

THE USES OF MODERN TECHNOLOGIES: PROBLEMS AND PERSPECTIVES FOR INDUSTRIALIZED AND DEVELOPING COUNTRIES¹

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The way medical technology is selected, developed, and deployed in any country is bound to have an important impact on public health. Relatively few efforts are being made to assess medical technology in most Latin American countries today. However, in many cases it would appear possible to have a program that identified technologies needing assessment, sought information from various sources, and prepared guidelines or recommendations based on this information. This would not have to be an expensive process, but it would appear to be one that could prove very useful.

As an aid to policy-making in the health care system, technology assessment has gained increasing attention in recent years. Such technology assessment addresses the fundamental problem faced by all countries: allocation of scarce resources. In 1980 the subject of resource allocation and health technology assessment was examined at a conference sponsored by the Rockefeller Foundation and the Office of Technology Assessment of the United States Congress (1). However, the papers at that conference dealt primarily with the problems faced by industrialized countries, while those at our present meeting¹ will focus upon the problems faced by less developed countries.

We have many reasons to be optimistic about medical technology. We need technology in the health care system. We need new technology. And it is technology that offers the hope of improving the health of our peoples through the health care system. Consider the case of vaccines and antibiotics used against infectious diseases, for example. We now have

preventive and/or treatment measures for the following infectious diseases: measles, rubella, whooping cough, diphtheria, syphilis, gonorrhea, many pneumonias, typhoid fever, tetanus, puerperal sepsis, neonatal infections, infant diarrheas, and many others. Consider chronic diseases. We now have technology to control pellagra, rickets, scurvy, erythroblastosis fetalis, Addison's disease, juvenile diabetes, and certain types of cancer, among others. Many advances have appeared over the past few years. We have diagnostic tools undreamed of 20 years ago. We have new technologies for rehabilitation and for improving people's ability to function.

On the other hand, in some ways technology seems to be out of control. Even in the United States, policy-makers have begun to realize that it is not possible to do everything. The central problem is one of limited resources. No society is rich enough to do everything in any sector. The United States is already spending more than 10% of its gross national product on health services, and many people feel that this percentage cannot rise much higher. Even at that, many needs are unmet. Mental health services are poor. Services for the handicapped are poor. Long-term care services are poor. We have invested in curative technology even beyond the point where one could hope for small gains, while

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ignoring many possibilities in other areas of health technology. Perhaps this is what people mean when they speak of the "technological imperative."

I believe that this reflects the priorities of our people, who are inappropriately optimistic about the benefits to be gained from curative technology, especially that provided by specialists. This is not intended to be a statement against specialization. Specialized providers and specialized technology are very important parts of the health care system. The question is one of balance: Where do we invest our limited resources?

One does not have to be a government official or to work for an international organization in order to feel profound disquiet about the present scene. Some few years back a distinguished physician and cancer researcher in the United States, Dr. Lewis Thomas, had this to say:

Halfway technology [represents] the kinds of things that must be done after the fact, in efforts to compensate for the incapacitating effects of certain diseases whose course one is unable to do very much about. It is a technology designed to make up for disease, or to postpone death.

The outstanding examples in recent years are the transplantations of hearts, kidneys, livers, and other organs, and the equally spectacular inventions of artificial organs...

In fact, this level of technology is, by its nature, at the same time highly sophisticated and profoundly primitive. It is the kind of thing that one must continue to do until there is a genuine understanding of the mechanisms involved in disease. In chronic glomerulonephritis, for example, a much clearer insight will be needed into the events leading to the destruction of glomeruli by the immunologic reactants that now appear to govern this disease, before one will know how to intervene intelligently to prevent the process, or turn it around. But when this level of understanding has been reached, the technology of kidney replacement will not be much needed and should no longer pose the huge problems of logistics, cost, and ethics that it poses today. (2)

Dr. Halfdan Mahler, Director-General of the World Health Organization, had something similar to say:

Health technology can be divided into three main types—fundamental, palliative, and placebo. Most

countries that set essential care for all as their urgent health goal will have to restrict themselves to fundamental health technology that provides solutions without frills. In too many instances, health technology is either selected by individuals whose professional goals bear little resemblance to societies' health needs, or it is accumulated in a fortuitous and haphazard fashion. (3)

So the important question concerns how to develop, select, and deploy technology to meet human needs within the limits of resources. All countries are now grappling with these issues. The differences for a country like Brazil, I would say, are more of intensity than of kind. Brazil's resources are more limited than those of the United States. This means that the choices to be made are harder. But the methods for making those choices should have general application.

