Health inputs

In recent decades developing countries have invested heavily in health. Often with help from donors, they have constructed hospitals and buildings and purchased equipment to fill them. They have educated doctors, nurses, and other health care professionals. And they have set up new systems to supply drugs, research, and information. Worldwide, the number of hospital beds rose between 1960 and 1980 from 5 million to almost 17 million, which more than doubled the per capita supply. The number of physicians increased more than fivefold between 1955 and 1990, from 1.2 million to 6.2 million. Such investments have created new opportunities, but they have also led to problems.

Once built, hospitals are extremely difficult to close. Once trained, physicians create pressure to be employed. In virtually every developing country, facilities, equipment, human resources, and drugs are skewed toward the top of the health system pyramid (Figure 6.1). Yet the cost-effective public health and clinical interventions discussed in preceding chapters of this Report are best delivered at the level of the district hospital or below. That they are often delivered through tertiary hospitals simply increases costs without improving quality. This problem is found in poor countries in which the principal tertiary teaching hospital in the capital city consumes a large proportion of the total resources available for health. It is also found in cities such as London, where numerous specialized teaching hospitals absorb large amounts of resources while failing to address the most common and pressing health problems of city residents.

In many countries public investments are concentrated unduly on tertiary services, and public spending subsidizes high-end facilities, equipment, and human resources for private markets. The challenge for public policy is to redress the balance and so permit the efficient delivery of public health and essential clinical services. Where cost containment of health spending is a concern, public policy can play a useful role in limiting the growth of both public and private investments in specialist training, equipment, and tertiary facilities. For some inputs, such as buildings and human resources, changes will necessarily be slow. For others, such as pharmaceuticals, a new policy can alter inputs rapidly. This chapter suggests how to set about these tasks. It also assesses how public support for information and research can help improve health sector performance today and create new health systems and technologies for tomorrow.

Reallocating investments in facilities and equipment

Investments to support delivery of essential clinical services are best directed at health centers and district hospitals and at improving access in underserved areas. Some public investments in tertiary facilities are needed to support research and training, but at levels well below current levels of public financing in most countries. Investments in specialized facilities can be left largely to the private sector, and public subsidies, where they exist, can often be greatly reduced. Redirecting public spending toward lower-level facilities is difficult politically, but some countries are moving in this direction. In Papua New Guinea, for example, public spending on hospitals has for the past decade been limited to 40 percent of the Ministry of
Most health care should take place toward the bottom of this pyramid.

Health's recurrent budget, which is well below the average in most developing countries.

Facilities

Tertiary hospitals provide the most specialized and sophisticated services and are where most clinical research, education, and training take place. They are usually located in large urban areas. One step down the health hierarchy are district hospitals, which are typically located in towns or smaller cities serving rural areas but are valuable in large cities too. District hospitals generally have 100 to 400 beds, serve 50,000 to 200,000 inhabitants, and include departments of medicine, surgery, pediatrics, obstetrics and gynecology, and dentistry. They also provide basic anesthesia, radiology, and clinical laboratory services. The district hospital is the first level of referral from health centers and provides complementary services such as basic surgery. It mainly offers inpatient care but also typically provides some outpatient care, day surgery (in which the patient is operated on and discharged on the same day), and emergency services not available at health centers. In many cities that have grown rapidly over the past twenty years, periurban areas do not have enough health centers and district hospitals. In some African capitals one extremely large tertiary public hospital serves the whole city—an example is Zambia's University Teaching Hospital of Lusaka, with 1,835 beds.

Hospitals absorb the bulk—40 to 80 percent—of public spending on health in developing countries. Industrial countries have much higher health expenditures and more chronic disease problems, but the share allocated to hospitals is slightly smaller, 35 to 70 percent. Figure 6.2 shows the marked variations in hospital supply across the eight demographic regions used in this Report, from about eleven beds per 1,000 population in Central and Eastern Europe to less than one bed per 1,000 population in India. In most developing countries more than 60 percent of all hospital beds are public. The data used in Figure 6.2 unfortunately fail to distinguish between tertiary and district-level hospitals. The minimum package of essential clinical services described in Chapter 5 requires about one district hospital bed per 1,000 population. Given that some of India's and Sub-Saharan Africa's hospital beds are devoted to care outside the essential package, there is likely to be a shortage of district-level hospital beds in parts of those regions.

In some countries the underfunding of lower-level facilities has been exacerbated by the creation of multiple levels of outpatient facilities (health posts, dispensaries, and rural health centers), none of which functions well. At the same time, tertiary care hospitals are crowded with patients who could be treated in less costly and more accessible district hospitals or health centers. A study in Chad, for example, revealed that 71 percent of all central hospital consultations were for problems that could have been treated at lower-level facilities. An obvious way to reduce spending without sacrificing any health gains is to make full use of existing lower-level facilities. Measures for achieving this include charging a higher fee to patients who go straight to tertiary facilities without referrals, except in emergencies, and making a referral from the primary care provider a mandatory condition for specialized services. At the same time, however, the quality and responsiveness of services at lower-level facilities need to be improved.

Incentives and Investment Decisions. Public sector budgetary procedures often obscure the real costs of investments in health facilities and bias them toward high-profile investments in large hospitals. Major investments, including donor-financed projects, may be approved by a government body that does not have to face the recurrent costs of operating the facility. Regions can argue
Installed hospital capacity is lowest in India, Sub-Saharan Africa, and Asia and highest in the formerly socialist economies of Europe.

Figure 6.2 Hospital capacity by demographic region, about 1990

<table>
<thead>
<tr>
<th>Region</th>
<th>Beds per 1,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td></td>
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<tr>
<td>China</td>
<td></td>
</tr>
<tr>
<td>Other Asia and islands</td>
<td></td>
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<tr>
<td>Latin America and the Caribbean</td>
<td></td>
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<tr>
<td>Middle Eastern crescent</td>
<td></td>
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<tr>
<td>Formerly socialist economies of Europe</td>
<td></td>
</tr>
<tr>
<td>Established market economies</td>
<td></td>
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</tbody>
</table>

Source: Organization for Economic Cooperation and Development data; World Health Organization data.

for new facilities without having to weigh the budgetary consequences if federal-state resource transfers, instead of following predictable and transparent funding formulas (such as population-based schemes), are heavily politicized.

International assistance has frequently exacerbated the problem of unsustainable health investments. Donor assistance, particularly for tertiary facilities and teaching hospitals, has sometimes been provided even if the incremental recurrent costs from these investments are too high. Too many donor-financed hospitals have opened only partially, not at all, or at the expense of existing facilities. In Rwanda, for example, a 200-bed hospital was completed in 1991 but has not yet opened because of the difficulty of financing its high recurrent costs, which are estimated at about 15 percent of the Ministry of Health’s already tightly constrained budget. In Chad, where external assistance amounts to about 30 percent of national income, a national development plan proved useful for screening out inappropriate donor financing. Two new hospital construction proposals that were found to conflict with the plan are being reconsidered.

In the private sector, financial incentives drive investment decisions. Health maintenance organizations (HMOs) in the United States have incentives for providing care efficiently. As a result, they operate with much less hospital infrastructure than the health system overall. Large HMOs (with hospitals) have about 1.5 hospital beds per 1,000 members—well below the average of 8 beds per 1,000 for established market economies and 5 for the United States overall and slightly below regional averages for China and Latin America. Evidence indicates that quality of care in HMOs is maintained even with significantly lower levels of hospitalization and hospital infrastructure. Privately financed health insurance with unconstrained fee-for-service payment, by contrast, provides no incentives to rationalize physical capacity.

Duplication of health facilities in the public sector. Excess public facilities in urban areas are a problem in many countries. The historical growth of hospitals, especially in capital cities, has led to a proliferation of specialist tertiary services that are often linked to medical education and research. Another cause of duplication is the public provision of health services to different subgroups of the population, each with its own hospitals and health centers. In Poland, for example, parallel health systems exist for workers and their families
in the railway, mining, police, and military sectors and for prisoners; another set of facilities serves the general population. This can result in excess capacity, with no facilities achieving economies of scale.

