Human Rights in Health

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Contributors

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Chairman: G. E. W. WOLSTENHOLME The Ciba Foundation, 41 Portland Place, London W1N 4BN

D. J. BRADLEY Harkness Laboratory, Department of Pathology, Radcliffe Infirmary, Oxford OX1 3BD

I. BURTON Department of Geography, Sidney Smith Hall, University of Toronto, Toronto 181, Canada

W. C. COCKBURN Virus Diseases, Division of Communicable Diseases, World Health Organization, Avenue Appia, 1211 Geneva 27, Switzerland

B. CVJETANOVIĆ Bacterial Diseases, Division of Communicable Diseases, World Health Organization, Avenue Appia, 1211 Geneva 27, Switzerland

B. H. DIETERICH Division of Environmental Health, World Health Organization, Avenue Appia, 1211 Geneva 27, Switzerland

G. EDSALL* Department of Microbiology, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT

A. EIDE International Peace Research Institute, Oslo 3, Norway

WENCHE B. EIDE Nutrition Institute, University of Oslo, Blindern, Oslo 3, Norway

C. M. ELLIOTT Overseas Development Group, School of Social Studies, University of East Anglia, University Plain, Norwich NOR 88C

KATHERINE ELLIOTT The Ciba Foundation, 41 Portland Place, London W1N 4BN

K. EVANG Maltrostveien 11b, Oslo 3, Norway

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* Able to attend only one session.

VICTORIA GARCIA School of Public Health, University of Chile, Santiago

R. GEIGY Swiss Tropical Institute, Socinstrasse 57, 4051 Basle, Switzerland

D. B. JELLIFFE Division of Population, Family and International Health, University of California, Los Angeles School of Public Health, Los Angeles, California 90024, USA

E. F. PATRICE JELLIFFE Division of Behavioral Science, University of California, Los Angeles School of Public Health, Los Angeles, California 90024, USA

M. JUL* Danish Meat Products Laboratory, The Royal Veterinary and Agricultural University, Howitzvej 13, Copenhagen F, Denmark

M. KING World Health Organization, SHS Project IR 0559, The Lembaga Kesehatan Nasional, Jalan Indrapura, Surabaya, Indonesia

P. LINDBLOM The International Federation of Institutes for Advanced Study, The Nobel House, Sturegatan 14, Box 5344, S-102 46 Stockholm, Sweden

LORD LLEWELYN-DAVIES Department of Urban Planning, University College, Gower Street, London WC1E 6BT

O. MELLANDER Göteborg Universitet, Medicinsk-Kemiska Institutionen, Medicinaregatan 9, Göteborg, Sweden

W. H. PAWLEY Policy Analysis Division, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy

N. W. PIRIE Rothamsted Experimental Station, Harpenden, Hertfordshire

D. M. POTTS International Planned Parenthood Federation, 18-20 Lower Regent Street, London SW1Y 4PW

A. QUERIDO Department of Internal Medicine, University Hospital, Leiden, The Netherlands

T. R. TEWARI E2/12, Vasant Vihar, New Delhi 110057, India

G. F. WHITE Institute of Behavioral Science, University of Colorado, Boulder, Colorado 80302, USA

A. WIENER Tahal Consulting Engineers Limited, 54 ibn Gvirol Str., Tel Aviv, Israel

Editors: KATHERINE ELLIOTT and JULIE KNIGHT

* Not present at symposium.

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Introduction

G. E. W. WOLSTENHOLME and KATHERINE ELLIOTT

Most of the symposia organized by the Ciba Foundation in the 24 years of its existence have been concerned with medical and chemical research—with the experimental background to advances in clinical medicine. But from time to time we have broken away from this tradition, as we did ten years ago in a meeting published as *Man and his Future*, which explored the ethical and philosophical aspects of medical research. This step onto new territory, namely the social implications of progress in science and biomedicine, led gradually towards what is now perhaps a collateral tradition for the Foundation. In 1964 a symposium entitled *Man and Africa* tried to show what the situation in Africa might be if the continent could become a single entity, without the disadvantages of nationalism. Our 100th symposium in 1967 tackled an immense topic—*The Health of Mankind.* It attempted to survey the burden of ill-health in the world and trace some of its causes. It was only too clear then that the problem remained huge and that the numbers of trained health personnel were frighteningly inadequate and unfairly distributed. The symposium on *Teamwork for World Health* in 1970 therefore looked at unorthodox as well as orthodox ways in which this critical shortage might be remedied.

In 1971 we held a symposium on *Civilization and Science: in conflict or collaboration?* which examined the problem of whether modern attitudes to research and technology cause more of the present ills of mankind than they cure. Towards the end of the same year it was suggested that a meeting on the potential contribution of the most basic health measures, applied effectively and shared out more equitably, to a better quality of life for the poor and deprived, might be of use, especially to economic and health service planners. And it seemed fitting to hold such a meeting in the 25th anniversary year of the Declaration of Human Rights.

We make no excuses for calling this symposium *Human Rights in Health.*

Sir Harold Himsworth[1] has recently defined a right as being 'an expectation in respect to matters affecting the interests of the individuals within a particular society which the consensus of opinion in that society accepts as justifiable'. (He added that he felt this applied just as much in Bangkok as in New York.) We believe, and we have based our planning of this meeting on this belief, that safe water and sufficient food are now among the minimum birthrights every human being should expect, and that a world in which technology has advanced so far and produced so much destruction and pollution should be capable of endowing every newborn child with these minimum benefits.

The year 1973 was not only the 25th anniversary of the Declaration of Human Rights but also the 25th birthday of the World Health Organization. Its Director-General, Dr Candau, speaks in his last report of 'good sanitation (which implies making drinking water safe) and adequate nutrition' as having become 'inalienable human rights'. This view strengthens our choice of four fundamental human rights in health as the minimum at which mankind should aim. These are: safe water to drink, sufficient food, protection against communicable disease, and access to the means of controlling fertility. All are interlinked, and they lead to a fifth—the right to have within reach at least some form of health care—which could, if interpreted in a wide sense, cover all the others.

We realize that other factors contributing to good health might also claim to be considered as rights: education and shelter, for example. But we want, in this symposium, to explore the practical implications—in terms of funding, human and material resources, and management needs — of adopting the above four determinants of health as universal human rights. The word 'adopting' is deliberately used here in preference to 'providing'. Our biggest task is to suggest ways in which people deprived of these necessities can obtain them for themselves or be helped with dignity to do so within the framework of their own cultures and traditions, and of the prevailing economic realities. Expertly informed commonsense must dominate humanitarian instincts if the symposium is to produce anything convincing or constructively helpful to the hard-headed pragmatists who accept responsibility and political authority: this is particularly the case where the resources are scarcest and disease is most rife.

Reference

1. HIMSWORTH, SIR HAROLD (1973) in *Ethical Issues in Human Genetics: genetic counseling and the use of genetic knowledge* (Hilton, B., Callahan, D., Harris, M., Condliffe, P. & Berkley, B., eds.) (Fogarty International Proceedings no. 13), pp. 169-172, Plenum Press, New York & London

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Financial resources: present and future

CHARLES ELLIOTT

In the face of the imbalance between the demand for health care—in the widest sense—and the supply of resources to meet those demands, it is easy to convince oneself that any talk of health care as a human right is vacuous. To declare something a right is to imply that the associated obligations can be met. But as Bryant[2] and Gish[3] have shown, resources are desperately short in the health sector in all poor countries. Indeed, national poverty implies extreme scarcity of all goods and particularly public goods.

The economists' job in this situation is threefold. First we can see whether there are reasons for believing that public resources—that is, government expenditure—will increase. Second, we can cast around for other types of resource. And, third, we can suggest strategies that will make the most of existing resources. This chapter tries, in a preliminary way, to tackle these three tasks.

Table 1 sets out data on selected countries that show the amount currently (or recently) spent by Ministries of Health per head of the population and the relationship this bears to income per head. As one would expect there is much variation, even at similar levels of income, but a regression equation, $H = -0.0603 + 0.0176Y$, where H is expenditure on health, and Y income per head, was found to be significant at the 0.001 level ($r = 0.753$). This implies that as average income per head grows by £100, £1.76 per head is spent by the government on health care.

If we apply this relationship to future levels of income, we can see how much is going to become available to the health sector in the future. This is always a somewhat unscientific operation because we cannot be sure of the rate of growth of either national income or population. Further, there is no reason to assume that errors will cancel each other out: indeed it is more likely that they are multiplicative, since a higher rate of growth of income is likely,

TABLE 1

Income and public health expenditure of selected countries for 1967 or nearest date

Country	*Income per head* (£)	*Public expenditure on health per head* (£)	*Proportion of national income spent on health* (%)
Tanzania	27	0.4	1.4
Kenya	51	1.0	1.9
Uganda	43	1.0	2.3
Ghana	87	1.1	1.2
Ivory Coast	92	1.8	1.9
Tunisia	76	2.0	2.6
Zambia	110	2.8	2.5
United Arab Republic	67	1.2	1.7
Lebanon	176	1.2	0.7
Indonesia	37	0.1	0.3
Thailand	65	0.6	0.9
Ceylon	59	1.2	2.0
West Malaysia	114	1.4	1.2
South Korea	59	1.8	3.0
Honduras	84	1.0	1.1
Colombia	135	1.4	1.0
Chile	226	5.5	2.4

Sources: WHO report[9] and government accounts for individual countries.

other things being equal, to reduce the rate of growth of population. For these reasons, the figures in Table 2 should be treated as probable orders of magnitude, rather than as precise forecasts. It should be noted, too, that we are relating health expenditures to national income rather than total government expenditures. We are therefore ignoring current priorities given to health and are assuming that governments will approach an *average* expenditure on health in the future. Thus, although the third column of Table 1 shows that, at the moment, there are great variations in the proportion of income devoted to health, we have assumed that each government approaches the 'norm'. This seems a less risky assumption than the alternative—that political priorities will remain constant over twenty years.

One other methodological note is worth entering. We have considered only health budgets, although it is true that some preventive work, particularly in improving water supplies, is carried by other budgets, usually the Ministry of Public Works or its equivalent. Data are not available by which to separate these additional sums out but in most of the countries we are concerned with they are likely to be tiny, even negligible.

Treated as orders of magnitude, therefore, the figures in Table 2 show two

TABLE 2

Health expenditure per head in 1967 and 1987, for selected countries (in £ sterling)

Country	*1967*	*1987*	*Assumed rate of growth of income per head*
Tanzania	0.4	0.6	2.0
Kenya	1.0	1.6	3.0
Uganda	1.0	1.2	2.0
Ghana	1.1	2.0	1.5
Ivory Coast	1.8	5.1	6.0
Tunisia	2.0	2.1	2.5
Zambia	2.8	4.6	4.5
United Arab Republic	1.2	2.5	4.0
Lebanon	1.2	4.1	1.5
Indonesia	0.1	0.9	2.0
Thailand	0.6	3.6	6.0
Ceylon	1.2	1.5	2.0
West Malaysia	1.4	4.3	4.0
South Korea	1.8	3.3	6.0
Honduras	1.0	2.1	2.0
Colombia	1.4	3.5	2.0
Chile	5.5	7.9	3.5

Sources: as Table 1. Growth rates from *World Tables* (International Bank for Reconstruction and Development).

important features. First, there is already great variation in the amounts spent per head and this variation is likely to increase over time. This suggests that from the point of view of this symposium a pluralistic approach is essential. It is unlikely to be helpful to think about one strategy or one set of goals for all poor countries. I shall return to this theme in the last paragraphs of this chapter.

Second, even over the fairly long timespan presented in Table 2, some of the poorest countries will still be exceedingly poor. By 1987, Tanzania will be spending little more than Kenya is now spending on health. And Indonesia, with a prospective population of around 230 million by the end of the century, will be spending less per head than Kenya is now spending.

Is there any prospect that governments will switch resources from other uses—such as education or defence—to health? Inspection of the data in Table 1 reveals wide variations in this respect. Allocative decisions are based on political priorities and unless one expects the development of a much greater political demand for health services, *at the expense of other forms of consumption*, there is no compelling reason to foresee allocative shifts that will make much impression on the orders of magnitude revealed in Table 2. Cer-

tainly it would be a mistake to make any long-run plans on the assumption that there will be such shifts.

However, it would also be a mistake to assume that the figures presented in Table 2 account for all of the resources actually or potentially available. They do not, for the most part, include expenditures by local authorities (usually small) or by missions (in Africa, very significant: in Cameroon nearly half of all hospital beds are provided by missions). More important, they do not include private expenditures on health care, and it is on this element that I wish to focus attention.

There are two elements involved. The first is the sums spent by the élite to secure a superior service. Obviously, how significant these expenditures are depends upon the size and wealth of the élite. They are doubtless more significant in the Philippines than in Sri Lanka, in Malaysia than Tanzania. From our point of view they represent a financial resource—an ability to pay—that must be mobilized for the community as a whole.

The second element is more complex. We know that in most poor countries a traditional healing sector coexists with Western medicine and that this traditional sector is capable of mobilizing significant resources. How can those resources be made available for the purchase of a more scientific system of care? This is not the place to go into the sociology and anthropology of medicine, but work such as that of Marriott[7] and Bennett[1] has emphasized that the cultural adaptation of Western medicine has far to go before it can command the same loyalty as traditional medicine. But, in many cultures, part of that process of cultural adaptation consists precisely in allowing the patient and his family to relate to the healer through a cash relationship. Where this is true and is an important element of the social psychology of healing, it is perverse to deprive the patient of a customary element of the healing environment by inflicting on him Western notions of philanthropy.

At this point two objections will be raised. The first is that this applies only to curative medicine. Peasants will pay to be cured—if they are convinced of the efficacy of the cure and if the social context of the cure is acceptable—but they will not pay to be protected from disease. This may well be true, though I suspect that there are already large areas of the poor countries in which acceptance of preventive medicine is growing faster than such an argument allows. Further, prevention and cure are not as separate or discrete as the objection suggests. But the point can be easily met by simple cross-subsidization—that is, curative medicine paid for at a price higher than its real cost can be used to subsidize preventive medicine. The man who pays handsomely for half a dozen sulpha tablets is providing smallpox vaccine for three or four children.

A second objection is that any fee-paying system is inevitably regressive in

its distribution—the rich can pay but the poor cannot: the rich are cured but the poor are left to die. Even if we leave aside the evidence to the contrary that is provided by the example of education (where the extended family helps to minimize the social selectivity of a fee-paying system), we find that a perverse distributional impact depends on an absolute level of charges. It can be minimized (though perhaps never removed entirely) by a relative scale of charges that fixes the absolute fee in accordance with the ability to pay. If it is said that this cannot be done in a simple rural community, the evidence of local taxation in Uganda suggests the opposite.

But what sums can be made available in this way? The World Health Organization's *Fourth Report on the World Health Situation*[9] gave some figures, gleaned it seems from macro-economic data and the reports of the Ministries. There are reasons for believing that these much under-represent the total flow of financial resources going to health, defined broadly.

Although they are extremely difficult to record systematically—since survey respondents are often loth to admit these expenditures—there is evidence that, in some countries at least, these private expenditures are several times greater than government expenditures. In Sri Lanka[4] the government spends £1.2 per head per annum. Individuals spend on average £4.6, varying between £0.50 for the poorest groups and £5.4 for the richest. In Tunisia, one estimate[6] puts private expenditures at over three times those of government, while relatively modestly paid workers in Dar es Salaam spent four times as much on medical care as did the government.[5] There is statistical evidence of the same pattern from Zambia, Uganda and Ghana in Africa and reports of it from India and Thailand. We may assume, then, that it is common if not universal in Asia and Africa.

I must emphasize again that the mobilization of private funds for medical care depends upon the health system delivering care effectively and acceptably. There is little doubt that many hospitals and clinics in the developing countries would meet immense resistance to charges at the moment. This resistance is not evidence of reluctance to pay—since we know that many people do pay substantial sums—but of reluctance to pay for what they are getting (or think they are getting) from the existing health system.

Even more important than the mobilization of private financial resources, however, is the mobilization of what we can unbeautifully call 'the resources of participation'. If we are right in believing that the old cosmology, in which death and disease were accepted as the inevitable lot of mankind, is increasingly rejected in favour of the hopeful belief that health is possible (and obviously the speed of that rejection varies greatly from social group to social group), then we can expect the development of an increasingly active desire for the sources

of health. To argue from analogy, the political demand for education has become intense in nearly all poor countries. In some that demand has been, as it were, energized by encouraging parents to provide their own schools. One of the best known examples of this has been the 'Harambee' school movement in Kenya, but 'self-help' schools of one kind and another have become a common feature of the educational landscape in many countries.

The proposition is that, if Western medicine were made more culturally adapted and thereby made to fulfil more of the *social* functions of the traditional healing system, equivalent resources of participation could be made available—with immense benefit to the total impact of medical care. Precisely what resources are likely to be so mobilized? Building and maintenance, simple furnishing, at least the subsistence income of health personnel and services such as cleaning, gardening and the production of food—these are all provided in at least some schools in which the participation of parents and the community at large has been encouraged.

It would be misleading to pretend that no problems surround their provision or that it is easily encouraged. The point is that the woefully slender resources of governments can be greatly extended if people really want the services in question. To that extent, it is probably true that it is easier to mobilize these services for curative rather than preventive installations—people will help to build a clinic more readily than a sewer. That may be distressing to those who wish to abandon curative work and put exclusive emphasis on prevention. But those who see the possibility of using a modest curative base as a *point d'appui* for a less modest preventive programme will be glad, at least, to have the possibility of a base from which to work.

I must now move to the third task: can the cost of a service be reduced? This innocent question bristles with problems, one of the most important of which is that, despite a growing volume of work under way, we still know very little about the level and structure of costs in the health sector. It is becoming fashionable to talk of 'minimum health care'. That phrase, by itself, means nothing. Minima are not static: they are culturally defined and therefore vary from group to group within any one society. Minimum care for a rural peasant is not the same as the (subjectively defined) minimum care for a bank president in the metropolis. And if we try to define minimum care objectively, we have to be aware of the political resistance the imposition of such a definition is likely to engender.

A further difficulty stems from the effect of population density on delivery costs. As population density declines, the cost of delivery of a specific service rises. In the past this has skewed the distribution of health against the rural

dwellers and in an equitable system it implies sharply rising costs per head for delivery to the most impoverished section of the community.

Now let us pull together four facets of the discussion so far.

(1) To supplement the resources of government, private cash resources and the resources of participation must be mobilized.

(2) These are unevenly spread through the community.

(3) There is a political demand for super-minimal standards everywhere but that demand is roughly correlated to income.

(4) Costs rise (probably exponentially) as density of population falls.

If the object is to design as equitable a system as possible, these four facts plus some obvious but implicit assumptions suggest the following strategy.

Step 1. Protect the entire population from major communicable diseases.

Step 2. In the poorest countries, spend the remaining public resources on environmental and sanitary improvement in those areas where low density makes participation impossible. In the less poor, cover the same population with the simplest mother and child care.

Step 3. Set up, under state patronage, simple maternity and curative units in the urban areas and run them as a commercial enterprise, designed to maximize profits.

Step 4. Use the profits to trigger participation in lower-income urban and more advanced rural areas. Charge for the services of curative units built and run by local efforts on an 'ability to pay' criterion. Aim to cover costs.

I am aware that there are many pitfalls in this approach—and there may be many that I have not spotted. Some will object that an urban curative service will distort the distribution of skills and training. Some will point out that starting with preventive medicine will make the resources of participation more difficult to mobilize rather than less difficult. Some will say that this produces an inequitable distribution since the provision of services is still skewed towards the rich. All these objections may well be at least partially true. I put forward the strategy as one which, *within known political constraints*, is more redistributive than any system I know (without being perfectly so) and one which guarantees to every member of the community protection against the major communicable diseases.

Are there countries where even the first step is impossible within existing public resources? There may well be: namely, those that are exceedingly poor and sparsely populated. These would probably include many countries in Central Africa (though not Zambia or Zaïre), Bangladesh, perhaps Indonesia (especially outside Java) and perhaps Bolivia and Paraguay. This suggests that these countries will need sustained international assistance, but that

assistance will have to be carefully designed to prevent it diverting what resources there are from Steps 1 and 2 to Step 3.

The more immediate task is to make clear that the great majority of countries can already take Step 1, and Step 2, and that these will have a major effect on national morbidity. Indeed there are some historical reasons for thinking that Steps 1 and 2 will have more effect on national morbidity than a great extension of existing curative services. If that is so, the political fight implicit in Steps 3 and 4 will be well worth undertaking.

Discussion

Llewelyn-Davies: It is an extremely important question whether the proportion of the national investment cake—that is, of the income per head—which goes towards health in the broad sense is as fixed as the statistics indicate. I want to suggest that this will not necessarily be so in the future. Development in poorer countries has so far been a function of urbanization and of investment policies in urban areas. These policies have tended to be dictated by certain kinds of decision. When sophisticated decisions were made by international agencies they were often based on cost–benefit analysis applied to particular projects like electricity plants or highways. The investment appeared to be justified, in terms of the cost–benefit analysis of the particular project. What was omitted from the calculations was the total effect on the economy of the society of these heavy investments, very often made according to Western European standards. For instance, electricity plants have been installed with peak load safety factors equivalent to those required in developed countries, and highways built according to projections based on the Western car market. The mere fact that such expenditure was unjustified at the time, although true, is less important than the marked suction effect which this kind of investment inflicted on the national economy—a suction of resources away from social needs, such as health care. But there is a chance that this trend can be influenced into taking other directions in the future, because urbanization, which is the key process in development, is still at an early stage in many countries.

I have been involved in looking at cost and level-of-service comparisons between investments in health, education, transportation and housing in Colombia. These show that if the characteristic model of, for instance, road construction and electricity development is allowed to operate it will simply draw all the economic gain away from the other areas. But it is conceivable

that so long as the élite is taken care of (and Charles Elliott rightly stressed this) one could divert this pattern into one which permitted an increasing share of the cake to go to health. In addition, the trade-off between different kinds of investment in health, over the whole spectrum of health, in terms of service against cost, has not been very much looked at, and should be.

