Saharan Africa. *Int. J. Hlth Plan. Manage* **2,** 125–145, 1987.
17. Catsambas T. and Foster S. Spending money sensibly: the case of essential drugs. *Finance Dev.* **23,** 29–32, 1986.
18. de Ferranti D. Paying for health services in developing countries: a call for realism. *Wld Hlth Forum* **6,** 99–105, 1985.
19. Ellis R. P. The revenue generating potential of user fees in Kenyan government health facilities. *Soc. Sci. Med.* **25,** 995–1002, 1987.
20. Cassels A. Drug supply in rural Nepal: Bhojpur Drug Scheme. *Trop. Doct.* **13,** 14–17, 1985.
21. Foster S. and Drager N. How community drug sales schemes may succeed. *Wld Hlth Forum* **9,** 200–206, 1988.
22. Cross P. N., Huff M. A., Quick J. D. and Bates J. A. Revolving drug funds: conducting business in the public sector. *Soc. Sci. Med.* **22,** 335–343, 1986.

23. World Health Organization. Financing essential drugs: report of a WHO workshop. Harare, Zimbabwe 14–18 March 1988, WHO, Geneva 1988.
24. Hughes D. and Fiander A. The Bamako initiative [letter]. *Br. Med. J.* **299,** 683, 1989.
25. Anonymous. The Bamako initiative [editorial]. *Lancet* **2,** 1177–1178, 1988.
26. Kanji N. Charging for drugs in Africa: UNICEF'S 'Bamako Initiative'. *Hlth Policy Plan* **4,** 110–120, 1989.
27. Anonymous. The rational use of drugs. Report of the conference of experts. Nairobi, 25–29 November 1985.
28. Greenhalgh T. Drug prescription and self-medication in India: an exploratory survey. *Soc. Sci. Med.* **25,** 307–318, 1987.
29. Angunawela II. and Tomson G. B. Drug prescribing patterns: a study of four institutions in Sri Lanka. *Int. J. clin. Pharmac. Ther. Toxic.* **26,** 69–74, 1988.
30. Hardon A. P. The use of modern pharmaceuticals in a Filipino village: doctors' prescription and self medication. *Soc. Sci. Med.* **25,** 277–292, 1987.
31. Rashid H. U., Chowdhury S. A. R. and Islam N. Patterns of antibiotic use in two teaching hospitals. *Trop. Doct.* **16,** 152–154, 1986.
32. Chowdhury A. M., Vaughan J. P. and Abed F. H. Use and safety of home-made oral rehydration solutions: an epidemiological evaluation from Bangladesh. *Int. J. Epidemiol.* **27,** 655–665, 1985.
33. Mnyika K. S. and Killewo J. Z. J. Irrational drug use in Tanzania. *Hlth Policy Plan* **6,** 180–184, 1991.
34. Silverman M., Lee P. R. and Lydecker M. The drugging of the Third World. *Int. J. Hlth Serv.* **12,** 585–596, 1982.
35. Silverman M., Lee P. R. and Lydecker M. Drug promotion: the third world revisited. *Int. J. Hlth Serv.* **16,** 659–667, 1986.
36. Jayasena K. Drugs: registration and marketing practices in the third world. *Dev. Dialogue* **2,** 38–47, 1985.
37. Lexchin J. Doctors and detailers: therapeutic education or pharmaceutical promotion? *Int. J. Hlth Serv.* **19,** 663–679, 1989.
38. Messer E. Hot–cold classification: theoretical and practical implications of a Mexican study. *Soc. Sci. Med.* **15,** 133–145, 1981.
39. Cunningham C. E. Thai "injection doctors": Antibiotic mediators. *Soc. Sci. Med.* **4,** 1–24, 1970.
40. Wyatt H. V. The popularity of injections in the Third World: origins and consequences for poliomyelitis. *Soc. Sci. Med.* **19,** 911–915, 1984.