There are two solutions for duplication: creating internal markets and instituting central or regional planning linked to health budgets. If effective internal markets are created within the public sector, money will follow patients—and patients, together with their general practitioners, will have a choice as to which hospital to use. The availability of good information about quality and price will help efficient providers of specialist services to prosper, while less-efficient hospitals will close. The alternative is rationalization of services by central or regional planning. In the largely publicly financed health systems of the Nordic countries, health resources are allocated by region. Each region of about 350,000 inhabitants elects representatives who make decisions about health care spending. These representatives have incentives to avoid duplication of services and to capture economies of scale in service delivery. If left to individual hospitals, decisionmaking for large investments will tend to reflect the interests of that hospital, not the region. Multiple hospitals will want to provide specialized, "prestige" services, leading to overinvestment.

EQUITY CONSIDERATIONS. For the rural poor, lack of physical infrastructure is the largest obstacle to use of health services. Distance to health facilities limits people’s willingness and ability to seek care, particularly when transport is limited. There is a heavy urban bias in the distribution of health facilities. Large cities are much better served by both public and private health infrastructure than would be expected from their roles of serving urban populations and providing referral services for the surrounding population. (Referral hospitals are needed for only a small proportion—no more than 10 percent—of total hospitalizations.) Wealthier regions also have better access to infrastructure. In India the richer states of Maharashtra and Gujarat have 1.5 and 1.1 beds, respectively, per 1,000 population; the poorer states of Bihar and Madhya Pradesh have only 0.3 and 0.4 bed, respectively, per 1,000 population. Public investments need to address inequities in the present distribution of health infrastructure. Donors have an important role in this regard, especially where a significant proportion of investment is donor financed.

PRODUCTIVITY. The potential for improving the productivity of installed hospital capacity is large. In addition to the financing and management reforms discussed in Chapter 5, efficiency gains can be achieved by taking the following measures, which will need to be supported by investments in training and infrastructure:

- Convert some acute care hospital capacity to less costly extended or chronic care facilities for patients who require less-intensive care for long-term recovery and for rehabilitation of chronic conditions. Extended care facilities operate at a lower cost per bed-day than acute care hospitals. In the absence of such lower-level facilities, patients occupy high-cost acute care beds.
- Perform outpatient diagnostic tests before admitting the patient to the hospital.
- Support home care as an alternative to long-term hospitalization for some ailments.
- Modify treatment protocols—for example, reduce unnecessary surgeries, perform low-risk deliveries at maternity centers, and treat tuberculosis patients and many surgical cases on an outpatient basis. In Cali, Colombia, costs per procedure for day surgery are less than 30 percent of the cost of traditional treatment in hospital. Outpatient surgery has grown rapidly in many industrial countries but is used much less in developing countries.

MAKING THE TRANSITION. The 1985 earthquake in Mexico City destroyed about 20 percent of public hospital capacity. The Ministry of Health chose to concentrate reconstruction and new construction in low-income periurban areas that had hitherto been poorly served, and six new 144-bed district hospitals were built in these areas. But such possibilities for rapidly reconfiguring capacity toward lower-level facilities and underserved areas are seldom available. The alternative is to reduce or refrain from public investment in tertiary hospitals while simultaneously increasing investment and operating budgets for health centers and district hospitals. Over time, the tertiary hospitals can be operated on a self-financing basis, or they can be closed, converted to chronic care facilities or district hospitals if these are needed, or even sold to the private sector. But in most countries this process will necessarily be slow.

Equipment

Developing countries account for about $5 billion, or 7 percent, of the $71 billion spent each year on
medical equipment worldwide. This global estimate includes medical and dental supplies, surgical instruments, electromedical and X-ray equipment, diagnostic tools, and implanted products.

The ability of the medical equipment industry to develop new health care technologies has vastly exceeded the capacity of purchasers to evaluate the clinical value and the cost-effectiveness of such innovations. At present, approximately 6,000 distinct types of medical devices (equipment, supplies, and reagents) and more than 750,000 brands, models, and sizes, produced by perhaps 12,000 manufacturers worldwide, are on the market.

Efficiency losses from poor selection and maintenance of medical equipment can be very large. WHO estimates that less than half of all medical equipment in developing countries is usable. In Brazil an estimated 20 to 40 percent of the $2 billion to $3 billion worth of public sector medical equipment is not working. A study of twelve Kenyan hospitals in 1984 found that sterilizers operated for an average of two years instead of the six expected and that incubators lasted only two years rather than eight. Equipment failed prematurely because maintenance budgets were only about 1 percent of the value of the capital stock (10 percent might be considered optimal). In Viet Nam 39 percent of urban health centers and 29 percent of urban polyclinics surveyed in 1991 lacked a working sterilizer—a critical piece of equipment for developing countries that have to reuse such supplies as syringes.

Investments in medical equipment can be rationalized by controlling the purchase of expensive, sophisticated equipment and rejecting most donated medical equipment, new or used. To contain costs, Belgium, France, and Portugal directly control the acquisition of state-of-the-art medical technologies by both the public and the private sectors. In Canada major capital acquisitions require prior approval by the provincial or territorial ministry of health on the basis of a needs assessment and other factors. Alternatively, governments can encourage public hospitals to make tough choices by limiting their budgets. Even assuming that donated equipment meets local equipment requirements, very little of it ever becomes operational, for a variety of reasons, including missing or damaged parts, lack of disposable inputs and of user and service manuals, and problems with power supply. Standardization of equipment could simplify management and maintenance and reduce inventory costs. Purchasing decisions could be analyzed on a life-cycle cost basis. In many cases improving maintenance to increase operating life and reduce downtime of equipment is more efficient than buying new equipment.

Because of the many products on the market and the speed of change, carrying out technology assessments can be extremely costly. The international community could help by developing and disseminating information on the availability, effectiveness, and prices of equipment and on user guidelines. Essential equipment lists could be developed along the lines of the essential drug lists already used by many countries.

Equipment procurement would also benefit from greater use of competitive buying. Purchasing is commonly restricted to local distributorships, and some countries also heavily protect local industry. These policies reduce competition and can easily double the purchase price of equipment. Developing countries can cut costs by adopting competitive purchasing methods or by purchasing equipment from international agencies—such as UNICEF, Equipment for Charity Hospitals Overseas (ECHO), and the International Dispensary Association—that offer procurement services for some medical equipment at competitive prices.

There are several reasons for government involvement in the development of health infrastructure. The government itself, as a provider of health services, may finance and use infrastructure. It may also intervene to compensate for market failures that can lead to greater investment, particularly in specialized health inputs, than is socially optimal. Finally, the government has a role in undertaking technology assessment of medical equipment, which is a costly public good.

To reduce both capital and recurrent costs without sacrificing quality of care, governments can:

- Reallocate public spending toward the facilities and equipment required for providing public health programs and essential clinical services.

- Improve the efficiency of installed capacity by considering alternative uses of facilities, as well as new diagnostic and treatment protocols. (Examples are the conversion of some costly acute care capacity to less costly extended care beds and treatment of some surgeries on an outpatient basis.) Such reconfiguration may require modest new investment.

- When cost containment is a concern, consider controls on the purchase of expensive, specialized technologies, whether by public or by private providers.

- Support and disseminate technology assessments to purchasers.
Addressing imbalances in human resources

Nearly all countries face the same fundamental problems with human resources in the health sector. There are not enough primary care providers and too many specialists. Health workers are concentrated in urban areas. Training in public health, health policy, and health management has been relatively neglected. Medical training is subsidized even though physicians may earn high incomes and many work in the private sector.

There are several ways in which governments can do something about these problems. Public sector pay and employment policies can be improved to be more competitive with the private sector and to relate pay to performance. Career development paths and in-service training are needed to retain staff, especially in managerial positions. Policies on accreditation and licensing can be used to limit enrollments in training programs, to shape curricula (all physicians might spend time in rural practice during their medical training or be required to pass examinations in public health), and to set minimum standards for providers. Education finance policies can be used to curtail education opportunities for physicians and specialists and to expand them for workers in primary care, public health, health policy, and management. But where oversupply is greatest, as for specialist physicians, the only effective solution may be to set quotas for training, or at the very least for publicly subsidized training.