Tewari: This uniform pattern in the allocation of resources to health makes one wonder whether there is any point in struggling to obtain a larger bit of the cake for health, partly for the reason that it is difficult to change established practices, and partly because we may not be able to do so without damaging other prerequisites for good health. Our experience in India has been that by trying to do so, we deprive other critical sectors. Our Constitution has adopted the right of universal primary education for every child, and over the last 25 years we have not been able to achieve this. The point is being made that if we give more money to health we have to deprive some children of the right to be educated, and if a considerable proportion of the younger generation remains illiterate, are we getting the best from what we are prepared to invest, or from the additional inputs that we might think necessary in the interests of better standards of health? It has been claimed that the Education Act of the UK in 1870, and the steps towards universal primary education in Japan, contributed more to the economic development of these countries than the inputs into industrial development itself. These questions are relevant to the allocation of resources for health as well.

Evang: Dr Elliott said that expenditures for the public sector in health gave roughly £1.76 per £100 increase in income, as an *average* figure, but even among the well-developed countries the relationship between public money spent on health services and the amount of private money spent on health varies widely—compare Belgium and the UK, for example, or Italy and Sweden. To what extent does the average figure give a true picture for the underdeveloped countries, and has it been related to the percentages in the various countries?

C. Elliott: This is an average figure based on a regression between public expenditure on health, and income. The correlation coefficient is highly significant, statistically, at the 0.001 level. It was not possible to correct for variations in the degree to which the state accepts responsibility for health care, but we were able to exclude countries like the Philippines which have basically a private medical insurance system. So nearly all the countries in the sample (see Table 1, p. 4) were those in which the government accepts a basic obligation to provide a health service from public revenue.

On the question of how realistic it is to try to get a bigger share of the cake for health and para-health services, the sums are unfortunately so small, in relation to the total demands upon them, that it makes very little difference if

the Health Ministry manages to increase its share of the cake by 5, 10 or even 20%. A 20% increase might increase expenditure from £2 per head to £2.40 a head, but this is still a very small sum. In other words, the magnitudes are not very sensitive to shifts in allocation and it is therefore not right to imagine that some political trick can divert resources from wasteful electricity schemes, or overgrown educational programmes, to health, and make a substantial difference to the total resources available. The situation is not very sensitive to the sort of marginal changes that are politically feasible. I think these countries are stuck with the order of magnitude that I mentioned.

Evang: You raised the interesting question of whether alternative resources could be mobilized by making use of the willingness of the élite to buy the more expensive type of health service in developing countries. A solution along these lines has been applied in many economically developed countries already, by including the élite together with the rest of the population in a prepaid medical programme and basing the premium for health services on the taxation principle rather than on the insurance principle. The élite therefore pay more than the cost of their own services. If this were combined with a system by which the medical care programme provides not only curative medical care but also preventive medicine and rehabilitative services, one would in principle have solved the problem. However, this is clearly not applicable to poor countries, because the élite is so small that it cannot pay enough to finance the whole service. Secondly, if this principle is adopted, one accepts the obligation that the publicly organized health services will provide the quality of care which the élite asks for. If not, they will find some other way of getting it. Therefore, you have to establish a very expensive level of care, far beyond what a majority of countries in the world can afford at present.

C. Elliott: But one would not expect to be able to finance the *whole* of the medical service from the surplus earned by the service designed for the rich. The trick is to transfer the consumer (and producer) surplus from the rich to the poor. It can then be increased by taxation revenues in the normal way.

Wiener: Capital is not the only resource in short supply. There is acute scarcity of an equally decisive component, namely management talent. Many projects that are appropriately funded fail because they are not properly managed. To overcome this deficiency, we have to catalyse the growth of management capability in the local group in connection with its own health concerns. A further requirement that has been shown to be important, particularly in connection with housing projects, is the necessity of mobilizing local involvement in the conception and execution of schemes. A project in which the local group is involved has a better chance of success than one which is 'spoonfed' to that group. More concretely, when we are considering rural

areas, the common denominator is that such areas have too low an income, because their productivity is too low. We shall do little good if we expect the humanitarian philosophy of fighting poverty to provide the rationale for rural development programmes in the underdeveloped world. To be successful, programmes ought to be based on the economic motivation of the producer. This is perhaps the only motivation on which one can safely build, at least in the Western world. I believe that what has been said against economic motivation operating in the same way in underdeveloped as in developed countries has been proved wrong over the last 20 years. I refer you here to the work of Schultz.[8]

A further precondition of rural development is the setting up of cooperative or similar organizations at the village level. I think we should use this rural organizational infrastructure as a basis on which to build the additional superstructure necessary to provide health services. Here again, mobilization of participation by the rural population should be an integral part of the project design. My feeling is that the primary development campaign should be aimed at productivity and income increase, and that the organizational framework required for this campaign should be used as the foundation upon which the additional institutional features should be built for the provision of the four basic health needs. At the rural level we simply cannot afford two or three organizational systems.

Tewari: In principle, community participation is to be welcomed, but in practice the decentralization of planning presents immense problems, such as the availability of the required competence, and the capacity of the lower levels to project thinking and planning in the direction and to the extent necessary. I imagine that most developing countries, like India, have too little administrative, managerial competence to be able to delegate planning to the levels at which more decentralized development could be expected to take place. I agree that it is necessary to have community participation; but local people should be involved in *planning* too, and are enough competent people available at those levels?

The idea of community participation, and of drawing on private resources to finance health is, however, in conflict with the public declarations of a right to free health services which the newer democracies consider it an article of faith to promise their people. These pronouncements create difficulties for programmes which depend upon making use of private expenditure, which is of a substantial order, as Dr Elliott said. Surveys in India show that even a population containing more than 200 million people below the subsistence level is still spending 2–3 % of its income on buying medical aid, mostly through the traditional methods. In the face of political pronouncements on the right

to free health services it becomes difficult to draw those resources into the public exchequer, where they could supplement public funds being spent on health services. It is difficult to tell political leaders that the public resources do not exist and that it is necessary to train people to contribute towards medical aid and not to expect it to be completely free.

This has to be viewed in the context of the type of medical care and the way it is obtained through traditional channels. In many countries not only are conflicts growing up between the so-called modern system of medicine and the traditional system, but there is the curious phenomenon of parallel systems of medical care being constructed as a result of people's demands to continue to use traditional systems of medical care. In the context of scarce resources this is a wasteful situation, and finding the means to reconcile or amalgamate existing systems is one of the major problems of developing countries. It is accentuated by the way in which health services have been structured, mostly by the transfer of patterns of Western medicine as practised in Western environments to communities which are socially and culturally differently organized. The adaptation of modern medical practice to these situations, particularly adaptation of the institutional set-up, has not taken place to the necessary extent. Research is required into the methods of delivery of health services, if the economic factors are to be adequately contended with.

One feature of this wholesale transfer has been the dependence on fully trained health professionals in situations where they are so scarce, and the unbalanced health teams which have grown up. Countries have been trying to use the fully trained nurse or doctor in situations where they see them used elsewhere but which are not economically feasible. The appropriate kind of teamwork, and the adjustments and balances that can be worked out, require much study. The delegation of health activities to technical personnel at lower levels, and the desirability of integrating traditional practitioners into health teams, are only two of the problems incidental to this question of planning.

Llewelyn-Davies: I am fascinated to learn that such large sums are being spent in the private sector, with the poorer people buying quasi-health services in the private market. One wonders how this money can be mobilized. Secondly, I am struck by the analogy that the private sector in transport has created in many developing countries a standard of transportation for the poor which is far ahead of what is available to them in developed countries, operating through a rather crude form of private market which no public transport system would ever offer. Can you see a way to do this for health care through the market, Dr Elliott, or is the intrinsic nature of health care delivery such that resources have to be mobilized by moving out of the market into a collective form of utilization?

C. Elliott: I am struck by your analogy with, for instance, the Mammy wagons of Ghana and Nigeria. I suppose the traditional healer is, in embryo, the health analogue of the Mammy wagon. But the need is to attach to the enterprise, energy and community links of the private operator some elements (not the whole package) of modern technology. They are, after all, Mammy *wagons*, not horses and carts. A number of experiments are going on, the most glamorous being the 'barefoot' doctor in China. A less special case is in Tanzania, with the registration, unionization and education of traditional healers. This is an immensely complex problem and rapidly becomes an emotional issue between practitioners of Western medicine and the champions of the traditional healers, but it is something worth looking at closely. Can one find a way of better integrating the traditional healing sector, which certainly in Africa is much bigger than we thought, into a total health delivery system? That is one possible way of short-circuiting the operation. Another way, which again is very complex and contentious, concerns the social function of the traditional healing sector—for instance, the relationship between the patient and the doctor, or the relationship between the doctor or the health worker and the patient's family. How rapidly can we de-culturalize Western medicine and re-culturalize it in another cultural setting in a way that would make possible the kind of cash relationship that exists between the traditional healer, and his patient and his family? I have no immediate answer on this, but these are issues that we have to take more seriously than we have done.

On the second question—the extent to which health is necessarily delivered collectively—one needs to be level-specific. Obviously at a simple level of curative health care, a 'market' relationship is possible and perhaps desirable. Problems arise, I suspect, when one comes to preventive medicine, and that, after all, should be the main emphasis of any programme. There collective organization is inevitable and, since group pressure is helpful in persuading recalcitrants to take the necessary measures, highly beneficial.

Evang: As far as this other resource goes, namely the money being spent by poor people for traditional medical services, the élite and the poor illiterate man or woman in the village have one basic feature in common: they are not willing to give up anything they have achieved. There is therefore no question of people in poor parts of the world changing from paying the traditional healer and transferring this money to other things. It would be almost impossible to change that practice.

It would be interesting to know the numbers of traditional healers. In India I was told in the 1950s that the combined Moslem and Hindu traditional services provided approximately one healer per 1000 individuals in the country, and in China in 1960 they thought they had about one traditional healer per

1000. This is an interesting coincidence and perhaps says something about the quantity—the 'maturation point'—of such personnel.

Tewari: There are three traditional healers for one doctor trained in modern medicine in India at present, or say an average of three or four per thousand people.

King: I am delighted to see the emphasis laid by Dr Elliott on the traditional sector in medicine and on the need to study the equilibrium between orthodox and traditional providers of primary care. One of our most urgent priorities should be to experiment in seeing how we can improve the care that traditional healers provide. He also rightly said that we should look at why the traditional sector is often so popular, and try to see if we can incorporate some of the secrets of its popularity into orthodox medicine.

Querido: We have discussed the re-allocation of resources to health and the alternatives of getting over to governments what one really wants to do. I have had some experience of this, and it appeared that talking in terms of Gross National Product is often ineffective. Recently I was able to get something across by talking about the training of personnel rather than about GNP. One can then say that the government is responsible for the educational cost of the personnel, and if they have defined the objectives of their education well, the next problem is how to acquire funds to make trained personnel productive. This can be done either by the community or by a local type of insurance system. The interesting point is that this seems to be the beauty of the approach in the Chinese situation: that in fact the 'barefoot' doctor does not cost anything, because he is not a civil servant who needs part of the GNP, but is simply a worker in the community.

C. Elliott: The idea that one can greatly reduce costs by using personnel in a sense part-time—the other part of their time being used for their own support—is immensely attractive, but it depends on a fundamental political change which has been successful in China but which other countries have not managed to bring off. At the moment, the general position is that anyone who works in the public sector regards that as a claim to a lifetime's earnings. To suggest, in most of the countries with which I am familiar, that medical or para-medical personnel should support themselves *and* practise their particular technique would be politically difficult. If one could overcome that whole range of professional and personal convictions and aspirations, this could be an effective way of using manpower and saving costs. But it depends upon a fundamental political change that for most countries does not seem immediately possible.

Evang: This meeting is concerned with the problem of establishing and implementing certain basic human rights to health. The consensus referred to in the Introduction is, as we can see, not enough to establish a human right.

The consensus may result in a declaration in law, but even in a rich population the legal definition of a right does not produce the desired result.

It is interesting to make a comparison with other service sectors with which the health services have to compete economically. The two major areas are communications, including roads, television, airports and so on; and educational services, in the widest sense of the term. In many richer countries one of these sectors differs from the other two as far as the definition of rights is concerned, namely education. Not only is there a consensus that everyone should have the right to education, and not only is this defined legally, but it is frequently a punishable offence not to comply. In many countries a parent who does not send his child to an elementary school at the given age can be punished. Secondly—and this is more relevant to the situation in the health services—a person who has not received the education to which he is entitled under the law has a right to compensation. We must take this point into consideration as we discuss the question of human rights in health.

Victoria Garcia: When we speak about the rights of the individual we should also think about how to build up the responsibility needed to exercise these rights. Every right has a counterpart: the obligation to know, for example, how and when to use the medical facilities available; how to take care of them, avoiding wastage; how not to pollute our environment; how to have respect for others. I am aware how difficult it is to build up new values related to health in adults. That is why we have to consider our responsibility as professionals, and the responsibilities of the teaching staff in the school system or of the leaders within community organizations, to inform people about their rights but at the same time to teach them to be responsible.

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Water supply in developing countries

B. H. DIETERICH

This chapter reviews the ways in which people in the developing countries are supplied with water. It also tries to indicate the kind of change required before safe drinking water can be made available, gradually, to large numbers of people who are not only deprived of good and easy water services today but whose total environment reflects the conditions typical of underdevelopment: namely, the absence of environmental sanitation (of which water supply is but one essential element), poor housing, poverty and high levels of endemic diseases. The issue of water supply cannot be separated from the task of protecting the environment, a task which has become synonymous with the need to assure the human right to a higher quality of life.

Indeed, the word 'environment' has become a powerful expression for the concern people feel about conditions in their surroundings. Many people associate it with the pollution created by industries: with smog, noise, polluted beaches, radioactivity and pesticides. These are environmental problems in countries where large metropolitan and industrial complexes have been built for the enjoyment of a better life, and where high consumption levels have been accompanied by high levels of waste.

Industrial development certainly has much to answer for, but we should not forget that industrial pollution is only one part of a vast problem. To most of the world's population, the threat of the environment shows an entirely different aspect.

This has been vividly demonstrated recently by the resurgence of an old—and, in the developed countries, forgotten—disease, cholera, which is transmitted from man to man by a polluted environment—polluted not by industrial effluents but by human waste and unprotected water supplies. Hundreds of millions of people fall victim every year to a wide variety of communicable diseases in places where the biological pollution from community wastes is

allowed to reach drinking water sources. These diseases originate in a particular environment which also helps their spread, but they can be prevented by efficient environmental control and maintenance of community sanitation.

WHAT DO STATISTICS TELL US?

Reliable statistics from the developing countries are hard to come by. The only existing information on a global basis is from two surveys made by the World Health Organization, the first on urban water supply conditions and needs in 75 developing countries, which refers to the situation in 1962. This was published in 1963 as a WHO *Public Health Paper*.[5] The second survey was on urban and rural water supply and on urban and rural excreta disposal in 92 and 61 developing countries respectively. This survey describes the situation in 1970 and was concluded in 1972.*[8] In 1970 the plain fact was that 71% of the population of the developing countries included in the survey did not have what we would call a water supply, whether on the premises or within reasonable walking distance. In the cities and towns 50% had water supplied to their premises and 19% could walk and fetch the water. In the villages, however, a full 86% did not have access to safe water and this percentage represents more than a thousand million people.

DEFINITIONS

Before going any further with information from these surveys, I shall explain the meanings attached in these surveys to certain words.

First, 'urban' and 'rural': in the 1970 survey we simply let the countries' own definitions of urban and rural stand. The United Nations Population Division in New York found that no other arbitrary global criterion served the purpose any better.

Second, a 'piped supply' is a community public piped supply. 'Reasonable access' is (for rural areas) where a woman does not have to spend a disproportionate part of the day in fetching the water required for the family. 'Safe water' is water that is either naturally uncontaminated, such as ground water or spring water, or water that has been treated and chlorinated. Surface sources and open dug wells are not considered as safe water for this purpose, whereas well-protected tube-well water, even though it is not chlorinated, can usually be considered as safe water.

* Since this symposium was held, the results of the WHO 1971-1972 survey have been under further review. The data given in this paper represent the information available in mid-1973, subject to revision.

HOW MANY PEOPLE ARE INVOLVED?

The world population in 1970 was 3672 million. The 92 countries which were studied for community water supply in 1970 had a population among them of 1729 million, which is nearly half of the total world population but does not include China. By 1980 the world population is expected to increase by 23%, whereas the population in the 92 countries is expected to increase by about 32%.

We should note that population growth is not the same even among the developing countries in different parts of the world. In the Americas the urban growth rate in the developing countries is expected to be 51% for this decade, whereas in Africa it is expected to be as high as 72%. The rural growth rate in the decade is again minimal in the Americas, whereas it is at its maximum in the Eastern Mediterranean region, namely 28%.

NEED FOR SERVICES

Of the total population in the 92 developing countries surveyed, fully 71%, or 1228 million people, are without water supply services. Thirty-one % of the population in the cities and towns, or 149 million people, have no water supply; in the villages and rural areas, 1079 million people, or 86% of the total rural population, need reasonable access to safe water. The greatest need is in the South-East Asia region, followed closely by the African region. In terms of numbers, people without water supply in South-East Asia exceed the sum of the people without services in all the other regions of the world combined. South-East Asia has 707 million people without safe water supplies. Of these, 632 million live in the rural areas and 75 million in the urban sector. In all the other regions combined, the number of people without reliable water services is 521 million.

WATER QUALITY

The quality of drinking water is an essential part of the problem we are dealing with in this chapter. Increased quantity alone cannot meet the need for improved environmental sanitation. The water used by people, anywhere in the world, must meet certain minimum hygiene requirements.

The latest (third) edition of the WHO *International Standards for Drinking-Water*, published in 1971,[6] gives standards *(i)* for toxic substances such as

arsenic, cadmium, cyanide, lead, mercury and selenium, and *(ii)* for substances such as nitrates and fluorides. However, for the developing countries the most important part of the Standards is that related to the bacteriological quality of water, because biological pollution is ubiquitous. Here the Standards are not as rigid as is imagined in some quarters: for chlorinated supplies, no coliform bacteria should be present in any 100-millilitre sample of water entering the distribution system; for non-disinfected supplies, there should be no faecal *Escherichia coli* in 100 millilitres, and up to three coliforms in 100 millilitres may be tolerated occasionally; and for small rural supplies (individual wells, borewells, springs) less than 10 coliforms are allowed per 100 millilitres of sample.

During the 1972 survey carried out by WHO, 80 countries responded specifically to questions related to drinking water control. For these countries, in 1971, the public health authority was the agency responsible for quality control. Twenty-three countries had adapted WHO standards to suit their needs; 15 had adopted them *in toto*. Six countries had national standards prepared before the WHO standards, and eight countries had other standards—in all, 52 countries. There were 36 countries without any drinking water standards.

The extent and frequency of bacteriological examination varies. As could be expected, more urban water supplies were examined and more regularly, than rural water supplies. There has been occasional examination of some rural water supplies.

It will be seen that more countries have adapted WHO standards to suit their needs than have adopted them *in toto*. The WHO Standards for drinking water have legal status only insofar as international health regulations are concerned—that is, in relation to water quality at ports. Otherwise, the Standards are purely recommendatory.

It is sometimes said that perhaps one of the reasons for the slow progress in supplying more people with satisfactory water supplies is the high standards set by WHO for the quality of drinking water. This is not so. In fact, measures to control water quality are relatively inexpensive if the system is designed, built and maintained according to sanitary practice. Also, as I have said, the Standards published by WHO are recommendations and do not need to be applied rigidly; they can be adapted according to the circumstances. Some of the recommendations made with regard to aesthetic and chemical properties may be adapted, but recommendations on the bacteriological quality of drinking water need more stringent application. This, however, is usually possible without excessive cost.

WHAT SHOULD BE ACCOMPLISHED

In keeping with the principle that all people should enjoy the highest possible standards of health as one of the fundamental rights of every human being, there is no question but that safe and adequate drinking water should be available for every person in every country of the world. The only question is how this goal can be achieved under the well-known financial, infrastructural, logistic and political constraints existing in most developing countries. A practical approach to this end is to proceed by gradually increasing water services to people as quickly as possible within the limits of what is possible. Obviously many factors need to be considered here. There is no universal answer to the question of what can be accomplished within a given time. Much has been learned, however, in a number of countries, particularly in Latin America, where governments have taken a bold approach to the problem, demonstrating that much more can be done than is usually believed, if only there is determination, commitment, participation by the people and flexibility in the planning and management of actual systems. Some of these factors are discussed in more detail later.

A useful tool in planning programmes has been intermediate targets for specific periods of time. For instance, under the Charter of Punta del Este the Latin American countries established targets in 1961 for a number of sectors of activity in health. Among these was a target of providing 70% of the urban population with adequate water services by the end of the first decade, by 1970, and giving 50% of the rural population an adequate service of water. While the urban water supply targets were achieved, the rural ones were not.

For the Second UN Development Decade, targets were recommended by the World Health Assembly by which 60% of the world's urban population would be provided with piped water on the premises and 40% with piped water through public standposts within reasonable distance. If these objectives were implemented they would benefit mainly the poorer segment of the urban population without water supplies, rather than the residential areas and commercial areas of the cities. In the rural sector, it was recommended that the number of people having reasonable access to safe water should be doubled, so that 25% of the rural population would be served in 1980. Similar but higher targets have been adopted in the meeting of Ministers of Health at Santiago de Chile for the Latin American countries for the Second Development Decade. The experience of Latin America shows that the setting of targets has its value, but must be accompanied by other very necessary elements for getting programmes established and under way. Otherwise, targets can be self-defeating.

Whatever percentages or numbers may say, the essential purpose of in-

vesting more in water supplies is to reduce or prevent the risk of people being exposed to disease because of the absence of safe water and the prevalence of insanitary conditions. The main emphasis needs to be on the peripheral areas of cities and towns where people have massed together and where an infrastructure for sanitation is not usually available. These are the areas of highest risk, followed by the clustered rural conglomerates that are rapidly growing in many developing countries. Epidemiological investigations and surveys are essential tools in deciding where water supplies are most urgently needed, but the overriding factor should be human well-being and the right of the human being to a decent water supply which will not only protect him against health risks but also provide rudimentary amenities.

THE RATE OF PROGRESS NEEDED

The plain fact is that the present rate of progress in community water supply is inadequate. For instance, in 1970 additional water services were made available to 36 million people, but the rate of growth of the population was higher. In financial terms, it is estimated that some US $900 million were invested in water supplies in 1970, but to close the gap and reach the targets discussed the investment must be a little over US $1400 million per year.

