

Appropriate Technology for Developing Countries

Mahesh C. Goel, the national coordinator of the organization, Hands to Clinical Laboratories of Third World Countries, described in the group's January 1991 newsletter a visit he made recently to Zaire (1). That country's per capita income is about \$160; life expectancy is less than 50 years. Of the various estimates of its annual per capita expenditure on health care, the highest is \$1.25. About 6-8% of the general population is infected with AIDS, with the incidence in prostitutes being about 60%. Dr. Goel visited the largest hospital in the country. Although the 2000-bed facility had 12 operating rooms, only one was in working condition, and only four hemostats were available for surgery. He was not able to see the laboratory because the room was locked and the key could not be found. Using equipment he brought with him from the U.S., Dr. Goel screened some children for zinc protoporphyrin and found that half of them were positive for lead toxicity and (or) iron-deficiency anemia.

In the same issue of the newsletter, a Peace Corps volunteer noted that the majority of the laboratories in Liberia lacked running water and electricity. She commented on the need to reuse slides over and over and described the difficulties of washing cover-slips. Pipettes were rare and gloves were absent. Another Peace Corps volunteer, writing from Yemen, described a situation that was not much better. Dirty slides had to be used. Hematocrits were not performed because the centrifuge did not work, and hemoglobin was measured by visual comparison against standards. Quality assurance was not practiced. There was no distilled water, and reagents were often outdated. Urine and fecal specimens were collected in dirty containers.

In their overview of appropriate technology for developing countries, Drs. Heuck and Deom (2) provide an interesting insight into the economic environment of developing countries, which influences the type of health care that can be provided. A startling difference between developed and developing countries in terms of funds allocated to health care is given in their Table 2. The proportion of government expenditures for defense in developing countries is comparable with that in developed countries, yet developing countries spend on health only about a quarter of the proportion of their gross national product (GNP) that developed countries spend. Yet, the need for health expenditure is greater in developing countries because, although the population is exposed to the same diseases facing the residents of developed countries, they are additionally exposed to a greater array of infectious diseases, poor hygiene, and a generally inadequate system for medical care delivery. In the U.S., the proportion of GNP that is attributable to health care already exceeds 12% and is anticipated to reach 15% by the year 2000. The average cost of health

care to an American company for an employee was \$3217 in 1990 and, if the current rate of increase continues, will be \$22 000 in 2000 (3).

The proportion of GNP allocated to health care in the developing nations is much less than in developed countries and is insufficient to ensure a high standard of delivery. In most developing countries, health care resources are poorly distributed throughout the country. They tend to be concentrated in the major urban centers where the better hospitals are located, and where there are more physicians, nurses, and technical staff. There often is a precipitous drop in resources available, in proportion to the distance from the major medical centers. Thus, in remote areas, few physicians are available, and health care is the primary responsibility of nurses and other paramedical practitioners. Because continuing education opportunities are not readily available to such people, their ability to serve the population's needs lessens with time.

Developing countries tend to fail, as do the developed countries, through not investing in adequate preventive measures. Heuck and Deom cite the World Bank's data to show that it is more cost-effective overall to spend money to prevent disease than to treat it once present. This is especially true in developing countries, particularly in rural areas, where sanitation is poor and knowledge about basic health care is essentially lacking. Although the need to invest in improved clinical laboratory services is compelling, this expenditure should be considered in light of the overall needs of the health care delivery system. Money is probably more efficiently spent on health education and preventive medicine than on clinical laboratory instrumentation.

In addition, even in the capital cities of many developing countries, essential services such as electricity, water, sewage disposal, and transport often are not dependable; thus, despite potential access to the same analytical equipment as in this country, the possibility of providing good-quality analytical services is not assured. In the major teaching hospitals of developing countries, many of the same instruments that we use are indeed available. However, they do not necessarily work appropriately because they are not supported with the same level of service as in this country and because the staff is often less well educated than the technical staff in this country. Few biomedical engineers are available to maintain the equipment adequately. Import restrictions and practices are often so archaic that reagents, particularly quality-assurance materials, are often outdated by the time they reach the user. Even if not outdated, the lack of refrigeration often renders them useless.

Many of the leading laboratory directors from developing countries have the opportunity to visit or work for

some time in laboratories of developed countries. Although this undoubtedly can broaden their knowledge, it must also heighten their frustration because of the lack of the infrastructure necessary to allow that knowledge to be used in their own countries. The major medical centers use the same textbooks and journals as in our medical schools and hospitals, but the level of education of the medical staff, who have not traveled abroad, is often insufficient to differentiate the major issues from the minor ones. For example, C-peptide measurements may seem as important as glucose determinations for managing diabetics, because our textbooks discuss both, but the knowledge to use even the glucose test appropriately is often lacking. In such a context the need for the C-peptide assay is not apparent.

Much of the ability to improve the practice of clinical chemistry is outside the control of clinical chemists or the World Health Organization. Governments must make a major effort to improve their systems for health care delivery.

The equipment now available should provide satisfactory performance in hospitals when the laboratory staff is properly trained and adequate maintenance is available. What is lacking, as Heuck and Deom clearly state, is the equipment necessary to provide support for those physicians practicing outside the major medical centers. Not only must this equipment be capable of producing results of adequate quality, but also it must not be viewed as inferior to equipment used in developed countries. Physicians in developing countries often believe that, if generally accepted good medical practice in developed countries requires the availability of certain tests, those same tests should be available and used in

the developing countries.

Heuck and Deom also allude to another major problem facing laboratorians in developing countries: the practice of international standards organizations orienting their recommendations to the practices in developed countries rather than to those in developing countries. The World Health Organization's own initiatives in health technology development, assessment, and transfer should facilitate recognition by the developed countries of the needs of the developing countries and should also promote the flow of both information and technology from the developed world to those in a developing area. Within its own financial constraints, the International Federation of Clinical Chemistry is trying to address some of the needs of developing countries. However, a much greater effort than can be done by WHO and IFCC together is required if real changes are to be made to improve the practice of clinical laboratory testing throughout developing countries.

References

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3. Health care a growing burden. *New York Times*, January 29, 1991.

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