Improving the balance between primary care providers and specialists

A central role in delivery of most cost-effective health interventions belongs to primary care providers, a category that can include physicians, nurses, nurse practitioners, or midwives, depending upon how the jobs are defined. Nonphysician primary care providers have many advantages. They cost less to train (data from Myanmar, Pakistan, and Sri Lanka indicate that between 2.5 and 3 nurses can be trained for the cost of training one physician), and they receive lower salaries. They are easier to attract to rural areas and usually communicate more effectively with their patients. In Sub-Saharan Africa, where the few local physicians are concentrated in urban hospitals, nurses often function as primary care providers. China, too, has long relied on graduates of three-year (instead of five-year) medical schools to meet the needs of rural areas.

In some countries tasks traditionally performed by physicians have been successfully delegated to lower-level primary care providers as a way of improving the efficiency of health services. By specializing in certain common procedures (as midwives specialize in deliveries, for example), such providers may become better at their tasks than a generalist physician. Surgical technicians in Mozambique perform hysterectomies and cesarean sections and remove ectopic pregnancies. Some nongovernmental organizations (NGOs) in Bangladesh use graduate nurses to do sterilizations, and in Thailand public sector nurse-midwives perform this procedure. In these cases, evaluations indicate no differences in outcomes compared with procedures done by physicians. Ophthalmic clinical officers, who are not physicians, have performed cataract surgery in Kenya on a pilot basis, and evaluations indicate acceptable results. Africa has only one ophthalmologist per 1 million people; without the use of nonphysician services, many patients would not be able to get cataract surgery.

The distribution of nurses and physicians by region is shown in Figure 6.3. Appropriate staffing ratios depend heavily on the organization and financing of care and the specific tasks health personnel carry out. Health maintenance organizations in the United States, for example, operate with about 1.2 physicians per 1,000 enrollees, compared with about 4.5 in the fee-for-service sector. Evaluations of health outcomes and user satisfaction indicate that these savings in resources do not come at the expense of quality. Sub-Saharan Africa has the fewest physicians and nurses of any region, which is an obstacle to the delivery of the public health interventions and essential clinical services described in Chapters 4 and 5 because some of the existing personnel are providing other services. The public health and minimum essential clinical interventions require about 0.1 physician per 1,000 population and between 2 and 4 graduate nurses per physician. Given resource constraints, however, the relatively high ratio of nurses to physicians in Sub-Saharan Africa is a good sign. There is no optimal level of physicians per capita or optimal nurse-to-physician ratio, but a rule of thumb is that nurses should exceed physicians by at least two to one. (The ratio is five to one in Africa but well under two to one in China, India, Latin America, and the Middle Eastern crescent.)
The availability and mix of health personnel vary widely across regions.

Figure 6.3 Supply of health personnel by demographic region, 1990 or most recent available year

Physicians per 1,000 population

Ratio of nurses and midwives to physicians

Source: See Appendix table A.8.

Physician oversupply. During the 1960s and 1970s many governments encouraged, primarily through subsidies to education, rapid expansion in physician training to meet the need for primary care providers. In many countries the excess of physicians in relation to nurses and of specialists in relation to other physicians has created problems. By the early 1980s the established market economies, Latin America, and parts of Asia were having trouble absorbing growing numbers of physicians. These policies have been costly, and it will take many years to correct the imbalances.

Mexico illustrates the problems. Medical enrollments in 1970 stood at about 29,000 in twenty-seven schools. Within ten years there were 93,000 in fifty-six schools. Many of the schools offered highly subsidized or free tuition, and some of the largest had open enrollment policies. At the same time, health services were growing only modestly. In 1960 there were 20,600 physicians in Mexico; by 1990 there were 166,000. A survey of physicians in major cities in 1986 revealed that 7 percent were unemployed, another 11 percent were working in nonmedical jobs, and 11 percent were in low-income medical jobs or were seeing very few patients—which is a concern because the physicians may not see enough patients to maintain their competence. The quality of medical education also declined with the rapid growth in medical schools. Furthermore, the expansion of medical training did nothing to solve the problem of attracting physicians to rural areas. In 1983 an interinstitutional body was created, with representatives from the ministries of health and education, health care institutions, and universities. This group has, by agreement, reduced enrollments and contained the number of medical schools. More recently, the government has begun publishing average examination scores of medical school graduates by school to provide information on educational quality for prospective students and employers.

Other countries responded to physician oversupply by restricting medical immigration (Canada and the United Kingdom), by reducing working hours (Denmark), and by indirectly promoting outmigration of medical personnel. The last two
Box 6.1  International migration and the global market for health professionals

Over the past several decades, large numbers of physicians and nurses have migrated across national borders. WHO estimates that 14,000 nurses did so in the early 1970s and that in 1972 more than 140,000 physicians (or 6 percent of the total) resided outside the countries in which they were born or had been trained. Over the past half century the main flow of physicians and nurses has been from developing to industrial countries. Developing countries donate a full 56 percent of all migrating physicians and receive less than 11 percent. The principal donating countries for physicians are India and the Philippines. More than 90 percent of the nurses who migrate go to North America, Europe, and the high-income countries of the western Pacific, while only about 7 percent go to developing countries. Migrating nurses come overwhelmingly from the Philippines, which exports each year 2,000 to 3,000 nurses, many of whom go to North America. In 1970 more Filipino nurses were registered in Canada and the United States than in the Philippines, and the trend has continued to the present. Other major countries of origin for migrating nurses are Australia, Canada, the United Kingdom, and certain West Indian countries.

Consequences

The migration of health professionals has both positive and negative effects. It can help alleviate shortages in the receiving countries, and large remittances or tax revenues from overseas workers can improve the standard of living in the countries of origin. (The Philippines received an estimated $680 million from expatriate workers in all fields in 1986, and an estimated $8 billion in remittances went to developing countries as a group in 1975.) On the negative side, the net outflow of trained human resources can cause shortages of health workers. In Jamaica vacancy rates of more than 50 percent in nursing positions, in large part because of massive migration of nurses, have forced the Ministry of Health to close whole wards and to reduce the services offered in many facilities. In addition, emigrating health workers deprive their own countries of the benefits of (often state-financed) investments in their education. For example, the 111 registered nurses who resigned from government service in Jamaica in 1990 took with them nearly $1.7 million in government investment in training and education.

Policy responses

In an attempt to alter the patterns of migration, many countries have changed their immigration and licensing laws and regulations. During the 1980s, for example, the United States, to address its own nursing shortage, changed its policy on immigration of nurses, making it relatively easy for nurses wishing to come to the United States to obtain a visa. This had a profound effect on a number of neighboring countries. In the Philippines during the same period it became increasingly difficult for registered nurses to obtain travel documents because of the enormous outflow of nurses from that country.

Short-term immigration restrictions, however, may have only a limited effect. Other possibilities for encouraging health professionals to remain in their home countries include reforming education finance to require that individuals repay some or all of the costs of state-financed training, through student loans or enforced service bond requirements. And publicly financed opportunities for overseas training could be restricted because of its tendency to lead to outmigration.
variation in expenditures in the United States indicates that expenditures on physician services are unrelated to the total number of physicians per capita but are related to the ratio of primary care physicians to specialists. Many OECD countries limit the number of specialist training opportunities. This policy instrument is increasingly relevant for middle-income countries interested in cost containment. Subsidized medical education has already led to overproduction in some middle-income developing countries such as Chile, where 75 percent of all physicians are specialists, and Venezuela, where about 55 percent of all physicians employed in the public sector are specialists. In contrast, only 25 to 50 percent of physicians in Belgium, France, Germany, and the Scandinavian countries are specialists, and regulatory bodies and committees determine the number to be trained.

Few, if any, specialists are needed to deliver the cost-effective clinical interventions discussed in Chapter 5, even with a modest expansion in content beyond the minimum essential package. Some specialists are required for services outside the essential package. The overall proportion of physician generalists to specialists is an important indicator for governments to monitor, but this information is not at present readily available in many countries. A reasonable benchmark for the maximum proportion of specialists to physicians in developing countries might be 25 percent, which is about the lowest proportion found in the established market economies. In many developing countries the proportion could be much lower, given the epidemiological characteristics of the population and the smaller share of the population using clinical services beyond the essential package. Public regulation and rationing of specialist training, in addition to the elimination of training subsidies, may be needed to achieve this.