In urban water supply, the annual rate of progress must be increased by 84% over the progress made in 1970. In rural water supply an increase of 113% is needed, which corresponds to an investment increase of 104% (that is, an increase from the present annual rate of investment of US $157 million to US $320 million)—an investment which does not seem impossible. Roughly, one might say that the number of people to be served per year should be increased at double the rate achieved in 1970—that is, at a rate of about 67 million people a year!

CRITICAL PROBLEMS

A number of critical problems need to be resolved before progress can be substantially increased:

(1) *Costs of construction per head.* We need to reduce the cost per head of providing these supplies through better engineering adapted to local situations, greater participation by the population, and better organization. The present average world cost for urban water supplies on the premises is US $35 per head; for urban water supplies with public standposts, US $11 per head; and for rural water supplies, US $10 per head. Of course, these are global averages, and vary somewhat from region to region.

(2) *The cost of water.* Much has been said about who should pay for water. Gilbert White maintains that one must recognize domestic water as a human right rather than an economic good, and that this encourages a significant revision of the health definition of what constitutes potable water and induces new efforts to provide technology at minimum cost (see pp. 35-51 of this volume). This concept is not challenged; however, experience shows that unless people are willing to contribute to the cost of water, either in cash or in kind, these supplies fail to be maintained properly, and that the main problem seems to be to adapt the programme to make use of these resources. In practical terms what one would like to see is that the people actually pay at least the operation and maintenance costs of their supply, in order to avoid deterioration of the systems once they have been introduced.

As far as the willingness of people to pay for water goes, much can be learned by looking at people's private expenditure when they have to buy water from water vendors in areas where no other water supply is available. The amount of money paid under these circumstances is many times what people would need to pay to a public or communal water service, which would provide them not only with water at any time of the day in much larger quantities for the same amount of money, but also with water of a much superior quality.

(3) *Manpower resources.* If even modest programmes are to be carried out in most countries, as many as 44 000 professionals, and well over 2 000 000 sub-professionals, have to be trained. If the countries were to increase the tempo of progress in order to meet the targets discussed above, proportionately more people would require training. Shortage of manpower is the second most important constraint hampering progress today. The most important one is the inadequacy of internal financing.

(4) *Internal resources.* The lack of internal finance heads the list of constraints on progress in most countries where the rate of development of community water supply is insufficient. One estimate was that a phased investment programme for water supply would require about one quarter of 1% of the Gross National Product in an average developing country, which investment would seem to be entirely feasible, in view of the likely benefit. But international financing also may be improved if the financing of water supplies be made part not only of health programmes but of other public programmes, such as rural development or agricultural programmes, within which the provision of water supply should in any case be an essential component. Much may be gained by making water supply development an integral part of development programmes which aim at raising production in the developing countries. Usually these development programmes aim, among other things, at the redistribution of income, which is also a fundamental objective when

water systems are laid on for the poorer stratum of the population who are usually unable to pay for water themselves, but rather depend on water supplies being financed by some method of tapping the financial resources of the better-off part of the population.

(5) *Lower consumption figures used in designing facilities.* In projects which are financed and executed by governments, the present daily water consumption in urban supplies ranges from 90 to 280 litres per head for house connections and 25 to 60 for public standposts, whereas in the rural areas the present consumption range is from 35 to 90 litres per head per day. In future designs these consumption figures are intended to increase: urban supplies will be 150 to 300 litres per head for house connections and 40 to 70 litres for public standposts; but it is proposed to increase rural supplies to a range of 60 to 110 litres per head per day. It can be asked how the consumption figures per head used in designing facilities influence the feasibility of introducing new water supplies at a higher rate than in the past.

Another method of lowering the cost of water supplies would be by developing what might be called 'the quality of service' in a step-by-step manner; that is, to provide water first, if necessary, through public fountains rather than on the premises and to begin to lay on water to a single tap on the premises only gradually and in cases where the necessary funds can be found. This would then gradually lead to the introduction of multiple taps and ultimately to unlimited water consumption as the process of development continues and more and more resources can be allocated to a water service of higher quality.

(6) *External assistance.* External financial assistance is an essential prerequisite for an increased pace of construction of water supplies in developing countries. At the present time, the International Bank for Reconstruction and Development (IBRD) (the World Bank), Regional Development Banks, particularly those for America, Asia and Africa, the United Nations Children's Fund (UNICEF), and a number of bilateral assistance programmes, have an interest in water supplies and have made loans and grants available to this end. Obviously these funds can only match local resources which are being put into water supply projects, but their continuing availability is essential. In the past, however, these resources have not always been allocated to regions of the world where demand has been greatest. If we look at the distribution of foreign aid, which was to the tune of US $700 million in the period 1966-1970, half of this amount was given to Latin America (where only a quarter of the people needing better water supplies live), whereas South-East Asia, with half of the people in need of this service, received only 2% of the total assistance. The distribution of external assistance between regions has been extremely

disproportionate to the needs and South-East Asia in particular, with half of the world's needs in one region, is getting practically no external assistance.

An important consideration here is the nature of the criteria usually applied by national and international lending institutions to loans made for water supply projects. These criteria are often too stringent and make these projects uncompetitive with other projects which are seemingly more 'productive'. Much is to be expected in the future if international lending agencies such as the IBRD give more priority to investment benefiting the poorer segment of the population. At the World Bank the poor, who make up 40% of the world's population, are now becoming a target of concern and it can only be hoped that this new emphasis on a population so far neglected will rejuvenate many of the policies and methods used in the past in international cooperation and development.

(7) *Better management.* Along with attention to the development of manpower, use of better management techniques and methods is badly needed. Important lessons have been learned in this respect in the implementation of successful programmes, particularly in the countries of Latin America in the past decade. There great efforts have been made to train national managers in regional training institutions rather than abroad, and to make use of these trained experts, not only in their own countries but also as consultants within the region. This has led to a gradual building up of national expertise tailored to the specific needs of the regions. These experts have become instrumental not only in developing new governmental policies but also in implementing effective programmes.

The review made in this chapter has focused on factual information available from the developing countries and has given some interpretation of needs and of possible ways of remedying the present most unsatisfactory conditions. Although this chapter has not dealt with many of the social issues there is one thought which should not be neglected: environmental sanitation projects, and, foremost among them, water supply projects, may be regarded as a direct attack on poverty, for it is not difficult to see that the poor section of the population benefits the most from them. Low-income groups go without sanitary facilities mainly because of their inability to pay for them. When these are made available to them as part of the overhead social investment they get services they cannot afford themselves. This is why it has been suggested that development goals should be redefined and quantifiable targets fixed not only in respect of income growth, but also in terms of water services provided. This, in effect, would

make income redistribution an objective of policy applied to community sanitation and community water supply, thus providing new encouragement and more human rights to people who otherwise live in squalor and poverty.

Discussion

Cvjetanović: A major problem in promoting water improvement schemes is to obtain exact data on their likely effectiveness. It is difficult to propose to governments that they provide money for a project unless we can tell them the probable result, and health benefits. We have tried to calculate effectiveness, and we have found that it varies with the particular disease, the population, the area and the social situation.

As an example, let us take three diseases spread by contaminated water: dysentery, typhoid and cholera. In dysentery 200 microorganisms are required to infect one person. Typhoid requires 10^4 or 10^5 organisms to infect one person. To transmit cholera, 10^9 organisms at least are needed. This suggests that to prevent cholera one needs to achieve only a fair dilution of the pollution. In a cholera-infested area one may control the infection and achieve health benefits much more easily and much earlier than with the other two diseases. On this assumption we did an experiment in a rural area in the Philippine islands.[7] We provided one village with a simple water supply, a second village with privies and a third with both. Two other villages acted as controls. In the first year the incidence of cholera in the first village fell to about 50%, and in each of the following years it again fell to 50% of the remaining incidence. In the village provided with privies there was a similar pattern of reduction of incidence. In the village provided with both water and privies, in the first year there was little difference from the result in the other two villages, and in the second year likewise, but now, in the fifth year, there is no longer any cholera in that village. So we have achieved eradication there. This pattern would not be valid for typhoid or dysentery, of course; a much higher level of sanitation would be needed to obtain similar results. The cost of these operations was very low, as a result of the cooperation of the local population and authorities; the cost for water supply per family was around $1 and for privies also about $1; for both water and privies it was roughly double. One can ask whether this low cost reflects any real situation. Of course it does not correspond to any likely government scheme: it was planned by the community, without sanitary engineers, using what was available, without sophisticated equipment. All the manpower was provided by the villages, and some material such as sand was

locally available. But in these particular communities with a small investment the control of cholera was achieved. This was a Catholic population with certain traditions and habits; we are repeating the same study in a Moslem community with different habits, since the result may be different. To arrive at the same effect in another community one may have to invest many times as much.

We have also studied world patterns of typhoid.[1] The incidence in most countries, especially developed ones, is falling steadily as a result of improvements in sanitation but it has recently ceased to fall in the USA and the UK, because of imported infection through immigration and tourism. This suggests that funds should be provided by developed countries to be used in developing countries, since it is likely that otherwise there will be no further improvement in typhoid control in developed countries.

White: Dr Dieterich pointed out some of the dangers as well as some of the important merits of setting targets for improvement of water supplies. The Punta del Este targets were cited; they undoubtedly helped to mobilize activity in Latin America that might not otherwise have been organized. I would like to know more about the *form* in which such targets have significance to those making the necessary decisions about the allocation of resources, and how the 'rhetoric' of it affects national administrators and leaders and also local communities. One wonders if the kind of argument provided by Dr Cvjetanović's study of disease incidence in sample villages has convincing rhetoric for administrators at any one of the levels with which we are concerned.

Dieterich: The targets set for 1970 by the Charter of Punta del Este, drawn up ten years earlier, were reached for the urban population but not for the rural areas, where only about half of what was hoped for was achieved. Why? One very obvious point is that these targets were political declarations of intent and were agreed at central levels. They did not necessarily have active support from the villager at that time. I think the main merit of these targets was that in the national plans, for instance, allocations were made to this sector. For the villager it is more important to see and understand the direct health benefit. This is why health education is so important in this respect and I believe that an example like Dr Cvjetanović's would be of real value.

Patrice Jelliffe: This could be true for many rural health programmes: there is failure of implementation, and a waste of money, time and well-intentioned effort, because of a lack of communication with the recipient of the programme. This has been well demonstrated in studies quoted by Foster in his book *Traditional Societies and Technological Change.*[2] Time and again, because of the value system of a culture, complicated behaviour patterns may be evidenced which are totally unexpected and do not fit the conceptualized image of the

Western technocrat. The language barrier of rural societies is not the only one which must be traversed. I feel strongly that one solution is to involve intimately at the inception of a health programme a social scientist who, because of his training, will be less ethnocentric than his technical counterpart, and can bring valuable information and support to the programme.

Dr Cvjetanović's example regarding the disappearance of cholera in the third village was an interesting one. It would have been very informative to note, however, the sociological implications of the introduction of water, of privies, and of both commodities in this village. Could eradication of cholera have occurred sooner? How well were latrines accepted? Did both sexes as well as children use them? Or were they used, for example, as stores for grain by some families? Many rites and taboos exist around elimination functions, and these are useful to know when one is trying to eradicate infectious diseases.

Cvjetanović: In the Philippines the privies were used by most of the people, since they had built them and the population was motivated. In fact we made an anthropological study first and then selected an area with a cooperative population and helpful authorities.

Wiener: As a general comment, I think that our basic approach to problem-solving depends on the knowledge we possess. If we have sufficient data on investment levels and related benefits for alternative social programmes, we can draw what would be equivalent to a production curve in economics. Such a curve would demonstrate the quantitative relationship between costs and achievement of our objectives for alternative measures. This would enable us to select the package with the highest cost–effectiveness, where cost is measured in money and in other scarce resources, such as trained and experienced people, and effectiveness is measured in terms of degrees of achievement of objectives—for example, various degrees of prevention of an endemic disease. If we do not have sufficient data to draw such production curves, and we rarely have, we are forced to work with arbitrarily selected achievement standards, which are in economic terms fixed targets or constraints. When using them, we, of course, resign ourselves to accept programmes that are less than optimal. When we know still less about quantitative relationships between costs and benefits, we use portmanteau words like 'rights' and society's obligation to ensure these 'rights'.

Since we live in a world where the governing professional élite closest to the political process is an élite of economists, we have to translate the statement that something is a human right into economic terms. Myrdal[3] and others have said that a social investment like water, health, or improvement of nutrition is an investment in man and in his capacity to produce, and should therefore be considered as an investment and not as consumption. If we accept this, we

could, at least in theory, compare investments in water with other investments. It is now generally recognized that investment in certain types of education and training has proved to be the best kind of investment, and that such intangible investments in man can have a greater influence on production than direct investment in physical equipment. If we take a still wider view and consider that man does not live to produce, but produces in order to have a decent life, and if we introduce into economic evaluation other utilities in addition to those related to the acquisition of commodities, the use of the term 'investment' instead of 'consumption' would be still more meaningful. Such considerations are increasingly being recognized at the level of big international funding agencies, and they will gradually have more influence on the patterns of allocation of resources by governments.

C. Elliott: I would reject any attempt to dress consumption expenditures up in the clothes of investment, partly because I sense professional opinion is turning to a more ready recognition of the value of consumption *per se*, as an end in itself; and partly because it would in fact be extraordinarily difficult to do the sums on domestic water projects in a way comparable to other kinds of investment. The sums would be incomplete (in which case the cost–benefit ratios would not be competitive) or bogus (in which case any funding agency worth its salt would reject them).

Dr Dieterich discussed the WHO data on water supply in 1962 and 1970, and part of his case for relative optimism seems to rest on the assumption that the figures for urban areas include the peripheral settlements. I would like to know on what basis he makes that claim, because in countries with which I am familiar the governments have a strong vested interest in *excluding* peripheral settlements from the urban data. If it is the case, as I strongly suspect, that the relatively good performance of the urban areas is based on the much more restricted definition of 'urban', it seems to me that the case for optimism is seriously undermined.

Dieterich: These data are collected by the governments concerned, and we took their definitions of urban and rural. However, WHO experts took part in their collection. I think that bidonville settlements have been included, or the figures would be higher.

White: WHO did a pioneering study in Dakar on planning for the provision of water supply and sanitary facilities for peripheral areas as well as the central city. At the stage at which I saw the planning it appeared that the stance which the municipal government might finally be expected to take depended very much on the outlook of the investigatory team and the way in which they chose to present the problem. One possible choice was to exclude the urban peripheries as being something that could be ignored in meeting the needs of

the élite group in the city. Another approach was to indicate how readily the total problem could be solved without great cost to the élite, who were going to pay the major bill. So here is a case where the orientation of the professional workers can determine at the outcome the development strategy. I suspect Dr Wiener found the same in the Accra-Tema study.[4] The strategy involves transfers of income that are not easily identified by the contributors. Therefore the basic orientation of those presenting the plans for final approval by the political agencies may determine whether that peripheral group is excluded or not.

C. Elliott: The example that Professor White is talking about is very different from the cases lying behind the collection of the WHO figures. There is a considerable difference between an investigatory team producing data and governments producing information in response to a WHO questionnaire. Certainly in Kampala, Lusaka, Nairobi and Abidjan, the government authorities define the urban area in as restrictive a way as they can precisely because they know that if they include the peripheral areas, all the urban indicators will look bad. This is particularly true in housing.

Wiener: We had the opposite experience in Nigeria on a number of schemes, where the government insisted that we include not only the peripheral areas around the town but also an extensive rural area. The indirect redistribution which was inherent in the rate structure of payment for water made it possible to do such things, as Professor White says. We had some experience in Mexico of this; the inclusion of the low-income areas was made possible by using selective government participation in schemes exclusively for low-income groups and letting high-income groups pay the real costs of the scheme. I think this could be done in many cases, but there are others where we might find resistance.

Dieterich: We are moving here beyond the immediate interest of health in the narrowest sense, and I personally believe that we shall not be able to implement big programmes as long as we rely entirely on the budget of Health Ministries. There are other more important budgets in every country, and these can be used. Most countries have a relatively strong agricultural or land development or public works budget. We must not make the mistake of thinking that water supplies can be achieved only through the health standard. It is a health objective, clearly, but one can accomplish it in many other ways. One can build this kind of work into other programmes, and then the resources double or treble immediately. This has not been done enough.

The other point coming out from what Mr Wiener said is the question of how banks and bilateral assistance agencies look at this. If we start with the opportunity-cost of capital we are in a bad position. We may be able to apply

it in a large city; this is what the World Bank does. It has its criteria, according to which a project must comply with a certain rate of return. In larger cities this can be achieved. If one applies certain policies, one can make the high-income group pay for the whole project, but what one must not do is to divide a project into two parts and give $30 million to the part which is bankable (that is, eligible for a loan according to a bank's criteria) but decide not to include the poor part of the town. If one really wants to bring water to the poor one must tax the rich, and this can be done by charging for water according to the value of the house. Such things are quite possible, but one requires a policy on the part of the government and on the part of those financing the project. The whole question of criteria for projects should be reviewed in that context. I am not sure that the big banks are willing to discuss that yet, although the President of the World Bank was very outspoken in this respect. It remains to be seen how this can be translated into actual policies.

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Human Rights in Health
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Domestic water supply: right or good?

GILBERT F. WHITE

DIMENSIONS OF THE PROBLEM

The most nearly accurate and helpful set of data on the status of domestic water supply is that compiled by the World Health Organization. Based on preliminary data from questionnaires addressed to member developing countries, the statistics for 1970 from 90 selected countries account for 45% of the total world population.[7] The results are compared in Fig. 1 with a similar canvass of 75 developing countries in 1962 and with targets suggested by WHO for 1980, at the end of the United Nations Second Development Decade.

For statistical purposes the population surveyed is divided into rural and urban categories according to whatever classification is used in each country. Urban services are grouped according to whether the population (1) has a water connection within the house, (2) must carry water from a public standpipe, or (3) has neither service. Rural dwellers are classified according to whether or not the housewife has 'reasonable access' (not requiring 'a disproportionate part of the day fetching water') to a source that is uncontaminated.

The statistics are subject to several sources of error. They underestimate the population served insofar as the reporting agency is uninformed about local conditions or about the activities of other government agencies. An agency also may consider that a user lacks reasonable access to water because the agency did not provide the source. The reports often overestimate the population served in that they assume that once a community system is installed it is used or operated by the consumers in the way intended by the builders. Many a traveller in a developing country has encountered an unused well or a distribution system where the treatment plant no longer functions. On balance, the statistics probably over-report the community services and under-report the achievements of individuals and informal local groups. For any one country the figures may not be accurate, but the aggregate probably is moderately near the present situation.

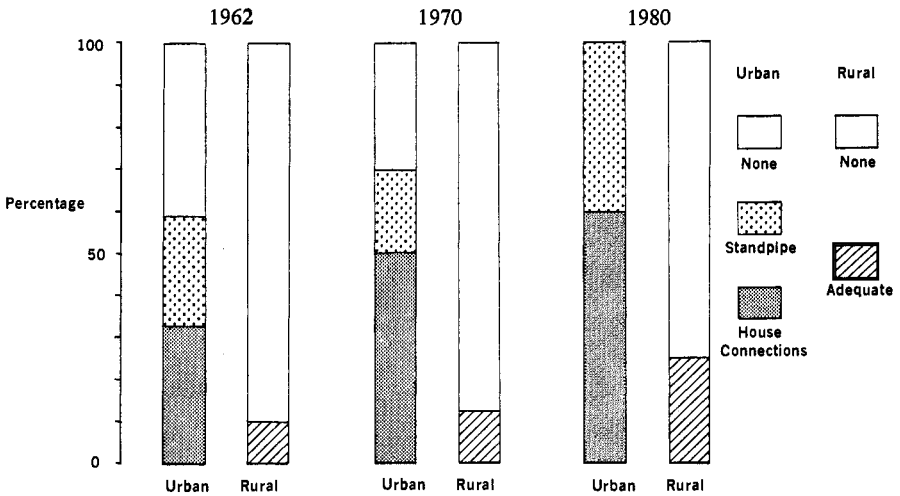

FIG. 1. WHO estimates of populations of developing countries provided with adequate water for 1962 and 1970, and target for 1980.[7]

On the basis of these data WHO concludes that for the 90 countries about 70% of the urban population, and 12% of the rural population, accounting for one-quarter of their total population, are served by improved supplies (Fig. 1). The situation in 1970 marks a slight increase in the proportion of the rural population supplied between 1962 and 1970.

Change was far more rapid in Latin America than in Africa and Asia. For the total of 27 Latin American nations the proportion of urban users served from house connections and public standpipes increased from 60 to 78% while the proportion of rural people with improved supplies rose from 7 to 24%.[1]

This picture of status and change can be supplemented in several ways to give a more nearly complete outline of the world problem. To do so requires some long leaps of estimation in order to fill in four major gaps.

First, to account for the other 55% of the world's population, one must attempt an estimate for developed countries as well as for developing countries not reporting to WHO. Of the latter, the most conspicuous is the People's Republic of China with its 800 000 000 citizens, give or take 50 000 000.

Second, it is desirable to classify populations according to spatial pattern. A helpful division in terms of problems of water supply and sanitation is as follows:

Cities: Organized urban areas and their satellites.

Peripheries: Disorganized shantytowns, bidonvilles, barrios, and other (one hopes) temporary living areas on the immediate fringes of cities.

TABLE 1

Characteristics of settlement patterns for water supply and waste disposal

Spatial pattern	*Cost of water supply*	*Health hazard from water*	*Cost of waste disposal*	*Health hazard from waste*
City	Low	High	High	High
Peripheries	Medium	High	Medium	High
Rural				
Clustered	Low	Medium	Medium	Medium
Dispersed	High	Low	Low	Low

Rural—clustered: Settlements, primarily for agricultural purposes, of households grouped together.

Rural—dispersed: Widely scattered households lacking grouping and nuclei.

These distinctions are important because the differences in density and arrangement of habitation are related to the types of management techniques used, the cost of providing water and waste services and the health hazards associated with them, as summarized in Table 1. The relationships vary according to density of settlement, the type of physical environment, and the volume of water used; a more detailed classification, for example, would distinguish between nucleated villages in arid regions and nucleated villages in wet lowlands.