41. Cosminsky S. and Scrimshaw M. Medical pluralism on a Guatemalan plantation. *Soc. Sci. Med.* **14,** 267–278, 1980.
42. Tomson G. B. *Drug Utilization Studies in Sri Lanka—Towards an Understanding of Medicines in Society.* Karolinska Institutet, Stockholm, 1990.
43. Hogerzeil H. V., Walker G. J., Sallami A. O. and Fernando G. Impact of an essential drugs programme on availability and rational use of drugs. *Lancet* **1,** 141–142, 1989.
44. Lindtjorn B. Essential drug list in a rural hospital: Does it have any influence on drug prescription? *Trop. Doct.* **17,** 151–155, 1987.
45. Laing R. and Ruredzo R. The essential drugs programme in Zimbabwe: new approaches to training. *Hlth Policy Plan* **4,** 229, 1989.
46. Bang A. T., Bang R. A., Tale O., Sontakke P., Solanki J., Wargantiwar R. and Kelzarkar P. Reduction in pneumonia mortality and total childhood mortality by means of community-based intervention trial in Gadchiroli, India. *Lancet* **336,** 201–206, 1990.
47. Pandey M. R., Daulaire N. M. P., Starbuck E. S., Houston R. M. and McPherson K. Reduction in total under-five mortality in western Nepal through community-based antimicrobial treatment of pneumonia. *Lancet* **338,** 993–997, 1991.
48. Soumerai S. B., McLaughlin T. J. and Avorn J. Improving drug prescribing in primary care: a critical analysis of the experimental literature. *Milbank Q.* **67,** 268–317, 1989.
49. Gurwitz J. H., Soumerai S. B. and Avorn J. Improving medication prescribing and utilization in the nursing home. *J. Am. Geriatr. Soc.* **38,** 542–552, 1990.
50. Soumerai S. B. and Avorn J. Efficacy and cost-containment in hospital pharmacotherapy: state of the art and future directions. *Milbank Q.* **62,** 447–474, 1984.
51. Raisch D. W. A model of methods for influencing prescribing: Part I A review of prescribing models, persuasion theories, and administrative and educational methods. *DICP* **24,** 417–421, 1990.
52. Raisch D. W. A model of methods for influencing prescribing: Part II. A review of educational methods, theories of human inference, and delineation of the model. *DICP* **24,** 537–541, 1990.
53. Soumerai S. B., Avorn J., Ross-Degnan D. and Gortmaker S. Payment restrictions for prescription drugs under Medicaid. Effects on therapy, cost and equity. *NEJM* **317,** 550–556, 1987.
54. Smith D. M. and McKercher P. L. The elimination of selected drug products from the Michigan Medicaid formulary: A case study. *Hosp. Formul.* **19,** 366–371, 1984.
55. Ferrando C., Henman M. C. and Corrigan O. I. Impact of a nationwide limited prescribing list: preliminary findings. *Drug Intell. clin. Pharm.* **21,** 653–657, 1987.
56. Soumerai S. B., Ross-Degnan D., Gortmaker S. and Avorn J. Withdrawing payment for non-scientific drug therapy: intended and unexpected effects of a large scale natural experiment. *JAMA* **263,** 831–839, 1990.
57. Soumerai S. B., Ross-Degnan D., Avorn J., McLaughlin T. J. and Choodnovskiy I. Effects of Medicaid drug-payment limits on admission to hospitals and nursing homes. *NEJM* **325,** 1072–1077, 1991.
58. *International Conference on Social and Cultural Aspects of Pharmaceuticals*, The Netherlands, 17–21 October, 1991.
59. Avorn J. and Soumerai S. B. Improving drug therapy decisions through education outreach: a randomized controlled trial of an academically based "detailing". *NEJM* **308,** 1457–1463, 1983.
60. Ray W. A., Blazer D. G. and Schaffner W. Reducing long-term diazepam prescribing in office practice a controlled trial of educational visits. *JAMA* **256,** 2536–2539, 1987.