**Content of Training.** Primary care training should include, at a minimum, the skills necessary to provide the essential clinical services discussed in Chapter 5. In fact, however, basic curricula in medical schools often fail adequately to cover some of these services, such as family planning services and the proper diagnosis and treatment of sexually transmitted diseases (STDs). For more than two decades there have been calls to stop training health professionals in high-technology tertiary institutions and to expose them thoroughly to health problems and practice at the grass-roots level. But progress has been extremely slow. The fifty-five member institutions of the international Network of Community-Oriented Educational Institutions for Health Sciences have adopted curriculum reforms that emphasize community-based and problem-based learning. The goal is to produce graduates whose competencies and experience correspond closely to community health needs. Significantly larger proportions of graduates from these schools have followed careers in primary care. Similar reform efforts have taken place in nursing education. In Nigeria, Senegal, and Uganda (for basic nurse training) and in Thailand (for public health nurse practitioners) the nursing curriculum has been oriented more toward community settings and preventive services.

*Attracting primary care providers to underserved areas*

Health providers are concentrated in urban areas. Professional isolation, lack of additional work opportunities, substandard housing, and other disamenities often make staffing rural health facilities difficult. If public sector wages cannot be increased, other methods must be found to increase the attractiveness of rural posts. Many countries require a period of rural service following publicly financed medical training. Canadian provinces have used many incentives, including differential pay scales, settlement allowances, payment of expenses for continuing education, and provision of scholarships for later study in return for a certain number of years of service.

In some settings lack of female health providers is an obstacle to utilization of health services. In Egypt, for example, most physicians are male, but cultural beliefs constrain women from being seen after puberty by men who are not family members. Even when trained, female primary care providers are hard to attract to underserved areas because of security concerns and the importance of living with their families. The Aga Khan Development Network in Pakistan, recognizing this problem, has trained women to work in their own communities as lady health visitors.

Community health workers can complement the work of primary care providers in rural areas. Burkina Faso, the Gambia, Ghana, and other countries have trained large numbers of community health workers as part of the national strategy for primary health care; in many other settings much smaller programs have been set up by NGO groups. Evaluations sometimes show disappointing results: community health workers have often had little impact on health service utilization and
health indicators (Box 6.2). These same evaluations point to four necessary (but difficult) conditions for success: community health workers must be well trained, well supervised, well provided with logistical support, and linked to well-functioning district health systems for referral when needed.

**Increasing training in public health, management, policy, and planning**

Improvements in health systems performance can be facilitated by training adequate numbers of policy-making and management personnel, including public health specialists, policy analysts, hospital managers, and drug management specialists.

These skills are in short supply in most developing countries. Public health often receives little attention in basic medical curricula, specialty training is often inadequate, and courses in public health schools may be too academic and not relevant to local problems and needs. In Sub-Saharan Africa, where public health capacity is weakest, fewer than 100 people receive specialty training in public health annually. Some countries are exploring and implementing multidisciplinary training programs that include management and communication techniques as well as the traditional public health sciences. An innovative example of public health training designed to produce future leaders is the Union School of Public Health in Beijing, established in 1989 to stimulate public health training in
might then be forgone if the trainee agreed to work for public subsidies for training. Repayment of loans is not a concern if they were later employed in nonmedical work. Public subsidies could be specifically targeted to encourage those training and career choices that are in the public interest.

Health policy and planning and good management are fundamental (albeit insufficient) conditions for better performance of health services. Over the past thirty years the role of managers, economists, and planners in health services has expanded in the industrial countries. For example, in many of these countries professional (nonphysician) hospital managers commonly run hospitals, in contrast to developing countries, where hospitals tend to be run by physicians. As developing countries seek to boost efficiency and as they move toward decentralized management of health facilities, the need for trained managers increases. In most developing countries, however, training programs in these areas are poorly developed.

Distance education can facilitate training in public health, health economics, and management by allowing rapid implantation of what are often new curricula without the time-consuming task of training a new generation of teachers. Distance learning has been used, for example, to build health research capacity in China. The University of Newcastle in Australia, in collaboration with Chinese universities, has set up a postgraduate distance-learning program in clinical epidemiology. The printed materials and academic standards of the distance-learning program are equivalent to those in the Australian program. Chinese professors help the students with applied laboratory and research work.

Reforming the finance of health training

Many of the problems with human resources in the health sector derive from the fundamental flaw of public subsidization of medical training. If physicians paid the full costs of their training, it would be of no concern if they were later employed in nonmedical work. Public subsidies could be specifically targeted to encourage those training and career choices that are in the public interest.

Student loans could replace most of the current public subsidies for training. Repayment of loans might then be forgone if the trainee agreed to work in a priority sector (such as primary care or public health) or in an underserved location. Not only would professionals be better distributed and used, but there would be substantial savings of public resources.

Almost every country today is grappling with problems in the mix and quality of its health professionals. Government financial policies can play a constructive and central role in correcting market failures that lead to distortions in access to training and in the supply of professionals in different fields. (For example, if credit is not widely accessible, only the better-off may be able to go to medical school; if the private rate of return for a certain specialty greatly exceeds the social rate of return, more professionals may choose that field than would be socially optimal.) Government policy can:

• Help meet the need for training primary care providers and other health professionals by improving capital markets—using student loan programs, where feasible—and through national service mechanisms.

• Increase spending on training of, and improve public sector wages and benefits for, health professionals in areas in which social benefits currently exceed private returns. These include, in particular, nonphysician primary care providers, health care managers, and staff in rural areas.

• Limit or eliminate subsidies and financial incentives for specialist training.

Improving the selection, acquisition, and use of drugs

Drugs and vaccines embody much of the power of modern medicine. Governments can enhance their own utilization of drugs and assist the private sector in increasing its efficiency through policies that improve selection, rationalize acquisition and production, and encourage better use. Through drug regulation and the development of a national list of essential drugs of established cost-effectiveness, governments can help providers and consumers make better choices among the approximately 100,000 different drugs—composed of more than 5,000 different active substances—now available worldwide. Governments can encourage health systems to buy drugs of assured quality from the lowest-cost supplier, whether domestic or international. They can eliminate the incentives that in many countries induce physicians to overprescribe drugs because of the profits they earn from directly dispensing them. In China, Japan,
and Korea such incentives helped to drive drug spending up to 35 to 50 percent of total health spending.

Selecting essential drugs

The Model List of Essential Drugs developed by WHO suggests a basic list of drugs that WHO considers important and effective for dealing with health problems in developing countries. First drawn up in 1977 by an expert panel, the original list has been revised and updated seven times and now includes about 270 products. It is designed to serve as a template from which countries can develop their own still more specific lists of essential drugs.

Drugs on the national essential list are intended to be available at all times and in the appropriate dosage forms in publicly provided health services. At the health center level about thirty to forty drugs can treat almost all complaints. District hospitals require no more than 120 drugs. If properly purchased, these drugs tend to be relatively inexpensive; almost all have multiple suppliers on international markets. Drugs are listed by international, nonproprietary (generic) names. Although many countries have created these essential drug lists, only a few have used them to guide purchasing and management of public sector (or publicly financed) drug supplies. And occasionally national drug lists have omitted important products, particularly contraceptives.

Bangladesh and Sudan use limited lists not only to select drugs for public financing but also to guide the national drug registration process, thereby affecting the mix of drugs available in the private sector as well. Norway has limited the number of drugs registered by incorporating cost-effectiveness, among other factors, into the review process. Since 1991 Zimbabwe has used its national list to determine which drugs can be imported by the private sector without a permit.

The applicability of the essential drug concept is not limited to developing countries; drug formularies, which are detailed lists of essential drugs, are widely used by institutional health providers (public or private) and insurance companies in industrial countries. The formulary contains the names of drugs that are approved or recommended for health providers and supply systems. It also provides useful information for individual prescribers. In creating formularies, drugs are assessed on the basis of their safety, effectiveness, and cost-effectiveness in comparison with other therapeutic products. Evidence from the United Kingdom and other countries shows that the adoption of formularies can contribute to considerable savings in drug costs if physicians are involved in their development and are educated about the results.

Governments are also responsible for carrying out regulatory functions to ensure that all drugs on the market are of acceptable quality, safety, and efficacy. Building up a national regulatory authority requires the creation of a core group of trained staff, enactment of supporting legislation for administrative drug review, and the establishment of quality assurance laboratories. These are important areas for donor assistance and perhaps for internationally shared efforts.