Economies of scale and concentration make the water supply of a city relatively low in cost for low use per head, whereas the difficulties of waste disposal are relatively high as use increases, and the health hazards from both water and waste are high. Dispersed settlements may require high costs per head for water supply but they carry low health risks.

Third, while the prevailing standards of water quality constitute desirable targets for planning, they are not a basis for a binary classification of water service as a contribution to well-being. The definition of a 'safe' supply reflects the local judgement of acceptable risk. As Bradley shows (see pp. 81-91), the quantity as well as the quality of the water used makes a difference to the health of the user. The *hazard* to health from water should be thought of as ranked along a continuum from very hazardous to insignificant. In parallel to that continuum runs a second dimension of *amenity*, in which supplies can be graded from those having negative value to those yielding high degrees of convenience and pleasure. We may think of any individual or community supply as falling somewhere along the scales outlined in Fig. 2.

The two scales of water hazards and water amenities do not always harmonize: a Lango housewife may withdraw abundant supplies of Nile water to use for bathing but the water may be so contaminated that her household chronically

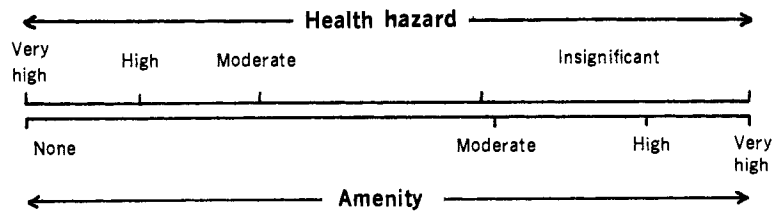

FIG. 2. Scales of the health hazards and amenities resulting from the water supply.

suffers intestinal disease; and a family in dry areas of Rajasthan may lament the small volume it can draw from the village standpipe during the dry season but enjoy the security of a fully protected supply. In general, the greater amenities are associated with large usage of supplies having insignificant hazard to health.

The volume used daily varies roughly among the four major types of population distribution and organization as shown in Fig. 3. For city dwellers the mean daily consumption per person is 10 to 50 litres for those dependent upon standpipes, 15 to 120 litres for those having only a single tap in the household, and 30 to 300 litres for those with several house connections.[5] Rural consumers without tap connections or standpipes use 4 to 25 litres: their use of single tap and standpipe supplies is similar to but generally lower than that of urban consumers.[5,2] The picture is complicated by the many arrangements made to combine domestic with livestock, irrigation and other uses. The actual measured consumption is somewhat less than that commonly used for design purposes.

Fourth, any evaluation of water supply as an environmental component of well-being implies some safe mode of disposal of waste, waste water, and human excreta. The more concentrated the population and the larger the volume of water withdrawn per person, the more difficult is the sanitary disposal of excreta (see Table 1). In cities it involves either carriage and disposal by water or the collection of nightsoil and its disposal on land. In many urban periph-

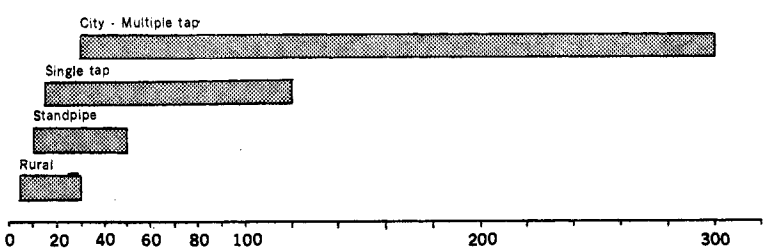

FIG. 3. Daily consumption per head in litres for major classes of water improvements.

eries disposal is casual and unorganized. In clustered rural settlements the technical problems are less acute because of the sparser population at risk and the greater space for disposal facilities. In dispersed settlements the cost of providing suitable water supplies may be large for any one household, depending upon local terrain and hydrology, but the difficulties and hazards of waste disposal are minimized. A programme for water supply necessarily implies provision for waste. Sewerage lags far behind water supply in developing countries.

AN ALTERNATIVE DESCRIPTION OF THE PROBLEM

Taking these four considerations into account, I shall present the problem of the world water supply in an alternative way. By dealing with the total population and by first classifying it according to spatial pattern, we can estimate water service in 1970 as shown in Fig. 4. In doing so, we are making rough judgements about the adequacy of water services in rural areas where WHO

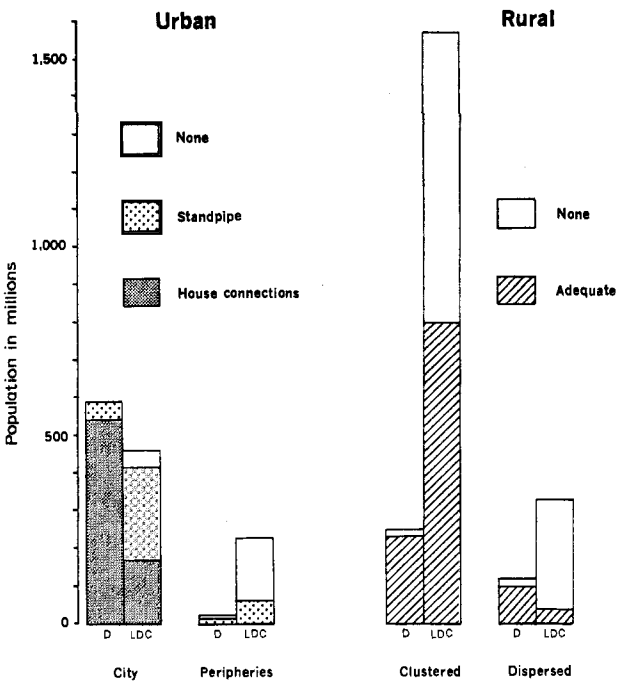

FIG. 4. Estimated distribution of water services for the world population in 1970. D, developed and LDC, less developed countries.

reports are not summarized. These rough estimates are presented here on a preliminary basis, in the hope that more nearly accurate estimates will be provoked or forthcoming.

For the higher-income countries it is estimated that 1 to 10% of the rural population is not now provided with adequate water and sanitation where required. Among the developing countries, it is estimated (on the basis of personal interviews while travelling in the country) that the People's Republic of China has provided standpipe service for 90% of its city dwellers, that the peripheral populations are relatively small, and that about 70% of the rural population, virtually all clustered, have adequate supplies and sanitation, if we take into account the facts that the Chinese tend to boil their drinking water and that they remove nightsoil for use as fertilizer on agricultural land. A major and rapidly growing component of the population in other developing countries is the peripheral group of shantytowns around tropical cities which are largely neglected and may rely on standpipes and water vendors.

On the basis of these rough estimates we obtain a picture which appears to be one of relatively adequate water for city people in developed nations; deficient supplies for more than half the cities in developing nations; generally inadequate supplies in the peripheries of tropical urban areas; and thoroughly adequate supplies for only about half of the rural dwellers—chiefly those in clustered settlements.

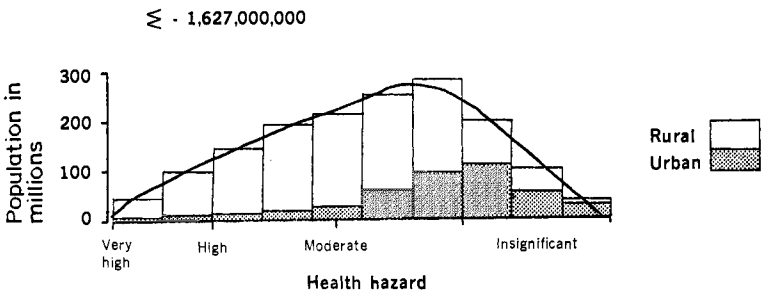

FIG. 5. Distribution of population for 90 developing countries on a scale of health hazards.

Fig. 5 shows for the 1970 WHO statistics how the same data for 90 developing countries might be presented on a scale of health hazard. The important difference between the approaches in Figs. 1 and 5 is that the latter shows a continuum rather than a hard and fast dividing line. In that framework, the primary challenge is to move the population as far as practicable within financial constraints towards a sector in the distribution curve where health hazard is insignificant, rather than to transfer blocks of population from unsatisfactory to satisfactory categories. For example, in many tropical cities

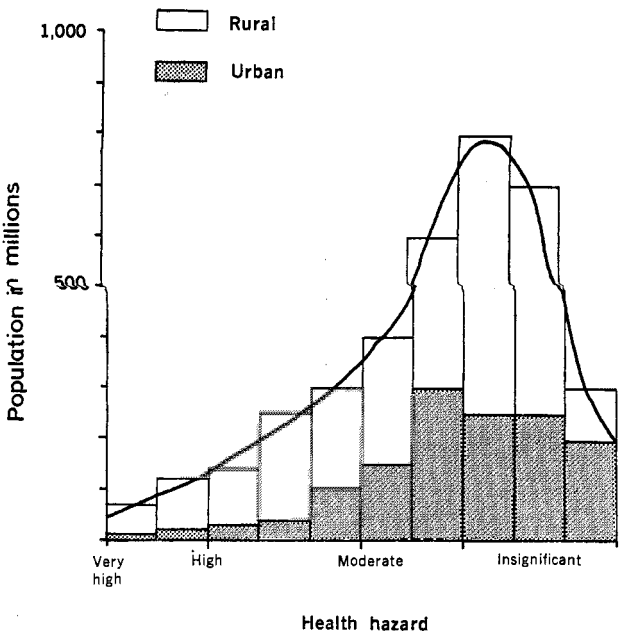

FIG. 6. Estimated distribution of world population on a scale of health hazards for 1970.

now provided with central water systems the most productive investment is to assure that standards of quality are maintained.

Applying the same approach and a great deal of guesswork to the total world population, we arrive at the estimate of the 1970 situation shown in Fig. 6. This global picture recognizes the very great progress already made by high-income countries, by builders of city water supplies, and by the People's Republic of China. It also suggests that the immediate activity on the world-scale which would offer the larger benefits would be the movement of the mass of rural and peripheral urban dwellers along the spectrum towards a situation of insignificant health hazard (Fig. 7).

OBSTACLES TO IMPROVEMENT

This brings us to the most puzzling of the problems relating to water supply. Why is it that in almost all low-income countries the concern of the common people for improving their water supply has been insufficiently strong and persistent to force programmes to provide such minimal improvements for all?

A possible explanation is that people's concern is a function of income and

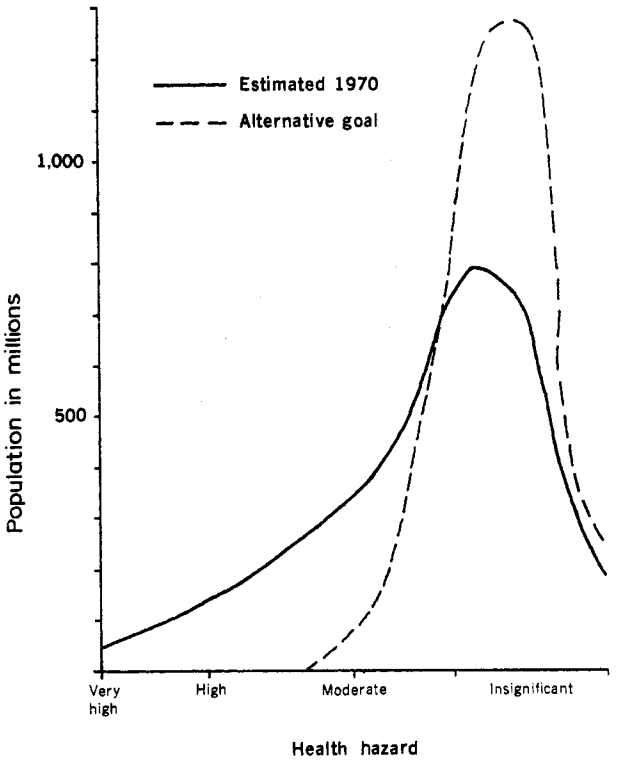

FIG. 7. Estimated distribution of world population on a scale of health hazards and amenities for 1970, and for an alternative goal.

the way of life providing it, and that only as nations increase their income per head to some minimum will the basic right to clean water be met generally. Such an explanation overlooks at least two important considerations. Some countries with a much larger Gross National Product still fall short of the goal. Argentina reports 16% of its rural population served, and among the higher figures reported for a large nation in Latin America is Venezuela's 46%. Cuba reached 60% in 1966 and Costa Rica 56%. At the same time, the People's Republic of China with an average GNP of $150 appears to have met the basic needs of a very large proportion of its rural population.

The argument that concern is related to income is not convincing, and we must look for other obstacles. They include the volume of supply, technology, finances, administration, training, and a catch-all often loosely described as 'motivation'.

Enough water

At the outset it is clear that in virtually all parts of the world with any significant population density, the amount of water available is adequate to meet reasonable domestic needs. The mean daily flow of the River Nile is enough to supply all of the domestic needs of the world's population. This excludes industrial and public service requirements and the amenities of lawn-watering and swimming pools.

Even though there are places where there is less water readily available than the population would like for domestic purposes, the practicability of extracting water and transporting it over long distances is such that many (although not all) clustered desert populations can receive a supply. We can make only rough estimates of the financial hardship involved in problem areas.

Technology

There are many ways in which the techniques for finding, extracting, conveying, storing and treating water could be enhanced. There are a few ways in which a breakthrough in technology, such as a fixed-bed disinfectant without taste or odour, could bring about a sweeping change in the availability of adequate water and sanitation. It is painfully evident that the available technology is often not applied effectively: for example, disinfection in numerous tropical urban supplies.

Burton outlines the opportunities and the constraints elsewhere (see pp. 61-70), but for our purposes two generalizations seem warranted. The first is that technology *is* available to provide water to all inhabited areas. The other is that the costs of such techniques are so high in some places, or the skill of applying them is so demanding, that many dispersed rural areas are unable to use them.

Finances

The construction cost of water improvements runs from about $1 to $300 per head, depending upon environmental conditions and the desired quality of service. As outlined in Table 2, multiple-tap supplies in cities fall in the range $10–$300; single taps cost $5–$40, and standpipes about $3–$20. Services to rural dispersed areas range from $1 to $30 in cost.

If we accept the view that all people should have an adequate supply, in

TABLE 2

Range of capital costs for domestic water supply improvements (From *Drawers of Water*[5])

Type of improvement	*Cost per head in dollars (1970)*
City	
Multiple taps	10–300
Single taps	5– 20
Standpipes	3– 20
Peripheral	
Standpipes	3– 20
Rural	
Clustered	3– 10
Dispersed	1– 30

order to reduce the health hazard, then the financial problem of providing it becomes one of finding the lowest effective cost and of paying the costs efficiently. The record for design of low-cost, multiple-tap supplies in cities in Latin America is on the whole excellent.[6] This suggests that consumers in cities and in many clustered rural settlements can be expected to repay all or a large part of the costs through volume or tax charges. In numerous cities where consumers using standpipes pay on the basis of the water withdrawn, users spend more per unit of volume than those with house connections, but the operating costs are so high and the collection of revenues is so cumbersome that system designers often tend to avoid standpipes and to disregard consumers who lack house connections. Slum dwellers may pay water vendors 20 times the metered rate. Fig. 8 illustrates the range of charges paid by rural and urban consumers in East Africa.

It seems likely that for many nucleated population centres the capital investments in water improvements can be returned over amortization periods of about 25 years at low interest rates if there is strong public support, often in the form of grants, for design and for the training and supervision of operational and administrative services for the poorer communities. A difficult question of policy arises in the design standards in cities of low-income countries. The tendency in some of these areas is to design for more multiple-tap connections and higher daily consumption than probably would be required to bring the health hazard down to a truly insignificant range.

For the urban peripheries and dispersed and smaller clusters of rural population the financial problem is more acute. The costs per head are often high in relation to income, the difficulty of preparing adequate designs adjusted to local conditions is large and sometimes insurmountable when handled

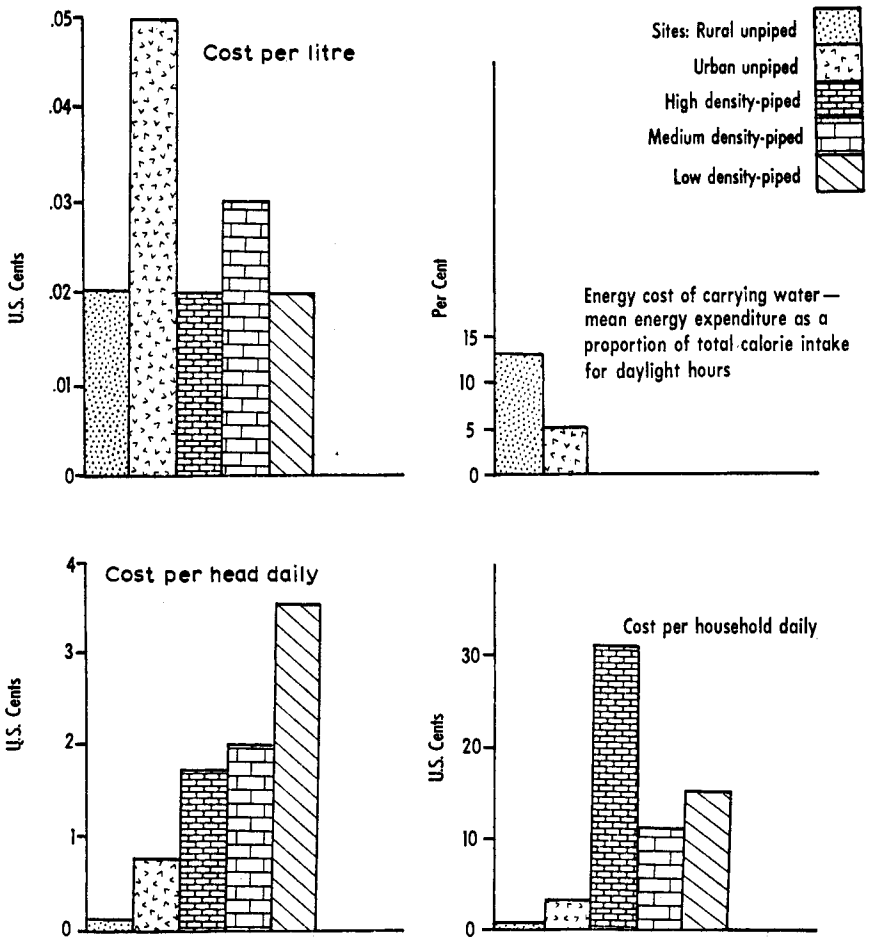

FIG. 8. Direct costs of use of water in selected East African sites. (From *Drawers of Water.*[5])

through a central organization, and operation and maintenance is impeded or destroyed by improperly trained but well-motivated personnel. The suggested solutions run along several lines including self-help, centralized management, or a combination of these.

Financial agencies argue that self-help projects, in which consumers share in the design and provide labour and materials so far as practicable, rarely work out, and construction agencies say that such works fall short of professional standards, but the number of systematic experiments with self-help is small. So long as the lending agency tries to assure full repayment and the construction

agency is committed to completing works meeting the critical approval of its peers for water safety and durability of works, the process is slow, likely to be very costly, and unlikely to arouse strong local participation.

The works initiated and completed by central agencies incur higher costs in the long run, do not necessarily command use by the intended beneficiaries, and may fail to function when placed in local hands. Often it is asserted that the central agency must continue to operate the works if they are to attain their purpose.

Were the national government to regard the improvements as a means of redistributing income and of helping people to claim a right to clean water, the financial arrangements might be quite different, and would recognize the full social costs, in contrast to financial costs, of inadequate supplies. In cities the charges would be adjusted to provide single-tap or standpipe service to the peripheries free or at nominal charges. The rural users would be encouraged to make their own improvements, with national tax income being used primarily for technical advice and sophisticated materials when required. In especially hazardous environments national subsidies to the users would be warranted, but the basic stance would be one of facilitating self-help by those individuals or groups that wish to improve their supplies and lend themselves to assistance of the type described above.

Administration

Wherever water is managed for the public good, the administration of the planning, construction and operation tends to be complex because of the frequent need to serve several purposes—domestic, livestock, irrigation, electric power and the like—by multiple means. Domestic water is no exception. In cities it usually is a straightforward municipal service, but water supply is often under a different management from waste collection and disposal. Many peripheries are an administrative no-man's land. In rural areas domestic water may be handled in a variety of ways: as a principal aim; as a subsidiary to irrigation; as a sector of a national water agency; as a sector of public health ministries; or it may be divided among geological well drillers, engineering builders of surface works, and inspectors of sanitary conditions.

In most countries, the activities of national water agencies are focused chiefly on providing water whose quality meets the governments's standards of purity with works that meet engineering standards of safety at costs that—it is hoped—will be repaid by the consumers. With notable exceptions, whether the costs are to be repaid or not, the works tend to be designed and built by

experts from the central government organization. It is practical for central agencies to stimulate local initiative and contributions. Only in relatively few instances, such as the Chinese programmes, does the agency serve primarily as a consultant to local groups or focus on basic education about the consequences and means of improved supply. In Guatemala and Peru, where the rate of improvement has been rapid, the central agency designs the works and promotes community contributions to the cost of construction and operation. The Peruvian communities pay for all local operation and maintenance; in Guatemala, the proportion ranges from nothing to the entire cost.

Training

Much of the training for work with water supplies and waste disposal has centred on the production of professional sanitary and civil engineers who can handle a wide assortment of environmental problems. In many countries short-term training enables intermediate personnel to operate simple works and keep them in repair. As with administration, the emphasis is on central responsibility for planning and construction with the expectation that the local groups will use, operate and pay for the works. In only a few instances are workers trained to provide education in water needs and opportunities, or to encourage local groups to carry out their own improvements with whatever levels of health hazard they are willing to bear.

Motivation, preference and value systems

When known techniques are not applied, or peasants are not willing to pay improvement costs within their reach, or a highly organized national programme fails to expand its projects, or consumers refuse to drink the clean supply, it is common to say that the people are ignorant or lack motivation. We know only a little about why many water and waste disposal schemes have failed or why so few are started, but several observations seem warranted by the studies made so far.