Dr. Mahler addressed the problem of choice by asking four questions:

- 1) Is it possible to assign health resources within a country on a problem-solving basis using different mixes of preventive, curative, promotive, and rehabilitative action?
- 2) What medical interventions are truly effective and specific for prevention, treatment, or rehabilitation, as measured in objective terms?
- 3) Can such medical interventions and the risk groups to which they should be applied be described objectively and in such a manner that the amount of skill and knowledge required for their application can be assessed?
- 4) Is it possible to design a health care establishment to carry out the above tasks which will result in the most meaningful interventions reaching the greatest proportion of persons at risk, as early as possible, at the least cost, and in an acceptable manner? (4)

Needless to say, I will not try to answer all aspects of these important questions. However, I will address portions of them. One of my tasks in this presentation is to describe how technology finds its way into the health care system of Latin America. In doing that, I will suggest that present patterns are not optimal and will cite a variety of problems that need to be addressed. The solutions to those problems depend on changes in existing policies toward medical technology. And one of those policies, which contributes in its own

right to wise policy-making, is the policy of technology assessment.

Technology and Technology Transfer

Before describing technology assessment in a preliminary way, it is worth attempting to define technology. Some people may have been surprised that I included drugs and vaccines in my discussion of technology. Basically, however, technology means "applied knowledge," or "application of scientific or other organized knowledge to practical tasks." Using this kind of definition, the U.S. Office of Technology Assessment has defined medical technology as "the set of techniques, drugs, equipment, and procedures used by health care professionals in delivering medical care to individuals and the systems within which such are delivered" (5).

Now, where does technology come from? Technology results from a complex process that has been described (6) as having seven steps:

- 1) Discovery, through research, of new knowledge, and relation of this knowledge to the existing knowledge base.

- 2) Translation of new knowledge, through applied research, into new technology, and development of strategy for moving the technology into the health care system.

- 3) Evaluation of the safety and efficacy of new technology through such means as controlled clinical trials.

- 4) Development and operation of demonstration and control programs to demonstrate feasibility for widespread use.

- 5) Diffusion of the new technology, beginning with the trials and demonstrations, and continuing through a process of increasing acceptance into medical practice.

- 6) Education of the professional and lay communities in use of the new technology.

- 7) Skillful and balanced application of the new development to the population.

This model offers a logical description of the process and suggests ways to intervene. However, it is important to realize that this is a grossly simplified model. Many technologies

develop much more empirically through practice, as in the case of surgical procedures, for example. And many technologies in fact are *not* carefully assessed for efficacy and safety.

The important point, however, is that technology is developed *somewhere*, and that it largely develops out of knowledge derived from basic and applied research. How much of such research do Latin America and the Caribbean support? The answer is not much. A 1979 study by the Vienna Institute of Development (7) found that the world's expenditure on *all* research and development was almost US\$100 billion. More than one-third of that amount was spent by the United States and Canada. The developed countries together were responsible for about 97% of the total. South and Middle America, on the other hand, invested only US\$902 million, or less than 1% of the total. Perhaps 10% of that amount went for health-related research and development. Not only that, but reports to PAHO indicate that investments in research and development are falling. Thus, it seems clear that Latin America and the Caribbean are unlikely to develop much of their own technology, at least by traditional means, in the foreseeable future.

This may be confirmed by looking at prevailing patterns of exports and imports. Drugs have been studied fairly thoroughly. In 1981 and 1982 the United States exported more than US\$200 million in pharmaceuticals to South and Central America (8). Although some countries in Latin America have local pharmaceutical industries, no country in Latin America has a positive balance of payments in the area of pharmaceuticals. In 1978, for example, Brazil exported US\$40 million worth of pharmaceutical products while importing US\$215 million (9).

Trade in medical devices has been studied much less thoroughly than trade in pharmaceuticals. However, the same pattern exists. PAHO recently obtained data from the U.S. Department of Commerce relating to this matter. These data indicate that as of 1981 the United States was exporting US\$363 million

in medical equipment to the countries of Latin America and the Caribbean. Although the world economic crisis has affected these exports, the total figure was still US\$307 million in 1982.