Acquiring and producing drugs

In 1990 the public and private sectors in developing countries spent an estimated $44 billion, or $10 per capita, on pharmaceuticals. Global expenditures on pharmaceuticals amounted to about $220 billion, or $40 per capita. Total expenditures on human vaccines, excluding those made in developing countries, were between $1.6 billion and $2.0 billion in 1992. Drug expenditures vary widely, from a low of $2 per capita in parts of Sub-Saharan Africa and in Bangladesh to a high of $412 in Japan (Table 6.1).

Table 6.1 Annual drug expenditures per capita, selected countries, 1990

<table>
<thead>
<tr>
<th>Country</th>
<th>Expenditure (dollars)</th>
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<tbody>
<tr>
<td>Japan</td>
<td>412</td>
</tr>
<tr>
<td>Germany</td>
<td>222</td>
</tr>
<tr>
<td>United States</td>
<td>191</td>
</tr>
<tr>
<td>Canada</td>
<td>124</td>
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<tr>
<td>United Kingdom</td>
<td>97</td>
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<tr>
<td>Norway</td>
<td>89</td>
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<tr>
<td>Costa Rica</td>
<td>37</td>
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<td>Chile</td>
<td>30</td>
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<td>Mexico</td>
<td>28</td>
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<td>Turkey</td>
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<td>Morocco</td>
<td>17</td>
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<td>Brazil</td>
<td>16</td>
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<tr>
<td>Philippines</td>
<td>11</td>
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<tr>
<td>Ghana</td>
<td>10</td>
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<tr>
<td>China</td>
<td>7</td>
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<td>Pakistan</td>
<td>7</td>
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<tr>
<td>Indonesia</td>
<td>5</td>
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<td>Kenya</td>
<td>4</td>
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<tr>
<td>India</td>
<td>3</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>2</td>
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<tr>
<td>Mozambique</td>
<td>2</td>
</tr>
</tbody>
</table>

In most established market economies pharmaceuticals and vaccines account for between 5 and 20 percent of health care spending, and, except in Canada and the United States, more than half of all drug expenditures are publicly financed. In developing countries, households' out-of-pocket expenditures make up a much larger proportion of total drug spending. In Côte d'Ivoire and Pakistan, more than 90 percent of household health expenditure is devoted to drugs. In the public sector drugs generally account for between 10 and 30 percent of total recurrent costs, making them the second largest category after salaries. Given this high volume of expenditure, achieving the substantial improvements in efficiency of procurement that are possible becomes a high priority.

Purchasing Drugs and Vaccines Efficiently.

Some countries have achieved savings of 40 to 60 percent in pharmaceutical expenditure by improving selection and by competitive purchasing. For example, for several years the Costa Rican social security agency has been able to purchase drugs at approximately half the price of its counterpart institutions in other Central American countries, partly because of its use of centralized purchasing, more open and transparent purchasing procedures, and selection of generic drugs on the basis of its national essential drug list. This, of course, is facilitated by Costa Rica's political stability. In 1986 several Caribbean islands joined together to carry out international tenders through the Caribbean Development Bank. In the first year they saved 44 percent over previous prices.

The first step toward efficient procurement is careful quantification of drug and vaccine supply needs over a given period, using essential drug lists or formularies where possible. Large stocks of low-priority drugs have high opportunity costs: they tie up resources and may expire before they can be used. Shortages of high-priority drugs are also costly; emergency purchases from local suppliers are always expensive. Good forecasting permits economical purchasing.

Some governments and many donors purchase drugs through international agencies (see Box 6.3). These agencies use international tendering and, because of the scale of their purchases and their low operating margins, pass on very low prices. (The total amount of drugs procured in this way is, however, small in relation to total drug expenditures in developing countries.) UNICEF purchased about $160 million worth of pharmaceuticals, vaccines, and related supplies for developing countries in 1992. Ethiopia, Sudan, Tanzania, and

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**Box 6.3  Buying right: how international agencies save on purchases of pharmaceuticals**

UNICEF and several nonprofit organizations offer purchasing services that enable countries to obtain favorable prices for drugs, vaccines, and some medical equipment. UNICEF, the biggest in the field, has supplied basic drugs and vaccines since the 1960s. In 1983 it issued its first international invitation to tender for the bulk purchase of pharmaceuticals for Tanzania. The prices quoted against the invitation to tender were up to 50 percent lower than previous price quotations. As a result of this experience, UNICEF has continued to use international tendering for the bulk purchase of pharmaceuticals and to pass on these favorable prices to developing countries. UNICEF contracts with the Danish National Board of Health to provide advice on quality assurance for pharmaceutical products. In 1992 UNICEF's purchases of drugs ($61.2 million), vaccines ($63.6 million), and refrigeration equipment, syringes, needles, and sterilizers ($33.4 million) were delivered to more than 120 countries.

The International Dispensary Association (IDA), established in 1972, is a nonprofit supplier of drugs to developing countries. IDA procures drugs and supplies on behalf of governments and nonprofit organizations in more than eighty developing countries. Its current annual turnover amounts to $80 million. IDA also carries out quality assurance, checking that manufacturers produce in accordance with internationally accepted standards. When the drugs are received, IDA tests samples for quality and verifies labels and certificates of analysis.

Price lists from UNICEF and IDA provide valuable market information for countries' own procurement. Competitive tendering in Mali reduced prices by 40 percent. In Kenya bulk purchasing of carefully selected essential drugs was estimated in 1985 to save nearly 40 percent (or $700,000) of the annual drug bill for church health institutions. In 1992 the Chinese government carried out international competitive bidding for drugs for tuberculosis treatment and—perhaps because of the very large scale of procurement involved, the low-cost packaging requirements, and the desire of manufacturers to enter the Chinese market—achieved savings of about 70 percent of UNICEF's published prices.
Zambia have all relied heavily on nonprofit international drug suppliers.

But many other developing countries fail to take advantage of international competition or international agencies. Purchasing methods, as well as import restrictions, tend to restrict competition and thereby raise prices. In addition, price competition is restricted by the industry’s extensive drug promotion practices and, in the case of patented products, by monopoly power. Some countries, such as Venezuela and Zimbabwe, protect local pharmaceutical industries from international competition (imported drugs will not be approved for import and sale if there is a local producer), and Belize and other countries impose import tariffs even if there is no local production. This results in great variation in prices for pharmaceuticals and supplies in developing countries. Cross-country data on the retail price of condoms show remarkable variation: condoms cost only $2 to $3 per 100 in China, Egypt, and Tunisia, $15 to $30 per 100 in Costa Rica, Ecuador, and Mexico, and more than $70 per 100 in Brazil, Burundi, Myanmar, and Venezuela. This price variation is attributable to a combination of factors, including import tariffs, import restrictions, and wholesale and retail marketing structures.

Some countries purchase directly from a few local suppliers because of liquidity constraints. International agencies do not extend credit, and they require payment in hard currency. Local suppliers often extend credit in exchange for significantly higher prices. Changing this practice to take advantage of benefits from competitive procurement would require the ministries of both health and finance to make budgetary funds and foreign exchange available when needed for large-scale drug purchases. Governments can also improve drug procurement by passing legislation to facilitate generic drug prescribing. This can increase the affordability of drugs purchased from private outlets.

**Pharmaceutical Production.** The cost of developing a sophisticated pharmaceutical industry with a significant research base is huge. During 1961–90, 90 percent of the approximately 2,000 “new chemical entities” (new drugs) brought on the market were discovered in only ten OECD countries. Five countries in the developing world—Argentina, China, India, Korea, and Mexico—discovered, developed, and marketed at least one new chemical entity between 1961 and 1990. Several other developing countries—among them, Brazil, Indonesia, and Turkey—have primary manufacturing capabilities or the ability to produce both therapeutic ingredients and finished products. But most developing countries either have only the capacity to produce finished products from imported ingredients or have no manufacturing capability whatsoever. (Countries in the latter group are typically very small.)