In virtually all settings where household water use has been studied with care the consumers have been found to be concerned with their own health and that of their families and to be willing to go to considerable lengths to safeguard their health. The steps they are willing to take do not necessarily include the improvement of the water supply. The housewife may be unconvinced that a bacteriologically pure, mineralized supply from a government well is more

healthy than a pleasant-tasting supply from a polluted spring. Her husband may mourn the death of a son but fail to recognize that a day's work contributed to protecting the spring might have helped to prevent the death. It is more than a nicety of phrasing to avoid speaking of 'man and water supply'. For two-thirds of the world it is the woman who daily draws the household's water from rural source or urban standpipe, and who, if she has the option, often chooses the source that she regards as more healthy.

Rural consumers generally have clear preferences about water in a community value system in which the use and improvement of water is only one aspect.[4] Improvement programmes, however sound technically, which ignore these perceptions of water, preferences and values, are likely to run into severe trouble.

In city multiple-tap or standpipe systems where the consumer has few or no real alternatives and where the system must be constructed by a central, professional agency, the assessment of such preferences and values may be unimportant. People either are willing to be connected up to the system or they are not. In rural situations where there usually are numerous choices and where individual contributions of labour or money may be essential to construction, such assessment may be crucial. The two essential and related ways of taking preferences and perception into account are to canvass people before improvements are designed and to involve the beneficiaries as deeply as is practicable in defining their needs and in designing, constructing and operating whatever improvements they may choose to undertake. Their willingness to help themselves then becomes a criterion for external technical assistance, as it has done in Argentina.

THE UNDERLYING ORIENTATION

The strengths of the organization required to meet the needs of city populations and high-income rural dwellers may become barriers when the same approach is applied to the poor of the urban periphery and rural areas. The first approach is oriented towards higher and relatively rigid standards of risk, and depends on professional engineering skills, cash repayment by the consumers, and administration and training aimed at fostering such modes of action. Meeting the needs of the mushrooming urban peripheries will probably require a financial and design policy of getting clean water to all the people in minimum quantities necessary for sustaining health without elaborate repayment. To reach the more than one thousand million rural folk who need improvements will probably require a more flexible approach which first finds

out local perceptions, preferences and value systems, then initiates education on the health consequences of improvement, and later offers technical assistance in planning, constructing and operating works to meet the aims of the user. Both approaches would hinge on a shift from regarding water primarily as an economic good to regarding water primarily as a human right.

IS A 25-YEAR GOAL PRACTICABLE?

In a period of 25 years would it be practicable to improve the water supply for those populations now inadequately served, so as to provide water supply and sanitation with low or insignificant health hazard to 95% of the human family? I am taking the time period of a generation as the maximum that a major world effort might be expected to accept in dealing with a matter of vital and universal concern. Five % is a minimum estimate of the number of people who live in such rigorous and remote habitats that improvement will not be feasible for a long time to come. It is assumed that sewerage would be provided only where the health hazard would otherwise be very high, high, or moderate. If we extrapolate the trends of the past decade for 90 developing countries the answer is 'no': over three decades at least half of the rural population, or more than 1 500 000 000 people, still would not enjoy the benefits of improvement. If we assume that the level and tempo of technical development, administrative management, and training and education are stepped up as part of an international initiative based on helping governments to enable people to claim their right to clean water, the answer is a hopeful 'yes'. These are heroic assumptions that need to be examined critically.

Indeed, some who are familiar with both the exigencies and the remarkable advances in community water supplies over the past century would ask why one should launch a larger world programme. Why not let work go on as in the recent past, simply speeding it up? According to this view, all that is needed is more money and more training of people to spend it. But the record gives no confidence that international funding could be increased or that the pace of national expenditure will accelerate beyond present rates, or even be maintained in some circumstances. Contrariwise, it might be argued that a time horizon of 1998 is far too long—that it is callous and complacent to expect events to march at such a slow pace.

With most ambitious undertakings the enthusiasm and energy harnessed by the initially high aspirations are accompanied by the danger that scattered or endemic failures in the early stages throw the whole effort into jeopardy. This might well be so with a 25-year, worldwide water supply and sanitation

programme undertaken either independently or as a part of a larger health programme. A preliminary planning component of about five years would seem essential. The preparation would include the refinement and popularization of possible technological choices for particular urban and rural habitats, the careful appraisal of the recent successes and failures of different management techniques in providing improvements in peripheral and rural areas, the financing of national training and educational programmes, and the cultivation of an awareness among responsible national leaders of the opportunities and problems presented by accelerated programmes. Basic to the new research, administrative studies, and training and education, is the fundamental change in approach noted here, with its emphasis on flexible standards and self-help responsibility.

In moving from a view of water as an economic good marketed where the consumer can afford it to a view of water as a right all are entitled to claim by their initiative, national governments, cooperating through the World Health Organization, would commit themselves in three important ways. They would publicly accept the obligation to help consumers to achieve adequate supplies within some target period, recognizing that rights are to be claimed and merited by contributions of time and money, rather than given. They would train people to assist local and regional groups in making technically sound choices. They would allocate sufficient funds to pay for environmental health components in education, continuing technical assistance, and in-service training, and would promote manufacture within the country of essential equipment which would otherwise make heavy demands on foreign currency.

Massive transfers of capital for construction projects would be neither necessary nor desirable. For the type and level of construction involved, foreign loans would be required chiefly for planning large city projects where revenues would repay the construction costs. The speedy provision of peripheral and rural facilities in many countries would call for international assistance in research on key technological problems, in establishing institutional competence to carry out educational, training, and technical assistance programmes, and in developing the capacity, either nationally or regionally, to produce the needed materials. International financial agencies would probably have the chief role in setting up the necessary institutions, but non-government international agencies might have influential parts to play.

Is this aim and this assessment of the practicability of reaching it within 25 years wholly visionary? I think not. More effective tactics and operating methods than those suggested here might well be devised, and almost certainly would emerge if a major international effort were launched. Even so it might fall far short of the mark. Perhaps more certain is that unless there is a world-

wide marshalling of technical knowledge, administrative wisdom, and political enthusiasm, based upon the simple principle of a healthy environment as a human right, the end of the century may see few advances in the lot of the poor on farms and in urban shantytowns in terms of water for domestic well-being.

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Discussion

Wiener: Professor White suggests that the shift towards providing the majority of people with adequate drinking water would be more easily achieved if different standards were adopted for different situations. If we wish to find out in a specific case whether this is true, we shall have to apply the concept of cost–effectiveness to various design standards. If it could be proved that this kind of multiple or graded standard would enable us to improve the basic health benefits achieved per unit of investments, Professor White would have a very good point.

Secondly, he noted the anomaly that some countries with higher average income still have very inadequate rural water supplies, and he mentioned Argentina and Venezuela as examples. One reason for this anomaly is that the concept of average Gross National Product per head loses much of its usefulness in countries where there are vast differences in income between sectors. In such cases use of *median* figures (that is, stating that 50% of the population have a certain income or less) would be preferable. In rural areas in Venezuela, for example, about 20% of the total population are employed in what is usually called traditional agriculture, and have to subsist on an income of \$150-\$250 per head, whereas the rest of the population has an income many times as large. The same is found in the depressed rural areas of north-east Brazil. These are typical examples of 'dual economies'. There is really no economic connection between the depressed and the growth sectors in the same country. Therefore, the low percentage of the rural population who are equipped with piped supplies is not surprising.

Llewelyn-Davies: What is needed to proceed from Professor White's conclusions is the development of methods by which the quality of service, or return in terms of service, can be graphed against the increasing cost. The crucial point is that when the cost is increased above certain levels, there is a diminishing return in the increased quality of service; and the problem of assessing the appropriate level of standards in any particular society, and also of considering the trade-off between investment and return, turns on the display of the relationship between the cost and the quality of service provided. Such methods are now being developed in Colombia. They are qualitative and avoid the questionable apparent accuracy of cost–benefit analysis. They are similar to cost–effectiveness analyses.

D. B. Jelliffe: Professor White's point about the hobbling effect of rigid, uniform standards has a wider application still: it is highly relevant, for example, in relation to infant feeding. The rigid standards laid down for weaning foods have had a hobbling effect on the achievement of adequate infant nutrition in the same sort of way as has happened with water supplies. One weaning food, developed in Haiti, has been called 'Heaven can wait' infant food,[3] and possibly one is looking for a 'Heaven can wait' water supply!

White: On the cost–effectiveness approach, for which I know of no prototype, in my opinion the ideal investment pattern for any country would be at any given time to invest available resources of personnel, materials and capital in small amounts in those water supply improvements which would be expected to move the largest parts of the population furthest along the spectrum of health hazard. We find in certain places in East Africa that small investments in projects which fail to meet Western engineering standards can greatly reduce the hazard of bacterial contamination. This raises the question of the validity of the spectrum and whether a move along it does have the hypothesized effects on health. Dr Bradley will discuss that question later (pp. 81-91). It embraces the remarkable lack of exact information on the effects on health of slight differences in the quantity of water available and also the quality of water, and how these may differ between dispersed and clustered settlements. For example, a relatively polluted spring may be much less of a hazard where it serves only one household than where it serves a whole village.

Victoria Garcia: When the emphasis or goal is changed from the higher to the lower income groups one has to take into consideration the fact that the cost of the service will not decrease. It is a principle of health planning that a good administrator does not allow a situation to deteriorate, and therefore the quality of the service to the high-income group has to be maintained while emphasis and every possible resource is shifted to services for the high-risk groups in rural areas.

Bradley: While it is true that supplies to high-level groups need to be maintained, to avoid political trouble, there is room for manoeuvre here. One can squeeze élites financially at the upper end of their consumption; most supplies are metered, and even an unreasonable member of an élite would probably appreciate, if a case is made out that water is short, that consumption should be charged very heavily above a certain level, when use is for lawn-watering or car-cleaning, which both consume a lot of water. This will either increase the amount of income available for paying for poorer people's supplies, or reduce consumption, so releasing supplies of water without the need for extending the plant to the same degree. This is feasible, with a little subtlety, and it can be done to a greater extent than might be possible in other fields.

White: In most Western countries municipal water supply developments were initially promoted through publicity campaigns and promotional rate structures. Only in the last few years in a few parts of the West, including Israel and some places in the USA, has the rate structure been other than one that encouraged use by providing lower rates for higher consumption. We are now moving to the opposite kind of rate structure in which rates are low for minimal consumption and increase rapidly for higher consumption. As Dr Bradley indicates, such a shift in Kampala or Nairobi would make it possible to provide the same amount of water to a larger number of people, with less use per person in the higher income groups, or would supply sufficient income from the better-off groups to cover the cost of providing a minimum supply to the rest of the peripheral population. In urban areas the problem of maintaining adequate quality for the high-income people is not a major one. There, quality supply can be provided with their paying the full cost and, in addition, sufficient amounts to cover the cost of providing minimal supplies to the low-income people.

D. B. Jelliffe: I am surprised by one point stressed by Professor White, which may merely indicate my ignorance; being very interested in cross-cultural clashes and overlaps, I am struck by his comments on the cultural suitability of water supplies. I had naively imagined that if a water supply were available, even if provided by a geologist or engineer knowing very little about the culture of the local people, it would be readily used, whereas we know that a new food introduced would have great problems in being accepted.

White: The cultural suitability of a water supply can be an important factor. In East Africa it is common to find a well in the bush that works but is unused. When one looks for the reason one may find that when people make tea with the water from this well, the tea turns black. To the user, this is an indication of an unhealthy water supply, and she usually goes to a nearby stream from which the water does not turn black, and feels she is doing the best thing for

her family. Again, in parts of Indo-China, people feel they should use water that is running; they believe that running sources are more healthy than still sources. We have probably all seen the system that has broken down, but the local people are not much concerned about it because they were not convinced in the first place that the improved water system was going to improve their health. They may have thought it was an amenity—a nice thing to have—but they were not convinced that it was essential to realizing their health aims.

This is a matter of great cultural differences. In China I spoke to a young surgeon who worked on a village medical team for three months as part of his annual service. He said that one of his principal jobs was to improve the water supply. At the beginning he knew nothing about water supplies but he became aware of the distribution of gastroenteritic diseases in the village, examined the water source, saw that it was polluted, and decided to try to help the people to do something about it. His main action was to use a microscope to show people what was in the water. As a result of this, the responsible members of the commune began to think about improvement of the water supply. At that point the surgeon became the expert in helping to carry out the improvement that they felt they needed. Not until then could he have had a significant effect on the permanent improvement of the supplies in the village.

Wolstenholme: Some of you will recall an incident during the outbreak of cholera in London in 1853. The district of Hampstead, celebrated for its water, remained free of the disease—except for one woman who had moved there from the city and who so preferred the tasty contaminated water to which she had been accustomed that she had a bottled supply delivered to her daily. Her isolated case of cholera was part of John Snow's evidence in his demonstration of the waterborne nature of the disease.

Tewari: Another example of the problem of cultural acceptance of water supplies comes from areas of India infested with guinea worm, where people are used to drawing water from what are called step-wells. There may be a hygienic hand pump available nearby which is not being used; the women of the village insist on going to the step-well. I don't know the whole explanation, but the step-well seems to provide a cultural forum or platform which the hand pump does not provide. The point, which Professor White made very pertinently, is how to make the real needs of the people coincide with their felt needs. In that direction, one wonders if any comparative studies have been made of the cost–effectiveness of investment made entirely on technical grounds and of investment made on grounds of the behavioural aspect, which tends to be neglected. Perhaps progress could be made if we had data showing that, apart from the investment made purely on technical improvement, investment made on the basis of sociological studies yielded a positive result.

White: I do not know of any study of this type. This lack reflects the traditional emphasis on the engineering aspects of water supply.

Burton: Dr Tewari has identified a crucial factor in the improvement of water supplies in rural areas. Unless the improvements made are harmonious with other aspects of village and family life they will not succeed. We should be careful here about the distinction between 'real' needs and 'felt' needs. It can be taken to imply that only expert or 'real' knowledge has a role to play. The needs that people feel are also real, and often a good deal more real than what some external specialist may suppose. The task is to obtain a skilful blending and merging of what the people want with expert diagnosis. To this end comparative studies of the sort Dr Tewari mentions could help to show how this might be achieved. None have so far been made, to my knowledge. In fact there is little experience or know-how in the business of trying to bring the perceptions of local populations to bear on water supply and sanitation improvements. New work in this direction is urgently needed.

A. Eide: As a general point, I am struck by our habit of starting to think in terms of financial rather than human resources. After all, the problem is to improve health, and the question is of where to start to analyse it. We have limited financial resources, and we tend to discuss how to use them better. Behind this is a tendency in the developed part of the world, in our money economies, where we think in financial terms and in terms of professionals, to look upon development related to GNP and so on as a way of solving problems. Both Dr White's paper and Dr Elliott's indicate that this is not necessarily the solution to the problem. What we should take into account is that 'development' (in terms of growth in GNP) tends to go hand in hand with underdevelopment. In the international system some states are in the lead technologically and financially. These we can call 'centre states'. They penetrate into the poorer states, which become the peripheral ones in a pattern of dominance and dependence. Inside these peripheral states are small groups who become associated with and participate in the penetration by the central states. These groups accumulate wealth as the resources of the country are harnessed to industrialization and to exports. But large parts of the rural population and the shanty-town urban dwellers do not take part in the new wealth—they (or large masses among them) in fact become worse off than they were before. This is the process of 'underdevelopment'. Land is taken from them by crude political measures, as we see in Southern Africa, or the peasants are pushed from the land by more subtle means, as we have seen in the wake of the Green Revolution in Asia. Many of them become slum dwellers, with nutritional standards lower than before. This is in some instances combined with, and forms part of, a labour-repressive system. The peasants' land is kept overcrowded and in a

bad condition and the inhabitants cannot survive unless they take jobs in industry, even when wages are extremely low. When this is combined with prohibition of the right to strike and even to remain permanently in the industrial areas, as in South Africa, an effective lid is put on pressures for more reasonable wages. The point is that in such cases, there is a deliberate lack of will to provide the rural population with facilities which could safeguard their human rights in health. We should be aware that similar phenomena, though less extreme, take place in other countries—and it does not always follow ethnic lines. This development of *underdevelopment* is to a large extent an outcome of the way in which rich countries invest in and trade with poorer countries.

In some cases, developing countries have in fact *benefited* from being boycotted by industrialized ones. I believe that this is one explanation of the development of the People's Republic of China. Cuba has benefited economically from the same thing. This raises an important question: does the unequal distribution of resources have something to do with the pattern of development, which is generated by and influenced by the way in which we trade and invest in Third World countries?

Burton: Yes, of course it does. At the international level attempts are being made to help the developing countries improve their water supply. To this end technology, know-how, equipment and capital are provided. International agencies and bilateral organizations for external aid also suggest how national programmes for community water supply can be mounted and what standards should be used. This is in keeping with a whole pattern of international relations that encourages a sense of dependence and inhibits self-reliance. In its extreme form perhaps it becomes a sort of neocolonialism. Usually it is not powered by any sinister motives, but simply grows out of the very unequal distribution of wealth, power, and technology, among the nations.

Rushing in to help, however well motivated or intentioned, can make things worse, and it may well be true that some countries are genuinely better off without help on the terms and in the ways that it is now given.

The pattern that can be seen at the international level also appears within countries. For example, central governments can adopt a similar patronising attitude to village populations. This encourages a sense of dependency, and perhaps expectancy, among the rural populations and can lead to an atrophy of the considerable capacity for self-help and the use of local ingenuity and creativity.

A point that is central to Dr White's argument is the change that he suggests is necessary in the underlying orientation of our approach. I would stress the complexity of that sort of reorientation. It will not come easily. It is not

simply a question of persuading an élite group of engineers or administrators at the international and national levels that this is necessary. The present underlying orientation grows from very deep roots. It involves not simply engineering techniques and planning activities, but also the kind of research that is done: the work of the consulting firms, the teaching institutions and the manufacturers of equipment. There is a wide network of activities which together reinforce the direction that has been followed. The underlying reorientation that is needed therefore will have to be quite far-reaching if it is to be fully effective.

C. Elliott: To go on from there, Professor White's plea was that the frequency distribution should be shifted radically to the right of the health hazard spectrum in terms of access to water. This raised two fundamental questions. What do we know about the relative costs of this sort of shift? It would seem to me that, given his costs, particularly for dispersed rural populations, this sort of redistribution is likely to be very much more expensive than the kind of norm with which he contrasted his alternative. Can he confirm or deny that?

Secondly, I think Professor White has not tackled the political problems implied in what is a very far-reaching redistribution of investment, with new investment being directed towards the poorest and the politically most powerless groups. This is something that has in the last ten years repeatedly proved to be difficult to achieve politically. Professor White asks us how we react to his alternative goal and whether it is feasible. I would like to know more about its cost; not only the cost–effectiveness but the absolute cost, and the political changes that are implicit.

Llewelyn-Davies: I think it essential that we come back to this question of resources, because the whole history of what has been done so far is of a set of standards being proposed as the requirements of the developing world, often by reference to the developed world, giving a totally false perspective, because the resources are not there; the only result is that one provides services to a very small degree to a small number of people in the country. It is useless to think in terms of standards in any of these areas except in relation to availability of resources.

White: We know relatively little about the financial costs of bringing about this change in the shape of the distribution curve. But on the basis of our studies in East Africa[5] and studies from other parts of the world, even with dispersed rural populations in semi-arid situations with seasonal problems, which present the most difficult situation, the costs are not likely to be prohibitive, *if* one assumes that the standards of purity of supply which would be applied to a clustered settlement will not be applied here. Although the

bacterial standards would not be met with dispersed supplies, the possibility of widespread harmful consequences arising from the failure to meet these standards would be minimized. It is when the supply is built to meet the high engineering and bacterial quality standards that we have been taught are essential that the problem becomes so hard to solve.

I am more hopeful about achieving this kind of redistribution than Charles Elliott. The two difficult sectors of the problem are the peripheral city populations and the disadvantaged rural populations. For the former one can imagine, without any great departure from our experience, the possibility of the rate structures and financing schemes for new urban developments including relatively high charges to the high-income users on a progressive rate schedule which would allow the total urban organism to provide a minimum quality and quantity of water to all its population. That would not require major movements of capital.

On the rural side, at present large amounts of energy, and in some instances money, go into the provision of water. In rural East Africa much of a person's energy output goes to providing water, and at certain times of the year this becomes a critical factor and the opportunity-cost is very large for that amount of energy. To the extent that rural populations come to recognize the genuine health-cost to them of *not* having improved supplies, one can expect them to be relatively willing to make improvements on their own. They would have to look to the outside for technical advice and occcasionally for some help in manufacturing hard-to-find supplies. By and large it could be a self-help operation making no heavy competitive demands on the capital resources of the developing countries. Nor does it necessarily require a larger investment in health education or health services; it does demand a different kind of input. This approach assumes, for example, that instead of an engineer going to a village and designing a complete water system for it, the engineer will, with a health worker, try to enable the village to see the need for the supply. When the people are ready he will advise them about kinds of measures they can take, but he will not take the responsibility for either the design or the operation. This is a definite break with prevailing patterns. I would feel less confident about it were it not that we have some demonstrations of movements in this direction in some of the Latin American countries, and in the People's Republic of China. In both instances there are significant moves towards the provision of adequate water supplies with a large component of self-help.

Mellander: Dr White, WHO has been concerned with the human right to an adequate water supply, but are the rights of animals also considered? The cow is particularly important from the nutritional point of view, and water is a limiting factor in milk production.

Secondly, to what extent has the Green Revolution influenced water supplies? How much will the use of modern fertilizers decrease the available resources of water?

White: One of the complications with water planning is that water is rarely used for a single purpose. It is generally used in several ways—as domestic water supply and livestock supply; for domestic and irrigation purposes; for irrigation and hydroelectric power. This is one reason why there are such complicated administrative structures with no single agency in a country with full responsibility for water. I made no effort in my necessarily brief analysis to deal with problems of the multiple use and multiple management of water, except to note that these administrative questions inevitably arise. For example, when large-scale water development begins the responsibility often shifts from the local public health group to a central water-planning group who may be more interested in kilowatts or supply of water for irrigation than in the health impact of the new water supplies. I agree that in each situation it is important to view the provision of domestic water in relation to all other uses, including the maintenance of the quality of the water for those uses.

I have so far been unable to find clear-cut evidence of changes due to the Green Revolution. One might expect some pollution of water from the very generous use of pesticides and fertilizers. On the domestic side, I am not familiar with such pollution beyond relatively unvalidated reports.