Limiting the data to one country, Brazil imported US\$32 million in medical equipment from the United States in 1981 and US\$28 million in 1982. More specifically, Brazil spent about US\$2.9 million on pacemakers in 1981 and US\$1.5 million in 1982; it spent US\$2.3 million on electromedical therapeutic equipment in 1981 and US\$1.9 million in 1982; and it spent US\$2.6 million on parts for electromedical equipment in 1982. The point is that what economists call "machine-embodied technology" is still being developed largely in the industrialized countries and is being imported by less developed countries, even countries as developed as Brazil.

Other kinds of technology transfer involve the transfer of skills and knowledge. Such transfers are not so easy to document and quantify. However, it is well-known that thousands of physicians and other health care providers from Latin America and the Caribbean have been trained in the United States and Europe. Many take continuing education courses and pursue residencies. Of course, it may be questioned whether the technologic skills obtained through these educational experiences are appropriate for the countries of Latin America.

Then there is knowledge transfer. The traditional method for moving knowledge to those who need it is through the written word—through books, reports, and journals. The countries of Latin America and the Caribbean have problems in this area. To begin with, only 3% of the world's professional medical journals are published in Latin America (10). Furthermore, within Latin America, Brazil and Mexico account for more than half of the titles. In addition, medical journals and books are too expensive for many professionals in Latin America to obtain. Even medical school libraries have difficulty, and hospital libraries are rare.

Also, because of recent economic conditions, many such libraries have drastically reduced their journal subscriptions and book purchases; indexing systems, despite the pioneering work of the Regional Library of Medicine (RLM) in São Paulo, are generally underdeveloped; and copies of articles are expensive. Thus, not only is knowledge largely developed in the United States and Europe, but the knowledge flow to Latin America and the Caribbean tends to be uncertain and erratic.

The Health System and Medical Technology

Many problems in the area of medical technology arise because of the nature of our countries' health systems. In this regard, the United States has much in common with Latin America. For example, in 1971 the Secretary of the United States Department of Health, Education, and Welfare made this statement:

I should like to suggest that our present concern is a function of two broad problems. The first is the inequality in health status and care, and in access to financing. The other is the pervasive problem of rising medical costs... The indices of general improvement in health pale in importance when we look behind them and see that the poor and non-whites are doing far worse than whites and those with decent income... When we look beyond our borders and compare ourselves with other nations, any sense of accomplishment over our long-run gains in health status is mitigated by the fact that other advanced nations are doing better than we are... (11).

In 1973, the Research and Policy Committee of the Committee for Economic Development, representing many leading North American corporations and banks, made this statement:

First, faulty allocation of resources is a major cause of inadequacies and inequalities in the U.S. health services that result today in poor or substandard care for large segments of the population.

Second, the task of assuring all people the ability to cope financially with the costs of health care has been made realizable by the substantial base of

coverage now provided by both private and public insurance plans.

Third, unless step-by-step alterations are made in the means of delivering services and paying providers, closing the gaps in financing would overburden an inadequate system and offer little prospect of materially improving the quality and quantity of medical services or the health of the American people. (12)

The United States health care delivery system is characterized by fragmentation, lack of coordination, emphasis on acute-disease hospital-based care, and underdevelopment of primary care and preventive services. All of these criticisms can also be directed at most countries of Latin America.

One problem that is particularly marked in Latin America is the multiple sponsorship and resulting fragmentation of medical care services. The typical health system is a complex of private care services, social security services, public services, and others (13). The per capita resources going into each of these subsystems vary widely, with by far the most going into the private systems, and by far the least into the public systems. Within this context, services in the rural areas tend to be undeveloped or absent altogether; and the coverage provided by the social security services is generally poor, with many types of workers and their families being excluded.

A simple example may help to illustrate some of the implications all this has for technology. One of the most useful and cost-effective health technologies is immunization. Studies in the industrialized countries have shown that many vaccines actually save money, by preventing disease and thereby avoiding medical care costs. Even in the least developed situation, where medical care may not exist, vaccines offer an economical way to prevent human suffering and death. However, few countries have high rates of childhood immunization. For example, Brazil has achieved a poliomyelitis vaccination rate approaching 100%; but the proportion of Brazilian children less than one year old who have been immunized with DPT is only about 53%, and the measles vaccination rate is only

64% (14). Furthermore, there are few countries in the Americas that can report figures as good as these.