61. Ives T. J., Frey J. J., Furr S. J. and Bentz E. J. Effect of an educational intervention on oral cephalosporin use in primary care. *Arch. Intern. Med.* **147,** 44–47, 1987.
62. Brooks P. M., Jones J., Lawrence R. and Ali R. Reducing the pill swill: an audit of clinical pharmacy. *Med. J. Aust.* **2,** 427–428, 1977.
63. Herfindal E. T., Bernstein L. R. and Kishi D. T. Effect of clinical pharmacy services in prescribing on an orthopedic unit. *Am. J. Hosp. Pharm.* **40,** 1945–1951, 1983.
64. Soumerai S. B., Ross-Degnan D. and Kahn J. S. The effects of professional and media warnings about the association between aspirin use in children and Reye's Syndrome. *Milbank Q.* In press.
65. Laing R. Rational drug use: an unsolved problem. *Trop. Doct.* **20,** 101, 1990.
66. Laing R. International network for the rational use of drugs (INRUD). *Trop. Doct.* **20,** 133, 1990.
67. Ayanbeku O. A., Omoyele O. O., Salako L. A., Oyegbile F. R., Iyun B. F., Isah A., Mabedeje A. F. B. Country experience paper: Nigeria, 1990.

68. Ofori-Adjei D., Amoa A. B., Arhinful D. K. and Adjei S. Baseline survey for implementation of Bamako Initiative in Ghana: methodology and drug use in the community. Country Experience Paper, 1990.
69. Ali H. M., Zaidan Z. A., Karim E. I. A., Homeida M. M. A., El Din A. T. and Ali M. H. Sudan Country Experience Paper, 1990.
70. Mwaluko G. M. P., Shija R., Mwasha C., Daya M., Kigodi P. G. K., Rwiza H., Kimambo A. I., Leshaberi M. T. and Hill E. Tanzania national drug policy, 1990.
71. Pradhan Y. M. S., Shrestha A. D., Karkee S. B., Gartoulla R. P. and Kafle K. K. Country experience paper: Nepal Country Core Group, 1990.
72. Santoso B., Sarnanto B., Arbanto T., Wirjoatmodjo K., Gardjito W., Prawitasari Hadiyono J. E. and Mawarwati Mulyadi B. Experiences with drug utilization in Indonesia, 1990.
73. Ul-Islam N., Chowdhury A. K. A., Choudhury S. A. R., Khan A. K. A., Ul-Alam N. and Das A. M. Regulatory approaches to rational drug use in Bangladesh, 1990.
74. Arhinful D. K. and Ofori-Adjei D. The impact of in-service training on the clinical management of malaria by assistants in Ghana. Presented at the *International Conference on Social and Cultural Aspects of Pharmaceuticals*, The Netherlands, 17–21 October 1991.
75. Das A. M. Drugs as an element of interactions between the physician and the patient. Presented at the *International Conference on Social and Cultural Aspects of Pharmaceuticals*, The Netherlands, 17–21 October, 1991.
76. Pradhan Y. M. S., Kafle K. K., Gartoulla R. P., Shrestha D. and Karkee S. B. Ethno-medicine and self-medication practices in Nepal. Presented at the *International Conference on Social and Cultural Aspects of Pharmaceuticals*, The Netherlands, 17–21 October, 1991.
77. Iyun Folasade B. Socio-cultural aspects of use of drugs in treatment of childhood diarrhoea in rural areas of Oyo State, Nigeria. Presented at the *International Conference on Social and Cultural Aspects of Pharmaceuticals*, The Netherlands, 17–21 October, 1991.
78. Prawitasari Hadiyono J. E. Beliefs concerning the use of drugs in Indonesia. Presented at the *International Conference on Social and Cultural Aspects of Pharmaceuticals*, The Netherlands, 17–21 October, 1991.
79. Reference Manager® is produced by Research Information Systems, Inc., Carlsbad California. Version 5/01 was released in November, 1990.
80. Foster G. M. Anthropological research perspectives on health problems in developing countries. *Soc. Sci. Med.* **18,** 847–854, 1984.

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