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Domestic water supplies for rural peoples in the developing countries: the hope of technology

IAN BURTON

Is there hope that through technological research and development the world outlook for domestic water supplies can be radically altered? The overwhelming weight of qualified opinion does not think so. Over the past year I have come to doubt the overwhelming weight of qualified opinion. This is a provocative statement from a non-engineer, and I cannot support it by pointing to some dramatic potential breakthrough that everyone can understand would provide an instant solution: 'Just add water ...' To that extent we are agreed. A dramatic breakthrough to some new wonder-technology seems unlikely.

The argument that there is hope in technological research and development is more involved and subtle. I think it can be shown that opportunities for potentially valuable research and development do exist which, if taken together, and if supported in other ways, could bring much better water supplies within reach of all the world's population by the end of the century.[2] It can also be suggested why it is that the conventional view persists that all the technology we need is there if only people would use it properly.

For the past year I have been studying the problem of water supply and sanitation for villages, dispersed populations, and small communities in the developing countries. I have enjoyed the assistance of two extremely able engineers, Professor Yves Maystre of the Ecole Polytechnique Fédérale de Lausanne, and Mr Emanuel Idelovitch on leave from Tahal, the Israeli water planning and development group. We have held two seminars of high-level experts, one in Ottawa in August 1972, and one in Lausanne in May 1973. In addition we have made field site visits to four countries in Latin America, three in Africa and two in Asia, as well as corresponded with about a hundred engineers, managers and water supply specialists. Some of our preliminary ideas have been widely circulated and we have received an active response. The initiative for the study came from the Development Assistance Directorate and

the Scientific Affairs Directorate of the Organisation for Economic Co-operation and Development, and it has been supported mainly by the International Development Research Centre (Ottawa) and also by the Swiss Government.

THE TWO TECHNOLOGIES

The most striking observation on the technology used in village water supplies is that there are two very different kinds. There is an enormous variety of traditional means for obtaining water. The ingenuity with which pre-industrial societies have devised means for lifting and transporting water is little appreciated. Descriptions of such systems are widely scattered and have nowhere been brought together so that the full range can be seen. Nor has there been any systematic attempt to see if transfers of traditional technology might be made from one cultural realm to another.

The sorts of traditional technology I have in mind are lifting devices (the shadouf, the Archimedes screw, and various animal-powered methods), storing methods (hafirs, tanks), and carrying and transporting methods (bamboo pipes, canals, kanats).

Contrasting with the array of traditional devices is a range of modern equipment. This includes intakes from surface or ground water sources, usually operated by power pumps, supplying water to a storage reservoir and including various kinds of treatment such as filtration and chlorination, and then a piped distribution system to public standposts, or to individual courtyards or house connections. In many villages, examples of the two types can be seen side by side, and often the new modern system lies abandoned and the people have reverted to the use of the former traditional system.

World Health Organization statistics show that about 12% of the rural population of the developing countries (excluding China) have access to safe and adequate supplies of water.[18] In so far as this figure is based on estimates of the number of people provided with 'modern' systems, and I have good reason to believe that it is in some countries, the figure of 12% is probably too high. I would estimate that as many as a third of the modern systems installed in the last two decades are no longer operating at all, and that a further number, at least a third, are operating defectively.

On the other hand, not all those classified as being without access to safe and adequate water supplies in the WHO statistics are in such dire circumstances as that might suggest. For the plain fact is that everybody has water. That some of the people who obtain water by means of traditional technology still have a high quality cannot be doubted.

Water quality has often declined as population density has increased, and the volume of human wastes has grown. A valley that could support an agriculture-based subsistence economy with 5000 people at a density of two or three per square kilometre cannot support ten times that number at a higher level of production and consumption without some risk of deterioration in the quality of water sources. There are more competing demands for water and the types of contamination have increased as well as the number of ways in which it can occur.

The methods for obtaining water in traditional ways and from traditional sources are increasingly inadequate. We do not know, however, how inadequate they are. Much water in use is no doubt highly dangerous and is a continual source of infectious disease. Other water is much safer, and more could be made so with relatively simple improvements to protect the sources from contamination or to ensure that contamination does not occur during carriage and domestic storage. Knowledge of the quality of water and of the quantities used in traditional systems is lacking because it has not been possible to mount the field surveys or to provide the laboratories and trained staff that would be needed. Much has been inferred from health reports, even though the water supply is often only one of the several ways in which diseases are transmitted.

In the face of this lack of precise knowledge of how defective the traditional water supply systems are, and the uncertainty thereby generated, and in the knowledge that modern technology exists that can deal with the situation, as demonstrated in much more wealthy countries in temperate latitudes, there has developed a strong conviction that the solution lies in the transfer of conventional Western technology for the benefit of village communities in the Third World. Belief in the efficacy of modern technology is often associated with a rejection of traditional systems. Thus, in reporting how many people have access to safe and adequate water supplies, those responsible for some national programmes have tended to equate modern technology with safe and adequate, and traditional technology with unsafe or inadequate. This occurs in the absence of reliable knowledge about actual water quality or of how many of the modern systems continue to function.

TRANSFER OF TECHNOLOGY

The situation in which two technologies, traditional and modern, exist together has been brought about through the attempt to transfer the benefits of modern technology to the developing countries. The agencies of external aid

and overseas development—the international banks and the UN family of organizations—have been willing and well-motivated instruments in this process of transferring modern technology.

The effort could be described as a partial success in that a slowly rising proportion of the target populations do now have access to high-quality water supplies. The proportion is still small, however, and even if it doubles during the 1970s there will probably remain as many people unsupplied at the end of the decade as at the beginning of it. If we also introduce the fact of failure of the new systems, the success story becomes very qualified indeed.

Quantitative evidence for the assertion of failure of modern technology is lacking, but there is much corroborative opinion which does not easily find its way into official reports. Writing privately an engineer from an international loan agency comments:

> Over the past twenty-five years, great amounts of money have been provided through bilateral programs for rural water projects. The world is covered with the remains of such projects where they were provided without regard to the people's interest in having them, and the mechanisms necessary to insure that the systems would be operated and maintained.

A report[20] from India by a UNICEF-WHO team states:

> The hand pump programme in Rajasthan has not been a notable success. None of the four hand pumps observed in the villages of Sapetia and Palari were in working order even though the installations were in some cases only a few weeks old. The first casualty was usually the steel pump handle, which could after some delay be repaired by welding. With the failure of the cylinder, however, for whatever reason, the pump is abandoned and the protective well cover is reopened with return to the old reliable bucket.
>
> The pumps furnished by UNICEF for this project are from a reliable English manufacturer, but they are of relatively light construction and were never intended for the heavy duty to which they are subjected at a public well in Rajasthan. During the emergency in Bihar and Uttar Pradesh last year (1968) a number of these pumps were transferred to that project. The report of the WHO consultant for the emergency well drilling project made note of the fact that the pumps were totally unsuitable and that failures occurred after one week of operation.
>
> With the long experience that India has had in hand pumps, including the development of indigenous heavy duty types, an occurrence of this type

> is indeed surprising. It is, in fact, difficult to divine why imported pumps had to be used for this programme.

When we began to report on failures of technology transfer a number of commentators expressed disbelief. Others, however, have rushed to support our evidence with their own experience. An engineer from the Republic of the Congo comments:

> In the light of our experience we feel that what the writers [Burton & Idelovitch[1]] say on this point is, unfortunately, largely true: frequently pumps and other equipment are out of service and villages are deprived of water because a pipe is broken and spare parts or fuel are not available.

The Brazzaville engineer goes on to state:

> Nevertheless, in numerous other cases things are properly done. However, we are convinced that oversophisticated technology should not be encouraged and wherever possible hand-operated equipment is preferable to automatic devices.

Confronted with the failure of the technology, the field engineers usually assume that the responsibility must lie with local factors. The efficacy of the technology is not open to question because it has been shown to work elsewhere. In effect we adopt the view that 'the technology is all right if only people would use it properly'. A Swedish engineer with considerable experience in East Africa writes:

> All the facts are already published; the technologies are already tested, the money is available (enough for the start at least), the needs are clearly illustrated, and the overall approach to be used is fairly well established.
>
> What is needed now is to get the politicians in the countries in question convinced of the needs, to push governments to allocate resources, to get close to the natives in rural areas, to start low-cost water supply development, to train people in villages for the running and maintenance of water supplies, and to meet slowly the demands of volume and quality of water.

I have only one important disagreement with this opinion, and that is about the technology. It is clear that the prescription of 'what is needed now' cannot be met very quickly. Politicians are often not responsive to the needs of their less powerful constituents or to the weaker sectors of the country. Governments are not easily persuaded to allocate resources to less productive activities. Water supplies are often the responsibility of the weaker ministries.

Contact with rural peoples is not easily achieved, and training and education is usually a slow process. The Swedish engineer is partly right, but if his diagnosis is the full story, then progress is likely to remain slow. The belief of the water engineers in the efficacy of modern technology in developing countries can be called into question.

A description of the situation in Thailand comes from Richard Frankel,[6] an engineer at the Asian Institute of Technology in Bangkok:

> To emulate the developed nations in providing potable water to rural communities, many nations have imported conventional water treatment (coagulation, sedimentation, rapid-sand filtration and chlorination) as a panacea for their rural health and water ills. For several reasons this has proved to be a disillusioning experience. Capital costs are high, and each plant must generally be tailored to a local set of conditions. This means that design and construction are time consuming and require well trained personnel. In Thailand operational difficulties in rural communities were found to be more numerous: laboratory equipment was not available for daily or weekly jar tests to determine proper chemical doses; operators were not sufficiently trained to perform or understand coagulation jar test results; chemical costs were expensive in rural areas and operators often tried to cut back on chemical use to reduce water treatment costs; chemicals ran short and ordering in advance or obtaining additional chemical deliveries on time was not always a simple task in distant communities; without proper dosages the chemical coagulation-sedimentation portions of the plant operated ineffectively with the result that turbidity loads were almost entirely handled by the rapid-sand filters; understanding of why or when to backwash the rapid-sand filter was generally not known; proper sizing of sand was often overlooked during construction in some areas; good sand was difficult to obtain; and lack of sufficient operating funds often curtailed use of chemicals and limited plant operation to 4–6 hours per day of discontinuous production. These difficulties leave village leaders and villagers alike feeling cheated and deceived when what they received was seemingly an out of place and unworkable technology.

The comments and cases cited do not stem from careful appraisals of national water programmes. Evaluation studies are sorely needed. Neither are the comments and cases cited isolated examples carefully selected to support a case. They do seem typical of much of the present effort. This conclusion is not arrived at easily or without the verification of our own field observations. To ignore it or to attempt to conceal it is unlikely to lead in fruitful new directions. Clearly the process of technology transfer is not working well. The

technology that is being transferred is inappropriate. To appreciate why this is so requires a description of a rather complex interlocking delivery system that seeks to provide safe water with modern technology and which also entails a set of economic and managerial requirements, with profound implications for education and research. Before highlighting some of the features of the delivery system I should stress that I am not going on to advocate the development of an intermediate technology which would be better than traditional, but not so good as modern or advanced. The idea that what is latest or newest is also necessarily best is not of much help. Rather the search must be for appropriate technology—appropriate, that is, to the needs and conditions of the people to be served. A measure of the success of a people in harnessing science and technology to their ends is not to be found in the degree of complexity or sophistication or newness of what is employed, but in the degree to which it preserves and enhances those values and qualities of life that are considered important. By this criterion the so-called advanced industrial nations cannot claim to be any further advanced. They are in need of appropriate technology as much as if not more than the developing countries.

AN INTERLOCKING DELIVERY SYSTEM

The technology with which we seek to solve the water supply problems for dispersed settlements, villages and small communities is inappropriate to local conditions and needs. It is often expensive to purchase and install; it has high demands for skilled operators and for skilled maintenance. It often relies heavily on spare parts which have to be imported and it therefore also requires a strong support organization that can ensure that parts and maintenance personnel are available when needed. Because it is costly, loans are required to finance it and revenues have to be raised to repay the loans. Thus the organization created for technical operation and maintenance must also include provision for administration and finance.

Such conditions are not easily met. Attempts are being made in many countries to establish or strengthen organizations charged with developing national programmes for rural water supply. Commonly they are struggling. Occasionally, they appear to be inspired by unusually able leadership, and to gain strong political support. They may do well for a while and then falter as the happy combination of circumstances changes.

The technology that is needed and would be appropriate often does not exist, and where it does exist is regarded with suspicion. The appropriate technology would be low-cost, made largely or entirely of locally available

materials, durable and capable of withstanding heavy use in tropical conditions, easy to operate and maintain, heavy in its use of labour rather than capital, and consistent and in harmony with local culture, social patterns and norms.[8] The closest approximation to such technology is to be found in traditional rather than modern systems. The traditional, however, is often suspect while the modern is prestigious.

Some efforts to develop the kind of technology needed have been made and are noted below. Mainly, however, the research centres and institutions in the Third World tend to concentrate their activities and their best talents on the more advanced and sophisticated areas of research, directed especially at metropolitan area problems. To do so is prestigious for the institution and helps to further the professional reputation and career of the research worker more than does corresponding work on appropriate technology for villages. The fact that such research clearly does not correspond to the needs in the nearby villages does not appear to act as a deterrent. That it is repeating or duplicating the research done in Europe or North America appears to be an incentive.

The same pattern is reflected in degree programmes and training courses. These are staffed by engineers steeped in the knowledge of modern water supply technology, and the students learn to adopt the fascination of their teachers for the new and sophisticated. The problem of devising technology appropriate to local needs appears unattractive and unrewarding.

The bias is strengthened and supported by the external sources of aid, who are anxious to see proved systems installed, and by the external consulting engineering firms often employed, who likewise advocate the adoption of what they know. The position is perfectly understandable since the alternative forms of more appropriate technology have not been developed and tested.

The system in which the developing countries, especially the rural areas and small communities, have become enmeshed has its roots in the success of the water supply industry in Europe and North America, coupled with a naive belief in the efficacy of modern technology when transformed into different societies and a failure to take sufficient care about the way that technology fits into or does not fit local conditions and needs. The system is perpetuated by universities and other educational institutions, by research organizations, by the international pattern of technical advice and financial aid, by the attitudes of engineers and by the aspirations of national leaders to have what appears to be the best. What is most lacking, however, is a set of proven alternatives. In the absence of such alternatives the present pattern will continue. It will provide high-quality water to a slowly and steadily growing number. Many will be left untouched for decades to come.

BREAKING-OUT

Efforts to break out of this pattern are being made and several should be briefly mentioned.

Through its programmes of research and development, WHO's Community Water Supply Unit is collecting data on existing situations; it is preparing manuals of practice, guidelines, design criteria and similar advisory material, and it is supporting fundamental research.[19] WHO has also established an International Reference Center for Community Water Supply in the Hague and through a network of collaborating institutions is disseminating information and helping to change the pattern of research priorities.[10] The WHO manual *Water Supply for Rural Areas and Small Communities* by Wagner & Lanoix[16] is the most widely used reference in the field and although somewhat out of date continues to exert a powerful influence.

The London-based Intermediate Technology Development Group has taken the traditional hafir (an excavated storage tank) from the Nile Valley and has attempted to improve it by lining the bottom and the walls and providing a cover. The lining used in an experimental project in Botswana is made from polythene tubing which is cut into lengths and filled with a sand–cement mixture to make sausage-shaped bricks.[9] About twelve of these improved tanks had been built in Botswana by July 1968, where they are used at schools for small-scale irrigation. There is potential in this design for drinking water storage.

Frankel and his associates at the Asia Institute of Technology, Bangkok, have been developing the use of local materials for filtration. Sand suitable for filtering has not been easy to obtain in Thailand and sand filters have encountered difficulties in operation. Experiments with alternative filter material have demonstrated the effectiveness of shredded coconut husks and burnt rice husks, both materials that can easily be obtained in quantity.[6]

Another approach is illustrated by Volunteers for International Technical Assistance, an organization based in Schenectady, New York, that has produced the well-known *Village Technology Handbook*.[15]

The support and encouragement that such efforts have received, however, has been pitifully small. The research and the information collection and dissemination that is going ahead is in need of strengthening and of redirection towards more appropriate forms of technology. If this can be done, there is a good chance that the world's basic water needs for domestic supply can be adequately met by the end of the century. Therein lies the hope of technology.

It is clear that there is no easy panacea, and the chances of success can be greatly improved if two other conditions could also be met. First the merits of

traditional technology should be more widely recognized, along with the ingenuity of those who use it and their capacity for making choices appropriate to their own social needs.[17] This requires a change in professional stance on the part of the engineers. Instead of seeing themselves as purveyors of the near-perfect, they must see their role as advisers and servants to a population not lacking in knowledge of what it wants, and better equipped than the engineers to know what is appropriate for them, and therefore what will work or not work. Imposed systems installed in a manner insensitive to local feeling are either doomed to failure or have to be operated and maintained at enormous expense without the cooperation of the users.[7] Innovations needed here include guidelines for the collection and input of social data into planning and design; the creation and testing of methods by which users can exercise choice among different improvements;[12] and studies to learn from and disseminate experience gained in the more advanced Latin American programmes, especially with respect to community participation in the construction and operation of projects.[4]

Second, the narrowness of financial and economic views imposes great restraints on progress. The long-established convention that water supply schemes should pay for themselves from the revenues generated by charging those served is a condition that cannot be met in most rural areas in developing countries. In realistic recognition of this circumstance there is a growing view that investments can be justified if the social benefits can be shown to exceed the costs. In effect we say that the actual revenues generated do not have to cover the costs so long as some economic measure can be made of the benefits. This view is leading to more studies of the improvement in health resulting from water supply schemes which seem entirely desirable, and to efforts to quantify the health improvements in monetary terms. The virtue of this latter exercise is more debatable, the more so if lack of quantified monetary benefits is used as a reason for not providing improvements in water supply. To recognize the provision of domestic water supply needs to all the world's people as a basic human right would shorten and simplify much of the economic debate. To deny the right when its attainment is within reach is to throw up roadblocks in the interest of rational allocation of resources, presumably to other more basic and essential requirements than safe drinking water.

If such a human right is recognized and if a local community role in the choice of technology is also recognized, then the potential of research and development becomes critical. It can help to ensure that a set of appropriate choices is available by blending the best of modern science with what is irreplaceable in the traditional way.

Discussion

Dieterich: In any situation where low-cost technology for water supply is to be introduced there is a technological minimum to be considered. For example, if water is to be brought from some distance, it has to be brought in pipes. However, even a minimum technology requires maintenance, and this is one of the major problems and may be more important than the cost per head. This is where one should begin, therefore. When a technological solution is being considered, simple as it may be, one should ask whether there are people ready to accept technology *per se* and ready to maintain the physical system. Technology fails when people cannot use it. The question of manpower therefore has to be stressed.

Victoria Garcia: I agree with you. We hope for too much from new technology, forgetting to put enough effort into people at the same time. Someone creates the technology, but others administer it, or are going to be the users. In some underdeveloped countries the technology is right even when we copy it from other countries, but we have an almost 'pathological' administration and a lack of education among the users that renders some technologies useless. That is why progress must go hand-in-hand with general education and with the application of the behavioural sciences. People are the most precious but also the most difficult resource to handle. We frequently lack people with managerial capacities or we don't know how to make the best use of them. On the other hand, the users are caught in the routine of their cultural background and they do not appreciate our efforts to change their behaviour.

Wiener: There is indeed a considerable problem of transferring models and approaches from the developed to the developing world. To me this unwarranted transfer is evident in everything the developed world has done in the developing world; and I am afraid it has failed almost everywhere. On the other hand, Professor Burton's assumption (I will call it the assumption of the 'noble savage') that people in the developing countries know instinctively how best to use their resources, although it has some truth in it, is also misleading. In my view, the water technologies of many rural communities today are a few thousand years behind the relevant contemporary technology. I would therefore not expect too much from traditional approaches. There is an analogy with the development of agricultural production: Professor Schultz[14] has shown that the traditional farmer, within the limits of his obsolete technology and the organizational framework, uses his resources very effectively. But the problem of rural development consists in helping the farmer to transcend these limits and introduce more up-to-date technology, inputs, and organization.

I would say the same for the 'noble savage' concept in rural water supplies. The villagers use the technology that they possess very effectively, but this does not mean that they should stick to this technology and confine themselves to improving it. There might be (and often are) much better answers which derive very little from what has been done in the past. I would, however, not like to dogmatize, since dogmatizing is wrong in both directions. We should adopt a flexible approach, recognizing the merits and disadvantages of the traditional and the new. In one situation we might find that some simple improvement of existing technology offers the best solution: in another area a completely different approach might be needed. As an example of the latter approach, an engineer who had worked for 15 years in the Sudan in rural water supplies told me that if he had to do the job again, he would not build local schemes depending on the active participation of village communities; he would rather rely on regional programmes with a minimum of local dependence. There is a whole range of solutions, from those relying completely on the rural community and its capacity, to those excluding it. I do not think there is a single valid answer. There is no Green Revolution for water!

Bradley: Professor Burton stressed the fact that some of the *apparently* unimproved supplies in rural areas might in fact be satisfactory. I came across one such instance in Sukumaland where, in spite of ten years of work on schistosomiasis, a traditional water improvement had been missed until very recently. The local people had a category of pond called a 'drinking pond' which they kept separate from other ponds. I analysed some field data, collected by Dr F. S. McCullough, on the use of these ponds and found that people who used only the drinking pond for their water supply, which quite a number of families did, had only half the amount of schistosomiasis that infected others who used both types of pond for drinking water. In a sense this supports the 'noble savage' idea. Practices of this sort are often very subtle, and may easily be missed. However, this is a very specialized example. To counterbalance it, I would say that in the control of communicable diseases, particularly schistosomiasis and malaria, no *effective* programme has demanded very much in the way of cooperation from the local people. In schistosomiasis control in general, no method or programme involving active participation has worked, and a number of programmes that did not require participation have worked.

Wolstenholme: You would have to exclude China from that generalization. There, the process of schistosomiasis control has depended very much on people's cooperation.