It is also easy to find technological problems in the hospital-based portions of the health system. While such problems have not been well-studied or cataloged, it is known that hospitals have been built but never opened for lack of demand or financing. In some cases medical equipment has been purchased but never uncrated for lack of money or expertise. It has been estimated that 30% of all the medical equipment in Brazil is out of service for lack of maintenance and spare parts. And a study performed in Colombia found that 96% of the medical equipment imported from 1973 to 1979 was not functioning in 1981.

As stated in a recent PAHO publication:

The experience of the sixties showed that applications of technological progress did not in most cases produce the benefits observed in the industrialized countries where the technology had been developed. It became evident that the health systems of the Region's developing countries had certain features that would make much of that technological progress irrelevant. It is not enough for an effective vaccine to exist if it cannot be used, or if prevailing human and environmental factors cause it to be used improperly. "Technological transfer" has been the most widespread means of bringing technological development into the Region's developing countries. In practice it has consisted in the uncritical acceptance and indiscriminate, wholesale acquisition of technologies rather than of knowledge, without any regard for their actual usability, suitability, efficiency, or effectiveness. (15)

The ultimate solution to these problems must emerge from the health care delivery system. However, governments have developed a system of policies to channel technological development and to promote change in the health system itself. The section that follows will suggest how these policies can improve the present situation.

Policies toward Medical Technology

One can examine policies related to medical technology in a very broad context. Our immediate concern here, however, is with poli-

cies that relate to medical technology in a direct and specific way. In general, such policies fall into four sets that correspond roughly to the stages of technology development. The four sets of policies are as follows: (1) research and development policies; (2) evaluation policies; (3) policies regulating safety and efficacy; and (4) policies governing medical technology investments and use.

Research and Development

It is important to realize that most governments have explicit policies concerning the research and development of medical technology. However, one of the characteristics of biomedical research in Latin America, particularly that conducted in universities, is a tendency toward basic research at the expense of applied research (15). It is true that recent trends have tended to favor applied research seeking more immediate improvements in people's health status. Nonetheless, such research is generally oriented to the dominant patterns of medical practice, especially treatment of acute disease cases and hospital care.

At the policy level, common research and development problems that have been identified by various working groups are a lack of clearly defined health research policies and the fragmentation of institutions doing research, leading to situations where there is little coordination or communication. The lack of medical journals alluded to earlier exacerbates this problem.

A very important question that has not been clearly answered is whether existing resources can be used to produce a more appropriate technology. Naturally, existing applied research is already producing useful innovations. In general, however, scientific research has not been steered toward the search for local problems, their causes, and solutions that are relevant and appropriate for the country involved. Local innovation has not been encouraged in the past, although that seems to be changing now.

Overall, there is a need to study this issue

and to discover examples of appropriate technology. One such example that can be cited is the development of appropriate technologies for delivering babies that was carried out in Montevideo, Uruguay, at the PAHO-affiliated Latin American Center for Perinatology and Human Development (16). (The technologies involved are based on natural modes of delivery and include such procedures as allowing women in labor to move about and to assume positions most comfortable for themselves.) Another example is development at Cali, Colombia, of simplified surgical procedures that can be performed on ambulatory patients. The existence of other examples, perhaps many of them, can be assumed, but to date few of them have been identified and publicized.

The "appropriate technology" approach does not end importation of technology, nor does it lead to a conclusion that capital-intensive technology is bad. What it does do, hopefully, is lead to mechanisms for acquiring technologies that are most appropriate for modifying and adapting those technologies that are needed, and for developing a capacity to generate those not available internationally. It also implies developing much better systems for distributing biomedical and health-related information. The Director of the Pan American Health Organization has stated that this latter is one of PAHO's highest goals.

Evaluation

Policies in this area are scarce. In the United States, the 1975 development of an evaluative "health program" in the Office of Technology Assessment was a landmark event, as was the national government's temporary creation in 1978 of the National Center for Health Care Technology.

Many other industrialized countries have developed explicit policies regarding evaluation of medical technology since the mid-1970s. For example, Australia now has a national committee and Sweden has a national program. The World Health Organization,

working through its Copenhagen office, has developed a network of those interested in medical technology and its evaluation, which includes members from most of the European countries and the United States; nonetheless, these efforts are still in the early development stage, and their impact has been very limited.