Except in the largest countries that have primary manufacturing capabilities, local pharmaceutical production in developing countries is likely to make sense only for intravenous fluids, which have relatively high transport costs; for local packaging of bulk imports in finishing plants; and for packaging of oral rehydration salts. Even in these activities local production may be inefficient and waste scarce resources. State-run drug and vaccine companies, from which the public sector purchases preferentially, are common in many countries, including Bangladesh, Brazil, India, and Laos. In some countries the local pharmaceutical industry (public or private) produces drugs that could be purchased less expensively elsewhere. Such industries survive only because of the protection accorded through the prohibition of competing imports, through import tariffs, or through guaranteed agreements for public purchase regardless of price.

The combination of protection and poor regulation can be particularly damaging. A 1990 study of more than 6,000 infants in Bangladesh revealed that the mothers’ tetanus toxoid vaccinations did not reduce the risk of tetanus. Subsequent testing in reference laboratories of Bangladesh-produced vaccine indicated no potency in several consecutive batches, raising questions about the efficacy of the more than 40 million doses already administered. Since Bangladesh has no independent national control authority for certifying vaccine safety, all testing had been done by the production facility itself. Evidence suggests that few public sector pharmaceutical and vaccine producers have been able to operate competitively, in terms of price and quality, in the highly competitive and rapidly changing pharmaceuticals market. Improved selection and purchasing practices—rather than protection of drug manufacturing—will usually be the best ways to counter the market power of international suppliers of drugs.

**Improving Storage and Distribution.** Theft, spoilage, and shortages are major problems facing public distribution in many countries. Systems for inventory control, port clearing, storage, and de-
livery can address many of these problems. In Zimbabwe a standard nationwide system of stock control was fundamental to recent reforms in the drug supply system. Surveys show a gradual improvement in drug availability: in 1991 the facilities surveyed had 78 percent of the representative essential drugs in stock, up from 38 percent in 1987. In hospitals, management information systems help to track periods of drug validity and to analyze rotation rates and drug consumption.

Influencing prescription and self-medication patterns

Significant efficiencies can be achieved by improving prescription and self-medication practices. Widespread overprescription and inappropriate prescription have been documented in most countries. For example, recent surveys found that the average number of drugs prescribed per single consultation in public health centers ranged from 1.3 in Zimbabwe and Ecuador to as high as 3.3 in Indonesia and 3.8 in Nigeria. These surveys also documented that unnecessarily high proportions of drugs were being administered in the form of injections (which carry the risk of abscesses, nerve injuries, and transmission of infectious disease) and that extensive overuse of antibiotics was occurring. A survey of seventy-five pharmacies in three Asian countries found that only sixteen gave appropriate advice regarding oral rehydration for treatment of diarrhea in infants.

Public policies for improving prescription and medication practices include:

- Distribution to health care providers and pharmacists of regularly updated essential drug lists or formularies that include descriptions of use, dose, adverse reactions, and costs; examples include the British National Formulary and the Uganda Drug Formulary
- Strengthening of medical and nursing training regarding pharmacology, appropriate prescribing practices, and problems caused by overprescription and unnecessary use of injections
- Public education on appropriate drug use, the disadvantages of injections when oral doses are available, and the importance of compliance with the full course of therapy
- Removal of financial incentives that encourage physicians to overprescribe.

Unlike facilities, equipment, and human resources, pharmaceuticals and vaccines are an area in which government policies can alter input use relatively quickly. And good policies could make a significant contribution. Because consumers and providers cannot possibly review all the information available on the quality, safety, and efficacy of drugs and vaccines, governmental involvement in regulation and in provision of information is necessary. In addition, the government must manage drug selection, procurement, and distribution for publicly provided health services. To support the rational use of drugs, governments can:

- Develop a national list of essential drugs and direct public finance to those drugs that support the essential package of clinical services and public health interventions.
- Purchase drugs competitively and reduce or eliminate protection of local pharmaceutical production of vaccines and drugs. These policies work to consumers' benefit. Efficient local industry is best created under competitive conditions.
- Provide information to public and private providers and consumers on drug use and cost-effectiveness and establish regulations that discourage overuse or overprescription.

Generating information and strengthening research

In health, as elsewhere, good information facilitates sound decisionmaking. Although some basic health information is generated by the private sector without government involvement, the government has a central role in requiring, standardizing, and financing the collection, analysis, and dissemination of health information, as well as in financing health systems research. Governments are already heavily involved in data collection. Unfortunately, the data are often irrelevant to policy and program design. And too often, the private sector is ignored when statistics are being gathered. Revamping health information systems is an attractive investment, both because it is relatively inexpensive and because poor decisions based on inadequate information can be very costly. But the impact of information systems depends crucially on the decisionmaking environment. Even the best systems may be seen as irrelevant if managers have no incentive or scope for using information to improve efficiency. Information helps guide choices among the existing options, and investments in research and development create new options, both for households and for providers of care. It can be argued that investments in research have been the source of the enormous improvements in health in this century. This section discusses ways of ensuring continued benefits from research, as well as the role of the international community in this task.
**Understanding health status and health risks**

An essential step toward improving health is to understand the distribution of disease, death, and disability. This requires the systematic collection, analysis, and dissemination of timely and accurate information on mortality, morbidity, and risk factors. Such data are a cornerstone of public health efforts in any country, and the government’s role is central in creating them because the private sector has little interest in producing such public goods. Epidemiological data are used to estimate the magnitude of health problems, study risk factors, evaluate health programs and the effectiveness of interventions, detect epidemics, facilitate planning, and monitor changes in health practices. These data could be used to estimate a national burden of disease similar to the global burden of disease estimated for this Report. The national burden of disease would quantify the loss of healthy life from the diseases that are important in the specific country. It could be used to monitor and track over time improvements in both mortality and morbidity.

Some countries have established surveillance systems that rely on sentinel districts selected to be roughly representative of the country. To improve the speed and accuracy of reporting, data collection systems are upgraded in these districts to a greater degree than could be done for the country as a whole. Cause-specific death rates, vaccine coverage, the effectiveness of vaccines, and the impact of specific health interventions are then monitored intensively within the district. National household surveys can also generate a wealth of information on health status, risk factors, and the utilization of health services according to age, sex, region, and racial and ethnic group (see Box 6.4). Unlike government health service statistics, population-based surveys cover nonusers as well as users of public services.

**Monitoring health spending and equity**

Previous chapters have recommended redirecting public spending to nationally defined essential clinical services, targeted largely to the poor, and to public health interventions, leaving to private

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**Box 6.4 The contribution of standardized survey programs to health information**

Three internationally supported standardized household survey programs have contributed immensely to knowledge of health conditions, particularly those of children, in the developing world over the past three decades. The World Fertility Survey (WFS) sponsored forty-three surveys between 1974 and 1982, with funding from the U.S. Agency for International Development (USAID) and the United Nations Population Fund (UNPF) and some country contributions toward the costs of survey fieldwork. The Demographic and Health Surveys (DHS) program, started in 1984, has so far implemented thirty-nine surveys in thirty countries; the third phase of the survey program, with a planned twenty-five surveys, is about to begin. The DHS program has received funding from USAID, with contributions from countries and other donors.

Both the WFS and the DHS program have used a common core questionnaire around which special topics could be explored. The core WFS questionnaire was primarily concerned with fertility and fertility-related behavior; for each eligible woman it included a birth history, recording the date of each birth and, if the child had died, the age at death. This information base has provided much of what is known about child mortality trends and the relationships between child mortality and birth spacing, maternal education, and household characteristics. The DHS questionnaire, in addition to a birth history, includes questions about immunizations, health care behavior, and other aspects of child health. DHS survey information has been used for purposes as diverse as examining the effects of economic reversals on demographic outcomes and studying small area variations in child mortality risks in urban areas.

Neither survey program has collected detailed economic information on households and communities. The World Bank’s Living Standards Measurement Survey (LSMS) was designed to fill this need by studying the determinants and interactions of poverty, health, education, nutrition, and labor activities. The survey collects a wealth of information about incomes, production, and prices. Some LSMS surveys are funded through World Bank-financed projects, but many have received grant support from a variety of bilateral donors, the UNDP, and other agencies.