D. B. Jelliffe: I suspect that what I would like to call 'adaptive technology' is required in this field and in others too—that is, a culturally appropriate blend

of new technologies and traditional practices. It is very much a question of communications. What is considered right and appropriate to the twentieth century has unfortunately been conditioned by films and television. The problem is how to reverse this trend—how to shut this Pandora's box, if you like—which has led to a technomania where what is wanted at once is something which is technical, and preferably electronic. (Someone in a developing country might well ask why we haven't got barefoot doctors, barefoot engineers, or even barefoot conference-attenders in our part of the world!) Fortunately, many changes that are happening now in other, related areas may make this blend between the two approaches come about more naturally. Until recently, the idea of using auxiliaries in various medical fields was regarded as second-class, mud-hut medicine. The fact that this is now being accepted as a *universal* need, not only in developing countries, is very helpful. There are, in fact, many lessons to be learned from developing countries: on biological methods of child rearing, for example.[11] We have to realize that this is neither the wisdom of the ancients nor outdated superstition, but something between.

Nationalism can play a part in this synthesis of ancient practices and modern technology. People are naturally and understandably gratified, and may incorporate their older methods more easily into this synthesis, if they have also the additional propulsion of a feeling of nationalism.

Burton: The operation and maintenance of new technology are crucial, as has been stressed. We have built many systems in the last 20 years which have failed for lack of them. The reasons are manifold. It may be that a spare part is needed and has to be ordered, and it takes two years before the paper can be processed and the part delivered, by which time people have lost any interest in having it. It may be also for some of the reasons that Dr White suggested, that what is supplied is at variance with the perceptions of the local community, and the choice they would, if given the option, have preferred to exercise. It is certainly a question of a synthesis of what can be produced from the best available scientific and technical knowledge, using the traditional techniques, abilities and resources that are available. In many cases they are considerable. In Indian villages with water supply systems that are not functioning there are nevertheless people quite capable of repairing bicycles or transistor radios; so it is not that there is a total lack of knowledge of this sort. It may be there, but if it is not being applied, then there is some good reason why not.

A good deal of effort is required on this interface to get feedback, in two ways: from the national organization to the grass roots, and in terms of the utilization of the technology and better understanding of why it succeeds in some instances and fails in others. This has proved difficult, and an important

immediate task is to see whether rather careful studies of national experience can be made. There have been some such studies but they tend to be cursory, with a visiting team asking questions and given little choice but to believe what it is told. This treads on sensitive ground, because people in charge of national or local programmes are understandably not anxious to have their affairs looked into closely. Nevertheless, we could learn more from experience than we have allowed ourselves to do, and I would hope that perhaps international organizations active in this field would find ways of making appraisals that are not offensive, and can provide us with useful lessons from experience.

Evang: Professor Burton made the excellent point that it is not primarily a question of *supplying* water to people, because they are supplied with drinking water: without it they could not exist. It is the question of making safe the water which people are drinking, or taking in the form of food (because only part of the physiologically needed water is taken as water). Certain age-groups drink water in the form of milk, made by animals from impure water. One way of using unsafe water to produce safe water is through cows, goats, sheep partly, even camels. The only warmblooded animal which cannot do that is the human milk producer, who needs safe water to produce safe milk. (Of course to protect the finished product—milk—against contamination is another problem.) So if technically the very limited amounts of water which are needed physiologically can be separated from the enormous amounts of water used for other purposes, the whole problem will be different.

Lindblom: In this symposium we are necessarily limiting ourselves to water for domestic use, but I am afraid that we have also limited the projections into the future by restricting ourselves to present use and need patterns. If we try to extrapolate into the future, which we must do, we have to be aware that use and need patterns will alter.

This is particularly true for rural areas. The need for water in these areas depends on the development of agriculture. Today 70% of the water we use goes to agriculture and only 15% to domestic use. The rural areas of the world have to provide for the nutritional part of human health, a fact which we must also take into account. This puts even greater emphasis on the need of water for rural areas.

A. Eide: I wonder whether Professor Burton has found, in the rural areas, evidence of developments by which modern (Western) technology has allocated water in such a way as to create even greater difficulties for those operating a more traditional technology in water. In other words, I foresee some kind of accumulation of water, in the same way as one sees an accumulation of capital for purposes related to profit-seeking investment.

A more general comment concerns the World Bank. This is an institution

with its own logic. There may be a rhetoric, operating on the level of the Director, and it is possible that he has some 'crisis of conscience', looking at what has happened as a consequence of the kinds of project which the World Bank has supported. But the World Bank is an institution which has to have money paid back. A study[13] has been made at our institute of correlations between Western investment and trade on one hand, and the allocation of grants or other support from the World Bank, compared to that of the UN Development Programme, on the other, and there is a clear difference. Allocations from the World Bank are clearly correlated with the investment interests and trade interests of Western countries, whereas the Development Programme does not have this pattern. This is not a coincidence: it is because of the way the system operates. So I don't think we should expect too much of the rhetoric as long as the system is financed as it is now and as long as the decision-making processes of the World Bank are unchanged.

Burton: One can aggravate problems and situations by the way one goes about trying to improve them. Certainly there is need, in looking at how to improve a water supply system, to have some better understanding than is commonly now the case of how the change will interact with the structure of the community; what it will do to the distribution of wealth and power and influence within that community; and, if it brings about some change which is unacceptable, whether that will lead to the collapse of the proposed innovation, not only on the social side, but also on the environmental side. One can induce changes related to agriculture or the raising of livestock or other changes that will affect the demands placed by the community on the rest of the resources of the biosphere. There is need for adding those understandings into what is being done.

On the question of financing and the policies of the World Bank and the UNDP, in my opinion the kind of action that is needed does not require large amounts of capital funds for the purposes of construction. Apart from money for research and development, and for display and dissemination of information on the set of available choices, and manpower training, the resources are probably going to be available in most cases within the nation or even within the local community, with a little assistance here and there.

Mellander: I would like to bring up an example which is also an emergency situation—the drought in West Africa. What have the UN experts done, and how prepared are they to meet this situation? Has there been any planning for rapid alternatives like piping of water to this population, as we know can be done in military desert operations, or carrying water by trucks, or moving the population?

Wenche B. Eide: The FAO report[5] on the Sahelian zone makes some inter-

esting comments and proposals for *long-term* measures concerning water resources development which are also relevant to the theme of Professor Burton's paper. It states that one of the most immediate and pressing issues of livestock and agricultural development of the drought-stricken African Sahel remains the provision of watering points. It says that the main reason for the lack of progress in making rural water supplies generally available is the disproportionate amount of attention paid to development techniques which require large expenditures, such as drilling of deep wells and expensive surface structures. Much work has been undertaken rather haphazardly, without considering other environmental factors; without coordination between the various national water supply services; or following an approach which pays insufficient attention to the integrated use of surface and sub-surface water resources. On the other hand, supply works once completed have not been kept operational and they frequently depend for their maintenance on distant centres or even the capital city. Above all, the report comments that the importance of ensuring the water users' interest and participation from the start has not been given adequate consideration. This gives a very good example of what can happen, and bears out what Professor Burton has been saying.

Querido: We discussed earlier the question of looking for resources which can be shifted from the élite to general public affairs (pp. 6, 12). One can do it, as Dr Evang suggested, by increasing taxes, but unfortunately the same élite is sitting in the offices that enact those laws or collect the money. I have often wondered what made *us* in the West make these changes in the second half of the 19th century, because we may have been as unwilling to do something for our fellow citizens as others are now. Possibly people then were afraid of catching infectious diseases from others, and so were prepared to go to the expense of protecting them? There are probably other reasons too but it could be worth investigating that historical situation.

Dr Burton's paper impressed me but it also left me with the feeling that one cannot do much at the moment. From my experience also I have realized that we frequently take for granted that basic provisions necessary for a project are present when in fact they are not. Then one discovers that the necessary infrastructure is not there, like a water system in which you turn a tap but nothing comes out. I wonder whether there is a relation between the GNP and the level of infrastructure at which one can *expect* a water system to work? It may be that at a GNP of $100 per head you will never find an infrastructure that will provide this. Perhaps at $300 the administrative and educational structure reaches the level at which it can make a piped water system work. It may be that in the 1880's the West was at that level, and for that reason could make the innovations. If these considerations are correct one may be

able to classify infrastructure levels, so that one could divide countries into those where you might be successful and those where you will not be, with a particular project.

D. B. Jelliffe: I have thought along similar lines in relation to why mortality rates have changed in different countries at different times. These situations could perhaps be regarded as historical 'experiments of nature'. It could be valuable to make an analysis of the background of different Western countries to see how these changes came about.

Cvjetanović: We studied infant mortality from diarrhoeal diseases, comparing the evolution of the disease during this century in the United States with its evolution in various other countries.[3] It is fascinating to see that infant mortality and diarrhoeal diseases, and some other diseases, are declining at present in developing countries in exactly the same way as they did some forty or fifty years ago in the US. It seems that there is some general rule of the effect of development on disease incidence.

Llewelyn-Davies: In Britain there is a fascinating history attached to 19th-century paternalistic improvements in the lot of the working classes, as it was seen. Jeremy Bentham and others laid the foundations of an attitude and approach to the whole question of social provision which has persisted rather strongly and has had a wider effect than in Britain alone. This is a complex historical concern: it rationalizes the provision of water and medicine in terms of increasing the profitability of industry in a rather elegant manner. I doubt if it has much analogy to the present problems of the developing world, however.

Lindblom: The most significant social change, seen demographically, during this century, is the rapid decrease in mortality since the Second World War, which is ascribable to the application of new medical technologies. In a sense, we have got quite a lot for the small amount of money we were talking about earlier: we have doubled the population! And that is one reason, and a major reason, why we have so many other health problems.

We have now to take a long-range perspective and in doing so we will become aware that medicine and health engineering have a relatively insignificant influence as compared with providing the coming generations with an adequate quantity and quality of water and food.

Incidentally, and referring to Professor Querido's point about what had been done, we tend here to omit a large group of people—ourselves. We talk about the developing world and about physical diseases. In the industrialized world we are creating *mental* diseases due to the society and type of production we have created. Stress or other types of mental disease are common in our developed society, which may manifest itself as abuse of alcohol or drugs.

We have to take into account that this lack of mental health could in a couple of decades be transmitted to the developing world.

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Water supplies: the consequences of change

DAVID J. BRADLEY

The preceding chapters have reviewed the present state of world water supplies and have shown how many people lack anything more than a minimal supply of dirty water. They have suggested means of improving the situation. Resources for improvements are limited and therefore the benefits of change must be assessed. The improvements suggested range from the provision of ample safe supplies to a small proportion of the population to the very gradual improvement of the water available to a larger proportion. These are clearly extremes and are not viewed as goals in so simple a form by any group. Nevertheless, traditional thinking on water supplies has tended to the first alternative, while urgency and social justice are making us begin to look at the second. The improvements proposed raise three main questions. The first is more relevant to traditional water engineering, the second is relevant to the alternative approach put forward at this symposium, and the third question is one that needs to be asked of any environmental alteration. These questions are:

(1) What benefits could be expected if everyone were provided with ample safe water or, conversely, what is the present total social cost of unimproved supplies in terms of health and social organization?

(2) What is the shape of the curve relating improved supplies to benefits? If partial improvements are made, such as a doubling of the volume available to each person, what benefits follow and what water-related diseases remain?

(3) What other consequences, often unlooked for, may follow change in water supplies? Few changes in the environment fail to have consequences other than those intended, and these also need consideration.

There is the usual paradoxical situation in developing countries that, because resources are so scarce, it is necessary to have a far more detailed knowledge of the relative cost and benefits of partial improvements than is needed in in-

dustrial richer countries. Yet data are extremely meagre. The overall social cost of poor water supplies has not been determined for any community in the world, so that neither precise local statement nor generalization about the globe is possible. However, there is some understanding of the different components of the cost in terms of ill-health from poor water supplies and of the variables likely to affect these components and to affect attempts at improvement.

DISEASES RELATED TO WATER

Some adverse effects of water are due to chemical substances in it, but in general these effects are mainly noticed in industrial countries where infectious diseases have largely been overcome. The great part of water-related disease in developing countries is infective and will be considered here. It is unhelpful to classify the infections by the taxonomy of the agent—viral, bacterial, protozoal —and they are subdivided here according to the likely effect of changes in water supply. There are four categories (Table 1).

Two aspects of water supplies can be improved independently of each other: quality and quantity. Each has its own associated disease changes (categories I and II). Then there are infections which can multiply at the water source (III), and lastly there are infections carried by vectors which depend on the water supplies (category IV).

I. Waterborne diseases

The most dramatic falls in the incidence of disease after the microbiological *quality* of urban supplies has been improved have been seen in the classical waterborne infections, typhoid and cholera (Table 1). These have been the preoccupation of municipal suppliers in temperate lands and thus have come to dominate thinking about water supply and the training of public health engineers. They are unusual infections in that the minimal infective dose of organisms is very low, so that even after extreme dilution of the infective material, transmission still occurs. The size of the epidemic that results from the contaminated water largely depends on the number of consumers. As the degree of faecal pollution of water increases it may become possible for microbes with a higher minimal infective dose to be transmitted. Paratyphoid fever and possibly hepatitis are in this category. Since such a degree of pollution is intolerable in a municipal source, these infections are only likely to be

TABLE 1

Classification of infective diseases in relation to water supplies

Category	*Examples*	*Relevant water improvements*
I Waterborne infections		
(a) Classical	Typhoid, cholera	Microbiological sterility
(b) Non-classical	Infective hepatitis	Microbiological improvement
II Water-washed infections		
(a) Skin and eyes	Scabies, trachoma	Greater volume available
(b) Diarrhoeal diseases	Bacillary dysentery	Greater volume available
III Water-based infections		
(a) Penetrating skin	Schistosomiasis	Protection of user
(b) Ingested	Guinea worm	Protection of source
IV Infections with water-related insect vectors		
(a) Biting near water	Sleeping sickness	Water piped from source
(b) Breeding in water	Yellow fever	Water piped to site of use

waterborne in small undeveloped communities. Also, since the way to demonstrate spread by water is through a point-source epidemic, it is hard to prove this method of dissemination. Mosley[6] has shown how difficult it is to prove that any sporadic disease is waterborne, even under ideal conditions in North America.

II. Water-washed diseases

There are many infections, especially in the tropics, which decrease markedly when the *volume* of water available for washing and personal hygiene is increased. For this purpose the water need not be free of bacteria. Most of these infections are of the gastrointestinal tract or of the skin.

The diarrhoeal diseases are immensely important as causes of death, especially in very young children. Although sometimes these may be spread by polluted water, it seems clear that many of these infections are not waterborne in any strict sense.[9] Moreover, several studies have shown that they decrease with proximity to a water source and are relatively unaffected by its microbiological quality.[4,10]

Cutaneous infections are even more widespread, with a prevalence of over 70% in schoolchildren in Ankole, in Uganda.[1] Skin sepsis due to bacteria, scabies and cutaneous fungal infections is commonly found. More serious but less frequent are leprosy and yaws, while trachoma, an eye infection often producing blindness, is also reduced when adequate water is available.[7]

III. Water-based diseases

Several parasitic worms depend on aquatic intermediate hosts. Eggs or larvae from infected people may reach the water and infect the intermediate host, and after a time large numbers of larvae infective to man will be present in the water. Two examples are schistosomiasis and the guinea worm. The schistosome larvae develop in some aquatic snails and the infective cercariae invade man through his skin. The guinea-worm larvae escape from man by way of lesions on his leg and develop in small aquatic crustacea. Man is reinfected by drinking water that contains the intermediate hosts. Infections produced by these helminths differ from the all-or-none waterborne infections of category I in that the infection can build up: a hundred schistosomes are worse in their effects than ten, and even in small communities the worm burdens can build up if the source is polluted.

IV. Water-related insect vectors of disease

The insects which transmit several major tropical infections are related to water in one of two ways. Mosquitoes which carry malaria and *Simulium* which transmits onchocerciasis breed in water. The mosquito vector of urban yellow fever in Cuba bred in the containers used for storing domestic water. Other insects, particularly the tsetse flies *(Glossina)* of the *palpalis* group, preferentially bite near water and may transmit sleeping sickness to those coming to fetch water.

HOW FAR IS DISEASE RELATED TO WATER ?

The preceding section has shown how two aspects of water supplies may affect health—volume, and 'purity' or safety. Each factor will affect particular infections, and thus the overall amount of water-related disease in a place, in a quantitative manner. The general case is shown in Fig. 1. Initially we consider the points *A* and *M*.

The size of *A* indicates the amount of water-related disease. A field study designed to determine this directly needs to include an assessment of the disease in a community or group of communities, the provision of ample safe water for half of the people and then, after a period of readjustment, a second survey of the whole group. No really satisfactory study of this type has been done, the nearest approach being in Zaina, in Kenya.[2,11] The conclusions

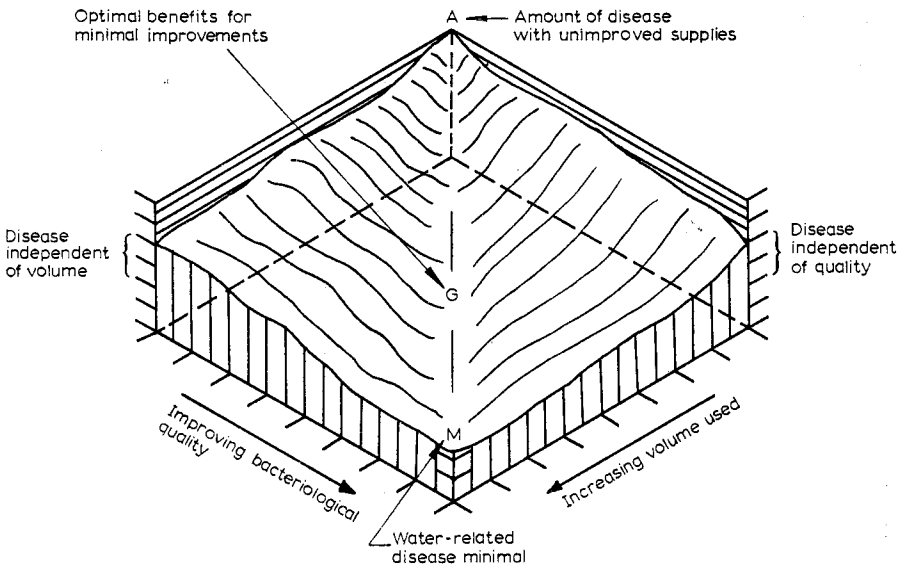

FIG. 1. The generalized relation between volume and quality of water supplies and the burden of water-related disease. *A* is the amount of disease with unimproved supplies. At *M*, water-related disease is minimal. At *G*, optimal benefits are obtained for minimal improvements.

are open to criticism[15], but they suggested that water-related disease was of limited importance, causing about a day's illness annually in adults, although more in young children.

Calculations have been made of the extent of water-related diseases among conditions reported from hospitals in East Africa. Diseases carried by water-related insect vectors and unlikely to be affected by improved supplies, such as malaria, have been omitted. About 12% of deaths and of in-patient diagnoses are due to water-related infections, whereas 22% of out-patient diagnoses are of such infections.

It is well known that, even with ideal water supplies, few infections vanish, with the possible exception of guinea worm, and therefore estimates of *M*, the residual disease from water-related categories, are needed. Studies in the southern USA suggest that half to three-quarters of the prevalence of dysentery bacilli and of roundworms *(Ascaris)* is due to inadequate water supplies.[8,14] Van Zijl[12] drew similar conclusions for bacillary dysentery in the Sudan, but found little change in the overall incidence of diarrhoea with improved supplies. Data collected over many years from American cities showed that the provision of safe water was accompanied by a 90% fall in the incidence of typhoid, but

TABLE 2

Main infective diseases in relation to water supplies

Category	*Disease*	*Frequency*	*Severity*	*Chronicity*	*% reduction by water improvements*
Ia	Cholera	+	+++		90
Ia	Typhoid	++	+++		80
Ia	Leptospirosis	±	++		80
Ia	Tularaemia		++		40?
Ib	Paratyphoid	+	++		40
Ib	Infective hepatitis	++	+++	+	10?
Ib	Some enteroviruses	++	+		10?
Ia, IIb	Bacillary dysentery	++	+++		50
Ia, IIb	Amoebic dysentery	+	++	++	50
Ib, IIb	Gastroenteritis	+++	+++		50
IIa	Skin sepsis and ulcers	+++	+	+	50
IIa	Trachoma	+++	++	++	60
IIa	Conjunctivitis	++	+	+	70
IIa	Scabies	++	+	+	80
IIa	Yaws	+	++	+	70
IIa	Leprosy	++	++	++	50
IIa	Tinea	+	+		50
IIa	Louseborne fevers		+++		40
IIb	Diarrhoeal diseases	+++	+++		50
IIb	Ascariasis	+++	+	+	40
IIIa	Schistosomiasis	++	++	++	60
IIIb	Guinea worm	++	++	+	100
IVa	Gambian sleeping sickness	+	+++	+	80
IVb	Onchocerciasis	++	++	++	20?
IVb	Yellow fever	+	+++		10?

again there was little change in the incidence of diarrhoeal diseases overall.[13] The available evidence suggests that in the tropics typhoid is less dependent on water for transmission in the rural areas than it is in towns.

Table 2 gives an estimate of the effect of ample safe water on the incidence of the main water-related infections. When this information is combined with data from hospitals on the presentation of these infections in East Africa it suggests that 6% of deaths and in-patient treatment and 11% of out-patient work could be abolished by good water supplies, quite apart from the effect on trivial ailments and on non-medical aspects of life (Table 3).

If, as has been suggested in earlier chapters, the aim is to provide safer water for many rather than safe water for few, how safe need it be? The shape of the curve relating bacteriological quality and the disease-cost of water is crucial, but unknown. There are probably three steps in the curve. A very small

TABLE 3

Estimated proportions (%) of hospital diagnoses due to water-related diseases in East Africa

	Deaths	*In-patients*	*Out-patients*
Water-related diagnoses in East Africa	11.2	11.8	20.9
Disease preventable by improved water:			
East Africa	5.9	6.1	10.9
Kenya	6.2	5.4	11.4
Uganda	5.8	5.1	8.2
Tanzania	5.6	7.6	12.3

reduction in pollution is likely to eliminate the non-classical waterborne diseases of Table 1. A further effort, usually by means of specific improvements aimed at a locally prevalent infection, will often reduce the water-based diseases (category III) as far as is possible by domestic water improvements. Removing the chance of an outbreak of one of the classical waterborne diseases is more difficult. Short of a filtered chlorinated supply all the time, complete safety is not possible. Improved bacteriological quality of water will be related to a decreased frequency of outbreaks. The size of any outbreak will depend on the number of people sharing the common water source. Thus it becomes of crucial importance in large towns and cities. In rural areas, improvement of the source may have a paradoxical effect. If most families have separate but polluted sources, the frequency of waterborne disease outbreaks may be high, but the scale of each epidemic is small. Partial improvement of some water sources may concentrate use on the improved ones, so that epidemics are much rarer but much larger when they occur. This illustrates the influence of community size or 'the geometry of living' on the relative importance of different improvements.