Honduras established a Health Technology Division at the Ministry level in 1982, with an associated intersectoral advisory committee. As yet, however, it appears that no Latin American country has an explicit policy or program concerned with the evaluation of medical technology. The result has been a lack of up-to-date, accurate, and comprehensive information at times when decisions have to be made about technology. Therefore, decisions are not being made on the basis of the best scientific and medical knowledge available; instead they are being based on other things, including clinical experience and political power.

Regulation of Safety and Efficacy

Some sort of safety and efficacy regulation of medical technology is probably being performed by every country in the world. In the United States, drugs must be subjected to extensive clinical testing—including randomized clinical trials to demonstrate efficacy—before they can be released for marketing. All industrialized countries have similar systems, although probably no country requires such rigorous drug testing as the United States.

The U.S. also regulates the safety and efficacy of medical devices. While randomized studies are not usually required, data must be presented to the United States Food and Drug Administration documenting efficacy and safety before a company can market a new device. Few countries regulate medical devices directly, although health authorities may examine an item's efficacy and safety in the course of procurement decisions.

In Latin America, mandatory registration of new pharmaceuticals with the government usually provides the basis for regulation (9).

This registration process varies greatly from country to country, but in virtually all cases little or no original testing is performed. One notable exception to this statement is Brazil, where the *Central de Medicamentos* has a strong quality assurance program for drugs. The U.S. Food and Drug Administration cooperates with the countries of the hemisphere to ensure that they have the data they need on drugs marketed in the United States. Medical devices are not regulated for safety or efficacy in Latin America.

Investment and Use

Decisions to invest in and use medical technology are exceedingly complex, and the processes involved vary greatly from country to country. At the same time, the complex of policies dealing with these decisions is exceedingly important (17).

To begin with, however, it should be noted that government regulatory efforts do not deal with medical and surgical procedures. If the government is to influence this area at all, it must critically examine policies that can affect physician behavior.

Also, the essence of the problem is how technology is used. That is, there seems little to be gained if a government stimulates the development of a new technology and then does nothing to ensure its use. And since it is the use and overuse of technology that costs the system a great deal, controlling costs means controlling and channelling use.

Most Latin Americans have at least theoretical access to health care services. However, most of these services are provided through some sort of public program. This means that decisions to use particular technologies are often not made by the individuals who wish to use the services. Rather, they are made by those who control the systems, often through explicit policies. In other words, collective constraints are possible, and in fact are applied often.

Within this context there exists a range of collective constraints—from direct prohibition

of a given technology (or direct orders to use some alternative) to indirect controls such as budgetary and fee constraints. Which of these may be applied in Latin America depends entirely on local circumstances. Clearly, the public health system makes purchasing decisions, and it may also decide to begin providing a certain service or to increase the extent to which that kind of service is being provided.

For example, a few months ago the head of one country's public hospital system was in the United States to discuss acquiring computed tomography (CT) scanners for his system. Likewise, the social security system provides services that must be planned in some way. The point is that policies can be examined for their impact on technology and can be explicitly changed and used to effect technological changes in the system.

Assessing Medical Technology

One type of research on medical technology that has gained increasing visibility in the U.S. is the evaluation of such technology's benefits, risks (5), and costs (18). However, despite this visibility and despite the availability of good methods, relatively little actual research of this kind has been performed.

The largest U.S. agency by far that supports medical technology assessment is the National Institutes of Health (NIH). In 1979, the NIH invested US\$136 million in 986 clinical trials (19). These trials were aimed primarily at demonstrating efficacy and safety. Other U.S. Government agencies invest smaller amounts in such studies. In addition, regulatory programs dealing with drugs and medical devices produce a great deal of useful information.

This matter of medical technology assessment has received increasing attention in a number of other countries, although the investments made have been relatively small. The existing priorities seem oriented to treatment, especially drug treatment. Overall, the United Kingdom appears to support more randomized clinical trials per capita than any

other country in the world (17). Other countries more or less active in this field include Australia, Denmark, Italy, Norway, and Sweden.

Aside from studies conducted under WHO auspices, few clinical trials have been performed in Latin America, partly because such trials are expensive, difficult to organize, and hard to administer.

Worldwide, cost-assessment and cost-effectiveness analyses are done even less frequently, and investments in such studies are small in all countries. Nevertheless, the number of such studies may be growing because increasing interest in the benefits gained from societal investments in health care is causing policy-makers to request them.