The experience with these standardized surveys indicates the great value of using comparable survey procedures and instruments across countries and the importance of rigorous supervision at all stages of the survey operation, from sampling to data processing. The LSMS and DHS programs have been particularly successful with respect to turnaround time; preliminary findings from a survey are available within six weeks of the conclusion of fieldwork, and a final report typically becomes available within one year.
finance health services outside the essential package. Private expenditures are always difficult to estimate, but even in the public sector, spending is poorly disaggregated by use. By revamping information systems, estimates can be made of spending on public health interventions and on categories of inputs (essential drugs, nonessential drugs, primary care physicians, other primary care providers, specialists, health centers, district hospitals, and tertiary hospitals). Although still imperfect, such estimates better capture the nature of government spending. In addition, public expenditures need to be regularly consolidated across federal, state, and local levels for analysis. In Brazil, where state and local governments account for about half of all public spending on health, expenditure estimates are available only for federal spending (except for 1984). Much less information is compiled from state and municipal levels, despite their importance. Household surveys can collect appropriate information for monitoring who benefits from public health spending. In part because such data are lacking, analyses of equity in health care have been carried out in only a handful of developing countries, among them Colombia, Costa Rica, Côte d'Ivoire, Indonesia, Malaysia, and Peru.

**Box 6.5 Evaluating cesarean sections in Brazil**

Operations research can examine variations in medical practice with a view to identifying areas in which changes in practice are needed, as well as possible instruments for modifying provider practice. In the early 1980s Brazil was estimated to have the highest overall cesarean section rate in the world—31 percent of all hospital births in 1981. Although cesarean sections are a life-saving procedure in certain circumstances, their unnecessary use raises costs and poses medical risks for the mother and the newborn. The financial cost of unnecessary publicly financed cesareans in Brazil was estimated at about $60 million annually in the late 1980s. Medical risks stem from incorrect estimation of the length of gestation (leading to premature deliveries), infection from surgery, and the use of general anesthesia. Among the many factors responsible for the rising rate of cesareans in Brazil are the financial and administrative incentives for hospitals and doctors to perform cesarean deliveries, the desire to use a cesarean delivery as a vehicle for obtaining a sterilization, and the widespread view that cesarean section is the preferred, ’modern’ way to deliver.

Brazilian studies of cesarean section rates illustrate systematic variations by region, type of hospital, socioeconomic status of the woman, and reimbursement patterns. Rates in 1981 were higher in the more prosperous Southeast (38 percent) and lowest in the poor Northeast (20 percent). In every region the incidence of cesarean section increased with family income. A 1986 survey showed that rates were highest for women with a university education (61 percent) and for births in private hospitals (57 percent). Other studies showed that rates were lowest among women with no insurance. Women covered under the social security system had higher rates of cesarean section, and women with private insurance had the highest.

The country’s social security institute changed its reimbursement policies in the early 1980s to remove some of the financial incentives for cesarean sections, and education campaigns for physicians were initiated. But it is clear that even stronger policies are needed to reverse these trends, as cesarean section rates have continued at high levels. A large sample of births in the state of São Paulo in 1991, for example, indicated a cesarean section rate of 47 percent.

**National research priorities**

Governments have a role in supporting the research necessary for understanding specific local health problems and for guiding public policymaking and program design. This ‘essential national health research,’ which is also undertaken by the private sector, examines health strategy in more depth than is done with day-to-day budgetary and management information. The international community can help both in gathering data for international comparisons and in assisting local institutions to build up capacity in epidemiology, health economics, health policy, and management. Research priorities in this area include cost-effectiveness analysis of health interventions, evaluations of medical practice and of variations in practice (see Box 6.5), and studies of drug utilization, equity, consumer satisfaction, and women’s health.

Where the national burden of disease is high and cost-effective interventions already exist, research can guide program implementation. One such example is the problem of intestinal parasitic worms. How can local programs be best designed to reach children? How can involvement of school officials be fostered? Another area is tuberculosis, where treatment compliance is a chronic problem;
patients often stop taking medication once they feel better, but before the problem has been effectively treated. What program approaches work best in different settings to ensure compliance with directions? In nutrition, how can policies and programs promote dietary change most effectively? Solutions to these problems are not universal. Research must be local, and often public support is needed.

In its 1990 report the Commission on Health Research for Development recommended the formation of international partnerships or networks to focus on ensuring that national health resources are used to maximum effect. The International Network for the Rational Use of Drugs (INRUD), established in 1989, is one such network. Another is the International Clinical Epidemiology Network (INCLEN), which was started in the early 1980s by the Rockefeller Foundation to build up a critical mass of researchers in clinical epidemiology, including epidemiologists, health economists, social scientists, and biostatisticians. INCLEN enrolls midcareer academic physicians who hold positions of influence in the medical systems of developing countries. It provides overseas study opportunities, support for research, and the opportunity to participate in annual scientific meetings. The network concept has permitted units to share experiences and teaching materials and to carry out collaborative research between clinical epidemiology units, training centers, and the international health community. Capacity building is a lengthy process, but INCLEN has already influenced health policy. Research on the effectiveness and efficiency of hepatitis B immunization in the Philippines brought about the addition of hepatitis B vaccine to the national EPI program. Studies on the cost-effectiveness of short-course chemotherapy for tuberculosis have led to a change in national treatment policies in Brazil, the Philippines, and Thailand.

Improving information at the district and facility levels

Health organizations also benefit from improvement of the information needed to make everyday management decisions. In publicly provided district health facilities, simple management information systems for measuring costs, inputs, and production could be helpful for monitoring program efforts over time and for making decisions about how to combine inputs efficiently. Yet many public facilities operate without such information. Without basic data on costs, it is difficult to decide, for example, whether to contract out services such as laundry, food preparation, and laboratory testing. Systems that gather information on vaccine utilization, equipment and vehicle inventories, preventive maintenance for buildings and equipment, personnel management, and the like are also fundamental.

Ministries of health frequently pay little attention to the activities of private providers, instead focusing all data collection efforts on public providers. To remedy this, governments can collect basic information about private providers and the population covered under private insurance plans. They can require standardized reporting from both public and private hospitals through uniform hospital discharge data. The information can then be synthesized to provide consumers, health researchers, and communities with information about the quality of care given by providers, both public and private, and about variations in medical practice. These systems can generate sophisticated information; consumers in California, for example, can obtain risk-adjusted mortality rates by hospital for common procedures. But relatively simple measures can also be useful; an example is cesarean section rates, by hospital, which can help identify overuse of this procedure (see Box 6.5). Such standardized information about hospital performance can help consumers make better choices about health care and can help central authorities identify problems to be corrected.

If there are incentives for using information in decisionmaking, improvements in data gathering can often be inspired simply by giving those who need the information more training in how to collect it and more responsibility for doing so. District medical officers, hospital superintendents, and health care managers are usually not trained to make the best use of data. Whenever possible, tabulation of data should be decentralized so that local decisionmakers can immediately use the information instead of relying on feedback from central levels. In Papua New Guinea, for example, when local-level staff began to see the relevance of management information for their work, they sought to verify data and to eliminate reporting that was irrelevant.

To summarize, governments have a twofold role in health information systems and operational research: generating the information necessary to guide health policies and public spending and providing certain types of information about provider performance that would be too costly for consumers to collect. To this end, governments can:

- Gather and synthesize epidemiological and
other information necessary to monitor health status, detect disease outbreaks, and guide public policy and program design

- Support research, where needed, to generate local solutions to local problems
- Facilitate standardization of information about health production and health outcomes by district health systems and other major health providers; where necessary, synthesize and publicize this information to aid consumers in making informed choices about health care.

**Expanding the range of choice**

A revolution in health care technology has taken place in the course of this century. Significant biomedical breakthroughs that have generated international benefits—for developing countries as well as for the established market economies—include the development of measles, pertussis, polio, and tetanus vaccines; chloroquine for the treatment of malaria; oral rehydration therapy; antibiotics and other antimicrobials; and synthetic hormonal contraceptives.

Basic research and product development are public goods that require support through government subsidy or intervention (for example, grants of patents). In addition, because the poor in developing countries lack market power, the system of patent protection fails to provide incentives to the commercial sector for developments related to diseases of the poor. Thus, there is a clear argument for government and international assistance to catalyze technological development. In the developing world many serious health problems do not present sufficiently attractive commercial markets to induce the development by private companies of better methods of prevention, diagnosis, and treatment. Developing countries account for almost 90 percent of the global burden of disease, and much of that burden is from conditions such as malaria or tuberculosis that primarily occur in...
those countries. Only about 5 percent of the $30 billion global investment in health research in 1986 went to health problems unique to developing countries.