Overall, it is important to realize that methods are available for assessing medical technology, particularly with regard to efficacy and safety. The cost and cost-effectiveness of such technology can also be usefully assessed, although a greater number of methodologic and data problems must be faced. In addition, broad social implications can be examined before a given technology is employed.

Of course, assessment by itself cannot solve the problems identified earlier as being associated with technology. Resolution of those problems requires a policy framework and a well-organized, well-planned health care delivery system. But given the existence of a sound policy framework, technology assessment can be a very useful aid to policy-making. While such assessment will rarely lead inevitably to a clear-cut choice, it can provide information that is both valid and useful to the policy-maker.

A Model for Medical Technology Assessment

Historically, medical technology assessment has developed incrementally in response to specific demands. In many cases, the specific methods and programs devised have contributed to public health; however, these various

different responses to specific problems do not constitute a coherent, sensible system for assessing all classes of medical technology. For example, the present approach to medical technology assessment in the United States is characterized by multiple participants from the public and private sectors, and by uncoordinated activities. The large number of medical technologies already in use, together with thousands of new technologies appearing every year, serves to further complicate the situation.

In examining this situation, the Office of Technology Assessment found that a strategy was needed to guide the selection and implementation of components that would provide a coordinated system of medical technology assessment (19). It conceived of the system as being founded upon the social values and resources available in a free market economy, coupled with the social responsibility to make safe and effective medical care available. In my view, the general model developed by this office has applicability to virtually all countries, and can also provide useful guidance for international organizations such as PAHO.

An ideal system for assessing medical technology can be conceived as an information flow with the following four stages of assessment:

- 1) Identification—monitoring of technologies, determining which need to be studied, and deciding which to study.
- 2) Testing—conducting appropriate analyses or trials.
- 3) Synthesis—collecting and interpreting existing information (including the results of the testing stage) and in most cases making recommendations or judgments about appropriate use.
- 4) Dissemination—providing the synthesized information, or any other relevant information, to the appropriate parties who are to use the medical technologies in question or make decisions about their use.

Identification. The decision to conduct a technology assessment must be preceded by identification of the technologies to be assessed and the setting of priorities among candidate technologies. Such identification can be accom-

plished in various ways. In the case of drugs, for example, the process of drug regulation identifies candidates for assessment; requests by physicians for a particular service may likewise point to a technology needing assessment; and medical journals and other sources of biomedical information may help identify technologies. Regarding determination of which technologies should have priority, these determinations can be made on the basis of such factors as the number of suffering people who could be helped and the possible costs involved. In the United States, technology-related drugs and medical devices appear to be adequately identified at present. However, medical and surgical procedures, whether new or old, have not been adequately identified.

Testing. The testing of a particular technology may be limited to safety tests, or the tests can be so wide-ranging as to include evaluation of social effects. The information sought must be tailored to that which is needed. The United States does a reasonable amount of testing, but it is not done on the basis of any system of priorities. For example, preventive technologies are seldom tested using public funds; and technologies that might have the greatest impact on health status, whether positive or negative, are not singled out for testing on that basis.

Synthesis. It is necessary to synthesize the information generated during the testing stage of the assessment process in order to provide a convincing and responsible basis for decisions made during all phases of a technology's life cycle. Synthesis activities that pertain to medical technology assessment fall into two broad areas: (1) synthesis of the results of individual research studies, and (2) synthesis of a body of research findings with matters relating to various concerns such as risk, social, ethical, or cost factors. The first type of synthesis addresses questions about a given technology's safety, efficacy, or effectiveness. The latter type of synthesis is more policy-oriented, often seeking to set guidelines or standards for medical practices or for payment policies. The value of the latter depends on the adequacy of

the former. But since the latter step is putting the acquired information into a form understandable to policy-makers, it might be considered the most important part of the entire assessment process.

Dissemination. Once the information has been synthesized, it must be provided to those who need it. Generally, this means giving it to a particular policy-maker. It would be possible, however, to develop health policy based on the premise that good information itself can affect behavior. No government, as far as I know, has used information in this way. However, some Scandinavian governments have developed what they call "medical care programs" for specific diseases or health conditions that describe optimal practices. This is an example of a pure information strategy, since no other policy decisions are made to enforce the program recommendations.