Setting priorities

Where is extra research really likely to pay off? Table 6.2 suggests priorities for research on prevention, diagnosis, and case management for the six conditions that make the largest contributions to the global burden of disease. These conditions account for about 40 percent of the DALYs lost in demographically developing countries and for about 25 percent of the losses in industrial countries (where cardiovascular disease accounts for much of the burden). If the global burden caused by a disease is large, if no cost-effective interventions exist, and if experts believe that such interventions might be developed, there is a case for greater investment in research and product development. One example that meets these criteria is inexpensive, simple, and reliable diagnostics for respiratory infections. For problems that create a large burden of disease and for which cost-effective interventions already exist, there is a need to direct efforts more toward program development and operational research to guide implementation. For example, little is known about low-cost methods of managing ischemic heart disease in developing country settings. One low-cost approach that is being adopted in many industrial countries is the use of low daily doses of aspirin to reduce the risk of obstructive blood clots inside the arteries. This approach, developed on the basis of the results of large-scale assessments of the efficacy of the intervention, illustrates the potential benefits of research on low-cost case management.

International agencies and governments can stimulate research on health and product development in several ways. They can provide information on potential markets for new products, including epidemiological data about the disease, the target population, and the technical requirements of desirable innovations. They can subsidize a portion of the development costs. They can facilitate or finance field evaluations in a variety of settings and support introduction of the technology in the field. Finally, they can provide procurement guarantees for new or improved products at an agreed-on price. A few examples illustrate the potential.

New and improved childhood vaccines. The EPI currently includes vaccines against six diseases: measles, tetanus, pertussis, diphtheria, polio, and tuberculosis. It requires at least seven patient contacts (two for the pregnant mother and five for the infant). Possible improvements in vaccine technology would reduce multidose vaccines to a single dose, improve the heat stability of vaccines, simplify administrative requirements (to permit greater use of oral vaccines as compared with injections, for example), create new combinations of vaccines to reduce patient contacts, integrate new vaccines into the immunization schedule, permit vaccination earlier in life to reduce infant deaths caused by vaccine-preventable diseases, and add to the menu of interventions new vaccines—for example, against diarrhea and pneumonia. These innovations would reduce some of the costs and improve the effectiveness of vaccination programs. An important source of support for this research is the Children’s Vaccine Initiative (CVI), which is identifying measures for catalyzing technological development in these areas. The CVI, which has its secretariat at WHO, is an international effort to harness new technologies that can advance the immunization of children.

Tropical diseases. It is primarily the rural poor who suffer from tropical diseases such as malaria, schistosomiasis, lymphatic filariasis, onchocerciasis (river blindness), trypanosomiasis, and leprosy. These diseases create a high burden, and existing interventions are inadequate against many of them. The UNDP–World Bank–WHO Special Programme for Research and Training in Tropical Diseases (TDR) is developing partnerships with commercial entities, national governments, scientists, and NGOs to support research and drug development for these diseases. One strategy the program has adopted is to look for new applications of drugs already in use in human or veterinary medicine. An example is the use of ivermectin, a drug originally marketed by Merck & Co. for treating worms in animals, in the fight against onchocerciasis in human populations (see Box 1.1). The TDR program facilitated the field testing of this product on a large scale for human use. The results showed that the drug was very safe, that it could be distributed by primary health care workers, and that one oral dose per year could prevent or arrest blindness. As a veterinary product, ivermectin has estimated annual sales of $500 million; Merck & Co. agreed to supply the drug without charge to governments for treatment of human onchocerciasis. The TDR’s network of internationally funded research centers in develop-
Box 6.6 An unmet need: inexpensive and simple diagnostics for STDs

This Report recommends that concerted efforts be made to develop or strengthen effective programs for control of STDs. Such efforts will be hampered by the challenges of diagnosing STDs, particularly in women, for whom the vast majority of infections are asymptomatic. Current methods are often unreliable and expensive, and their use requires refrigeration, electricity, and sophisticated equipment and training. In addition, certain tests require patients to return in one or two days, which is not feasible when, as is often the case, the patient must travel a long distance to receive health care. Even if patients return, the period of infectivity is prolonged by this delay in therapy. Syndromic-based approaches to treating STDs are currently being used to bridge this gap and are effective for men. For women, however, these approaches are less accurate.

New diagnostics that are inexpensive, simple, and convenient to use and provide rapid, stable, and accurate results would overcome these problems. An example of such a tool is a new HIV test. The availability of HIV testing has been limited by high cost, complexity, and requirements for reagents that need refrigeration and have a short shelf life. Even when labor costs are excluded, testing and confirmation can cost $25 to $50 (although this cost is declining rapidly). The HIV dipstick, developed by the Program for Appropriate Technology for Health with support from Canada’s International Development Research Centre (IDRC) and from private funds, uses synthetic peptides and a color change to provide an easily performed test. The test takes twenty minutes, requires only three simple steps, is stable for six months at tropical temperatures, has a pattern of sensitivity and specificity similar to commercially available tests, and costs less than $0.20. Thus, the per patient cost for testing can be brought down to less than $1.00, including a confirmatory second test. This test is now being commercially produced in India and Thailand. The Canadian International Development Agency (CIDA) is funding the establishment of a production facility in Cameroon, and there is interest in production in Brazil, Indonesia, and Zimbabwe.

The STD Diagnostics Initiative, which is funded by multiple donors, was established to facilitate development of appropriate diagnostics for resource-limited settings. The initiative, being carried out in collaboration with industry, clarifies and validates performance criteria for STD diagnostics, organizes and supports field trials, provides seed money for the development of new diagnostics, and brokers bulk purchases to create markets of adequate size.

Women spend up to half of their reproductive lives pregnant or lactating. Many protocols for treating tropical diseases exclude these women and sometimes even large numbers of women who might be pregnant (such as adolescent girls). Blanket exclusion of pregnant or lactating women has been the result not of clear evidence of problems but of reluctance to carry out appropriate drug trials on pregnant women. There is an urgent need to evaluate drug treatments for such women so that health services can offer them better treatment. This is part of a much broader problem of the common omission of women from medical studies and clinical trials in both developing and industrial countries.

Medical equipment. Another priority area for research and development is the development of low-cost and efficient diagnostic technologies for use in health centers in developing countries where sophisticated laboratories are unavailable. Examples of potentially important new technologies are visual methods of screening for cervical cancer, rapid plasma finger-stick diagnostic tools for syphilis, and new diagnostic tests for malaria for use at the local level. (Box 6.6 provides another example.) Rapid diagnostic tests avoid reliance on other levels of the health system because the health center, if supplied with the necessary drugs, can treat the problem on the spot. Innovations in medical equipment to reduce the cost or improve the effectiveness of preventing and treating problems at the health center level are high priorities for research and development.

International aspects

Some types of research and product development are costly; it can cost more than $100 million to bring a new drug to market. But several breakthroughs in medical technology have been inexpensive. (One of them, oral rehydration therapy, is now widely recognized as an effective way of treating acute watery diarrhea, which, untreated, can weaken or kill young children.) The need for public support for certain types of research is widely understood. The international community has played an important role in supporting health
research, and most governments support some research as well. Over the short to medium term, developing countries can use their scarce public resources best if:

- Governments reduce or eliminate finance of basic biomedical research that generates international benefits (which is best supported by the international community) and redirect it toward research efforts that generate primarily national benefits.

- The international community directs research support toward new and improved technologies where the expected social returns are highest and would benefit many countries.

International financing is needed for important biomedical research when the benefits transcend national borders and the research will not be undertaken by the private sector at socially optimal levels. (Even research that is internationally financed will take place principally in developing countries and will be done increasingly by scientists from developing countries.) The total investment in health technology research relevant to the needs of the developing countries is woefully inadequate in relation to its potential benefits. And the level of international coordination and cooperation falls well short of what is required. An international mechanism with stable funding over the medium to long term could more effectively build research capacity in developing countries. Donors and governments also need to give more support to activities for testing new technologies and incorporating them into health systems.