How does this model apply to a Latin American country such as Brazil? It seems unlikely that Brazil will choose to undertake much testing. Health care resources are too limited. There are more pressing needs. However, much information is available in the industrialized countries that has not been well-used in Latin America. It would be possible to have a program that identified technologies of high priority, sought information from various sources (including the medical literature and professional groups in different countries), and prepared a set of guidelines or recommendations for action based on this information. This would not be a particularly expensive process, but I believe that it could be very useful.

There is also the very important question of what PAHO should do in this area with its limited resources. For example, it might be possible for PAHO to develop a clearinghouse for information about important technologies.

Concluding Remarks

In approaching a specific technology, one needs to answer many questions. One appro-

priate set of such questions, put forward by Black (20), is as follows:

- What are the aims of the procedure or service?
- How many people, and what kinds, might be helped by this service?
- What proportion of these people actually get help now? Who does not get help?
- What determines who gets the service and who does not? Can that be changed?
- Does this procedure or service make any difference? If so, how much and to whom?
- What are the costs? And what are the costs of alternatives?
- Who pays?
- What does the public—those served, those eligible and not served, and those ineligible—think about the procedure or service?
- What impact might the procedure or service make on the demand or effectiveness of other procedures or services?

Another set of questions that might apply to a specific country or subregion and that need to be addressed is as follows:

- What are the most important health needs?
- What technology is available (known to be efficacious) to address those needs?
- What is the present distribution of technology?
- Where has technology come from, and where will it come from in the future?
- Are there policy instruments that can affect diffusion of technology?
- What is the research investment in the country?
- Is money available to do assessments?
- What kinds of reports would be most useful for policy makers?
- Who would use such reports (or syntheses) and what would be the results?
- Can feedback mechanisms be devised to assure constructive functioning of an assessment process?

Sometimes we almost despair of the problems facing us. The problems of sick people, and especially the poor, are indeed frustrating and demanding. Among our hopes are those grounded in medical technology. But technology brings its own problems. Included among them are the limited financial resources available—limited resources that make intelligent choice of which technology to use absolutely mandatory. Technology assessment can help make those choices.

At the same time, little is known about how technology is developed, acquired, and deployed in Latin America. Without at least a minimum of such information, policies cannot be adapted so as to constructively channel technologic change. Therefore, the development of such information should have almost

as high a priority as technology assessment itself. The purpose of our present conference on modern technology³ is to begin to develop that information.

³See footnote 1.

SUMMARY

Medical technology, which holds out the promise of improving public health, is obviously important. Nevertheless, it is also true that in some ways today's medical technology seems out of control. In the United States, for example, there has been investment in curative technology even beyond the point where one could hope for small gains, while many possibilities in other areas of health technology have been ignored. Therefore, the important question is how to develop, select, and deploy medical technology that will meet human needs without overtaxing our countries' limited resources.

In general, there are four types of government policies dealing with medical technology, these being research and development policies, evaluation policies, safety and efficacy policies, and policies governing investments and use.

By and large, the nations of Latin America tend to be in need of clearly defined health research policies and of improved coordination and communication between institutions doing applied research. One very important research and development question that has not been clearly answered is whether existing resources can be used to produce a more appropriate technology, for in general the region's limited scientific research effort has not been steered in this direction.

Regarding evaluation of medical technology, it appears that no Latin American country has an explicit policy or program concerned with the evaluation of medical technology.

In the area of safety and efficacy, the mandatory registration of new pharmaceuticals with the gov-

ernment usually provides a basis for regulation of pharmaceutical technology in Latin America. The nature of this registration process varies greatly from country to country, and in most countries except Brazil little or no original testing is performed. Medical devices are not generally regulated for safety or efficacy in Latin America.

Regarding investment in medical technologies and the use of those technologies, a large share of the health services in Latin America is provided through public programs. This means that the decisions to invest in and use certain technologies are not dictated by the individuals who wish to use the services, but instead are made by those who control the systems, often through explicit policies.

Ideally, a well-coordinated system for assessing medical technology can be broken down into four stages: identification of the technologies to be assessed, testing of those technologies, synthesis of all available information, and dissemination of that information to appropriate parties. At present, there is little indication that any of these processes are being performed in an extensive way in most Latin American countries. However, in many cases it would appear possible to have a program that identified technologies in urgent need of assessment, sought information from various sources (including the medical literature and professional groups in different countries), and prepared a set of guidelines or recommendations for action based on this information. This would not be a particularly expensive process, but it appears to be one that could prove very useful.

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