Where the population density rises, whether in towns or in some densely inhabited rural areas, safety becomes of greater relative importance.

HOW MUCH WATER IS NEEDED TO PREVENT DISEASE?

The water-washed diseases are of two main types (Table 1, p. 83). The bulk of such diseases as seen in the out-patient clinic are superficial infections of the skin and eyes. These reach their peak in dry areas where there is both a scarcity of water for washing and a dusty environment, though a generally insanitary habitat makes matters worse. These infections are clearly of the water-washed category and will diminish with a more accessible water supply of greater

TABLE 4

The variable needs and dangers related to water in different habitats in developing countries

	Urban area High density	*Rural area Arid*	*Highland humid*	*Lowland humid*
Habitat features:				
High temperature	+	++	-	++
Rainfall	+	-	++	++
Slope			++	-
Population density	+++	++	++	+
Distance to water	+	+++	++	+
Source pollution	+++	++	+	++
Disease hazards:				
Waterborne	+++	+	+	+
Water-washed skin	+	+++	+	+
Water-washed diarrhoeal	+++	+++	++	++
Water-based	+	+++	+	+
Insect vectors	+	++	++	+
Needs:				
Moderate purity	+++	++	++	++
Great purity	+++			
Increased accessibility	++	+++	++	++
New sources		+++		

volume, even in the absence of any change in water quality. The diarrhoeal diseases also decrease when water supplies are made more accessible. The precise causative agents of these diseases are in many cases far from clear and other factors than water are also important, so that prevalence varies between areas with comparable water supplies. A hot, dry climate and an insanitary environment particularly favour the diarrhoeal diseases, which therefore flourish in crowded urban and arid rural places (Table 4).

How much water is enough? Very few data exist on this question, which is crucial to the engineer and to our subject. If man has a right to water, how much does he have a right to? Two litres per day is clearly too little, and 500 litres per head daily, though it allows him to take a deep bath, to water his lawn and to wash any car he may have, is undoubtedly a luxury rather than a right. In East Africa there is a wide variation in the volume used: it varies from 1.4 to 48 litres where it has to be carried, and from 11 to 660 litres per head daily among those with piped connections.[15]

The only precise studies relating volume of water used to disease were made in parts of California where dysentery caused by *Shigella* is very prevalent.

These studies[4,14] all showed that, although all types of sanitary improvement tended to decrease the prevalence of *Shigella*, the big reduction came when water was available inside the house, rather than nearby outside. Our own observations in East Africa have shown that water use does not significantly increase when the distance to the water point changes, provided that it is not more than a mile away and is not inside the house.

A shower, or some similar washing facility, also seems to improve health. There is, however, no good evidence that, once each family has a tap and shower, further increases in water supply facilities appreciably affect health.

Although the evidence given here suggests that a large amount of disease results from poor water supplies, improvements in supply have not always produced the benefits hoped for. The best results from improving supplies have accompanied general material progress in a community. The effects of an isolated improvement in water have been less marked. In the absence of education the supply may be misused and, where technical facilities are undeveloped, maintenance is unreliable.

QUANTIFYING THE RELATIONS BETWEEN CHANGES IN WATER SUPPLY AND HEALTH

I have shown that many diseases are affected by changes in water supply, and in different ways. Some infections are altered most by changing the quality of water and others by increasing the availability of the supply. The threshold for an effect of improvements, and the form of the relation between water quality and the incidence of a disease, will depend on the particular infection and environment.

Practicable improvements to water supplies, though diverse, are not a continuous series. Each possible improvement will produce specific changes in the quantity and quality of water supplied. It is necessary, however, to reduce this diversity of diseases and supplies to something of more practicable use, and to do this we have reduced improvements to six categories: individual family improvements, group local improvements, rural pipelines, standpipes giving safe water, single tap, and multiple-tap systems. Fig. 2 shows, for four types of community (see also Table 4), the approximate costs of improvements per head in each category appropriate to that environment. Similarly, the disease-costs to the community have been estimated for each habitat and improvement level, on an arbitrary scale on which 100 units is the disease-cost of unimproved supplies in a semi-arid tropical area, and ample pure water provides a disease-cost of 0 units. Clearly such estimates are only approximate; yet they serve to integrate available information.

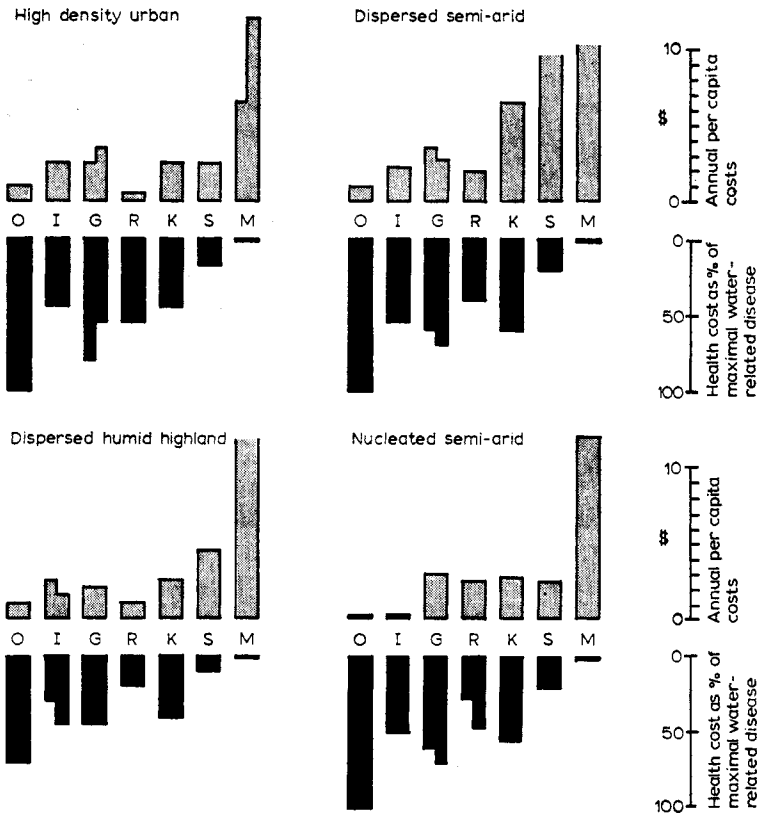

FIG. 2. The diversity of disease-costs and the variable benefits resulting from different improvements to water supplies in four different habitats in developing countries.

Improvement categories: O, nil; I, individual; G, small group improvement; R, rural pipelines; K, kiosk or municipal standpipe; S, single tap in house; M, multiple taps in house.

Three general conclusions may be drawn from Fig. 2. First, not all improvements of comparable cost produce similar benefits. Secondly, similar improvements in different habitats may have different effects on health. Thirdly, the relation between the costs of improvements and the health benefits is by no means linear. Where resources are limited, so that the long-term goal of ample safe water cannot be achieved in the near future, there is a wide range of partial improvements and the locally optimal improvements will show considerable diversity over a country. The best water improvements, at any rate in rural areas, require the combination of high-quality advice and operational

flexibility recommended by White (see pp. 35-51). What is epidemiologically desirable fits well to a decentralized approach.

INDIRECT CONSEQUENCES OF CHANGES IN WATER SUPPLIES

The indirect consequences of improved water, outside health benefits, also depend on the environment. After the first litre or two, the water used is not consumed, and waste water requires disposal. This raises no problems in arid rural places but in urban areas disposal may necessitate a sewerage system. This may sometimes be avoided if each family has only a single tap and shower, especially if use is controlled by a limited-volume valve, such as the Fordilla valve. However, if drainage is to pits or septic tanks, care must be taken to avoid polluting the water sources.

The economic benefits of good water supplies have sometimes been overstated, and it is doubtful if the growth of industries is often dependent on them. Farming in arid zones is often limited by water, and water storage for both livestock and people together may be developed. However, a domestic supply may be used for livestock when this was not intended by the engineer and may permit temporary overstocking in arid zones, with consequent harmful long-term effects.

A major problem in many developing countries is to persuade the better-educated and more able citizens to live in rural areas. So far as water supplies provide amenities comparable to those in cities, this may happen, though such an effect has not been measured. Parallel developments in other directions must presumably accompany this change.

ACKNOWLEDGEMENTS

The author is grateful to Gilbert F. White and Anne U. White for many comments and for the improvement cost calculations for Fig. 2; also to the International Development Research Center seminar members over two years for various comments.

Discussion

D. B. Jelliffe: I have wondered whether one could use *dermatological markers* of the availability of water and sanitation.[5] It has been my impression in many parts of the world that one can almost tell that in a community with a high percentage of scabies, or molluscum contagiosum, and certain other conditions

in children, also tropical ulcer, and perhaps carcinoma of the penis in adult men, water is probably in extremely short supply.

Another condition which might be added to the list of water-related diseases is malnutrition in young children. While the prime cause of malnutrition is dietetic, the infective aspects are sometimes underestimated and some of these, as Dr Bradley has indicated, especially gastroenteritis and diarrhoeal diseases, are much related to water supply. Even skin sepsis, which in a young child can be the result of infected scabies, can be the last metabolic straw pushing the child into overt malnutrition.

Tewari: On a recent visit I made to the Solomon Islands it was strikingly evident, going from island to island, how closely related were availability of water, skin conditions, the nutritional level of the children, and, incidentally, school attendance figures. A lot of scabies and *Tinea* infestations immediately suggested that an island was very short of water. At the same economic level in other islands one saw children who were without skin conditions, were better nourished, and had much better school attendance records. These places had better water supplies.

Evang: The grouping of diseases into four categories in relation to water is something I have not seen before and is most interesting. I wonder why you didn't include filariasis, Dr Bradley? I was taught that the mosquito, which is the vector, only multiplies on the roots of *Pistia* which grows only in water.

Bradley: I had to draw a line somewhere between domestic water supplies and the presence of surface water in general. I left filariasis out, mainly because in East Africa its incidence is more related to sewage and in parts of the East to drainage water; *Culex fatigans* tends to breed in the high water table areas where there are pit latrines, rather than in the water supplies.

Geigy: You could also add Rhodesian sleeping-sickness to the list of water-related diseases. Many wild animals act as a reservoir of sleeping-sickness. In East Africa people fetching domestic water may use water holes very close to where kongonis, water bucks, lions, hyenas, bush buck and so on drink. In tests on human volunteers we have found that the foci of disease in the Serengeti are related to such game: the same has been observed near Lake Victoria.

Bradley: One has to be careful here, because the tsetse fly which usually transmits Rhodesian sleeping-sickness has a wide range through the countryside. I think that if one hoped that this disease would vanish if water supplies were improved, one might be misled. One would probably reduce the incidence.

Evang: Dr Bradley, do I understand that you feel that having even one tap in a house, together with one means of washing the whole body, does not require a sewage system? That seems to be contrary to what most sanitary experts would say.

Bradley: This is an arguable point. It depends very much on the density of housing. Also, I was considering circumstances with a regulator on the tap so that large volumes could not be drawn at once. There are various methods for doing this. Even with a shower attachment which has been devised to go with this regulator, the total volume used may not be large, but it is made available exactly where it is needed. My impression from the literature is that in a number of looser peri-urban agglomerations and small towns and villages in many climates one could manage without waterborne sewage at that level of supply.

Tewari: I am not sure that sanitation is not essential. In India, for example, the population at risk from filariasis has increased from about 20 million to over 125 million over 15 years as a result of improved water supplies without supporting drainage systems. One wonders whether, having met a certain minimum quantitative requirement for water, further investment would be most justified in improving the quality or quantity of water, or in trying to combine it with sanitation or drainage facilities. Perhaps studies are needed to discover whether there is a critical point beyond which investment in a particular direction would be more fruitful and profitable.

Bradley: Certainly the volume must be regulated if drainage systems are not installed. The cut-off point at which one must put in a sewage scheme, or some form of coping with waste water, will depend on the geology of the substratum, the level of the water table, and many factors like that. I don't think one could make a general quantitative statement on this without misleading people. In fact, the generalization that can be drawn from our studies is really that one *cannot* generalize and there is only a specific answer for a specific place. There is a great variation in disease-cost and in the pattern of its response to different improvements in different areas. There is also variation in the cost of different improvements. If one was starting a series of self-help projects in a country like Tanzania it would be reasonable to divide the country into five or six ecological zones, for which one could do this sort of analysis and come to conclusions which would be the basis of advice given on request to local communities. On present knowledge there would still be a large margin of error. It may be that a particular community solution is not possible for other reasons and that different methods which might be tackled by the individual have to be considered. No country has yet offered help in providing corrugated iron roofs, or guttering for corrugated iron roofs, which certainly in some areas of Africa (not the very dry ones) can answer the water supply needs for the whole year: parts of Uganda,for instance. A vast storage capacity is not needed in such areas.

Burton: One implication of what you are saying in relation to the category

of water-washed diseases, and perhaps some of the others too, particularly with respect to some of the smaller rural communities, is that it looks, on the basis of rather slender evidence, as if substantial improvements to health are only to be gained by providing at least one tap per house. This raises two questions: firstly, how confident do you feel about that diagnosis and would it give us reason to feel discouraged about making much less ambitious improvements? And secondly, related to that, is there some point in beginning improvements that are less ambitious in the hope that they may produce more effect on health than we now suspect they would, or that in taking that step we shall start a community along the road towards having a different perspective, perhaps a different perception, of the relationship between water and health? In other words, what are the implications of this in terms of what we should be trying to do, in the operation and design of programmes and in research? Is this something we should push very hard on, in research, to try to firm up the basic understandings that we now have or the knowledge on which our present policies are based?

Bradley: The evidence that single-tap supplies cause the biggest jump in health benefits is indirect and suggestive, certainly not conclusive. Even if it were, this should not in any way discourage less ambitious improvements.

The single-tap issue is particularly relevant to the choice in urban and peri-urban installations between standpipes and single taps. We[15] have shown that these are of comparable cost—certainly less different in cost than is often assumed—and since taps give much greater benefits they are to be preferred over standpipes wherever possible. Such taps need a regulatory valve to limit wastage.

Less ambitious improvements may be far less expensive and yet produce appreciable benefits, particularly in rural areas. Clearly, funds are not available to provide taps for very many homes with unimproved supplies and these lesser changes would help the inhabitants a good deal. Although consumption is generally little altered when the water source is brought nearer the home from a kilometre down to a hundred metres or so, under extreme circumstances, such as the very arid Sahelian zone of Northern Nigeria where people may have to go eight kilometres for water, by bringing water just a little nearer you may alter consumption.

Professor Burton's additional reason for beginning small changes is an important one. Education is a slow process, and if one starts doing anything, provided it is done *with* the people, it begins to alter people's perception of their water supplies. If you protect a spring, I am not sure how often it makes much difference to health, but it does begin to raise the question of *why* it is being done, and it can act as a focus for people beginning to talk. It has a value at that level.

The implications for research of our relative ignorance about the quantitative relations between water use and purity on the one hand and disease on the other are straightforward. If governments wish to have a rational basis for making choices between alternative water improvements, then these relations need to be determined.

Cockburn: There are very simple methods of improving water supplies and making an impact on health, in terms not so much of quantity as of quality of water. Dr Cvjetanović and I, working on typhoid in Yugoslavia, found in use there an extremely simple method of chlorinating the unpurified water, by running chlorine into the pipe as it came out of the sewage-polluted river. This was sufficient to control typhoid for a long period. Only when a flood occurred and the system broke down was there an epidemic. Again, in Guyana, typhoid was highly endemic and the biggest difference to its incidence was made by running pipes along the coast with reasonably well-chlorinated water and setting up standpipes at intervals. The value of the measure depends on the epidemiological situation.

Geigy: In Ifakara, a small town in the Ulanga district of Tanzania, 30 years ago there was practically no water supply; people used water holes—wells—between their houses, and there was a lot of opportunity for contamination. Then the missions made their own water supply and later constructed two central water places where everyone went for water. The records of the mission hospital show the enormous improvement which can follow when one or two places are provided with clean water. And people use these wells; they prefer this water.

Again, in Madagascar we carried out a schistosomiasis project in a cotton plantation. People were not allowed to take water from the irrigation system; we made them special wells. There has been practically no infection with schistosomiasis in this plantation for five years now. This again shows that an improvement can be made by rather simple means.

Pirie: On these simple methods of making drinking water, Dr Evang (p. 74) praised the cow as a filter but it is an extremely wasteful one. You obtain only one-tenth of the volume of water as milk. By contrast, an arid-land plant such as an agave gives an enormous amount of water. One can scoop out ten litres of liquid a day and drink that. Palm trees have the same use. One shouldn't forget that in the Middle Ages in Europe hardly anybody drank *water:* they drank a weak beer, and yeast is very effective at cleaning up many waterborne bacteria. What interests me is that the Greeks drank wine mixed with water, and I wonder why they did not mix grape juice with water first of all, because they would have got a bigger volume of cleaner water, although a much weaker wine! One wonders if this technique is now used anywhere.

Wolstenholme: Early travellers in Ethiopia described how people put honeycombs in baskets into trees; the bees filled them with honey until they became so heavy that the boughs broke and fell into the ponds in the rainy season, and in no time one had a sweet fermented liquor, tej, which is still a national drink.

Bradley: The largest epidemic of typhoid that I have seen was in Kigezi, where people usually *did* drink a fermented liquor, made from ditchwater.

Pirie: And they survived?

Bradley: Some didn't! However, it does look as though in certain parts of rural Africa typhoid is *not* primarily transmitted by water, but it is very difficult to prove a negative, and I am not sure what the vehicle of transmission is.

D. B. Jelliffe: If we are looking for traditional or biological methods of saving and purifying water, we should consider the mother, not only the cow. While the mother *can* be overwhelmed by cholera or other severe pathogens, she has become accustomed internally to the local bacterial flora; and the supply of fluid in the form of human milk is a supply and demand phenomenon, as far as the breast-feeding baby is concerned. What is more, the sucking of the breast leads to the secretion of the pituitary hormone, prolactin, which is not only the main hormone stimulating the secretion of human milk, but also has an antidiuretic effect. Therefore, the mother not only is a purifier of the local water, but is also an extraordinary water-saving mechanism.

Cvjetanović: We have discussed the relatively small improvements that can make a considerable difference to the incidence of waterborne diseases. We made a study of bacterial *air* pollution in rural and urban areas of Upper Volta and Mali, to see whether environmental factors were influencing the incidence of epidemics of cerebrospinal meningitis there. We compared the numbers of airborne bacteria inside different kinds of houses, and found five times as many bacteria in air samples from houses of the Bobo tribe, which are low, square, beaten-earth huts, as from the houses of the Toussian tribe, which are round huts with high thatched roofs. There were also many more cases of meningitis among people living in the former, badly ventilated houses. In Mali too there were ten times as many airborne bacteria in simple earth houses as in houses with large window and door openings, and the incidence of meningitis was in direct proportion to the bacterial air pollution. This study[3] was published but there was no action and little concern about doing something to improve housing, in order to reduce the epidemics. I think people have a right to know the facts, where they exist, and to benefit from them. This knowledge could lead to considerable improvements in health.

White: Returning to the subject of water, I hope, as I look back over this section of the symposium and our review of the obstacles to improved water

supply (whether it be considered a 'right' or not), that we have not laid so much emphasis on the obstacles that we have overlooked the opportunities. We have recognized that there have been instances of rapid change, and that there are some clear opportunities, from the technological and managerial sides. We should also recognize that even though we are not certain about the point on the curve of quantity of water that is significant for effects on health, and even though outstanding cases of success and failure have not been adequately analysed, we have nevertheless accumulated a good deal of experience that points to a wide range of possible activities, centring on the reorientation of the view of the scientific and professional and intermediate workers. These activities promise early changes in the situation at a very different rate from that of recent decades.

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The food potential

N. W. PIRIE

For the foreseeable future, agriculture is likely to remain the main supplier of food, national rivalries are likely to make it hazardous for one country to depend on another for its basic foods, and the countries where population increase is most probable are those least likely to be able to pay for food imports. It is reasonable therefore to pay particular attention to foods that could be made by technically unsophisticated methods from local products for local use. This chapter is mainly concerned with the increased food production that could be achieved if existing knowledge were more fully used, but unexploited possibilities are commented on at a few points.

LIMITING FACTORS IN AGRICULTURE

The concept of a 'limiting factor' can be misleading if applied woodenly: but the concept is convenient and clarifies discussion in much the same way that a metaphor or analogy does. The yield of edible matter produced by a plant depends on the adequacy of the water and fertilizer supply, on the capacity of the plant to respond to good conditions, and on the extent to which it directs the product of photosynthesis into edible rather than inedible parts. With primitive varieties, the proportion of the product that is useful may be less than a fifth of what it is in varieties created by skilled plant breeding. There is growing recognition of the seriousness of the loss caused by pests in the field and store. Recognition of the losses caused by diseases is coming much more slowly. If there were worldwide control (which does not mean elimination) of pests and diseases, the food supply would be increased by at least 40% with little increase in farming costs. This is the limiting factor now most worthy of attack. Furthermore, as other aspects of agricultural technique improve and

we get crops that are optimally nourished and more uniform than those now usually grown, the danger from disease will increase. A crop that is well fed may not be more susceptible to infection than one that is deprived, but it produces much more of the infective agent (e.g. virus or fungus) once it is infected and so acts as a more dangerous source of infection for its neighbours. At present, research on the control of disease vectors, and on immune, resistant, tolerant or hypersensitive varieties of crop plants is not keeping pace with improvements in conventional agriculture. Hypersensitivity may be the most effective of these desirable qualities. It leads to the quick death of the infected plant so that it does not remain a source of infection for long.

It is not realistic to regard light as a limiting factor because there is little prospect of our being able to do anything about it except on a very small scale—for example, for hastening the development of seedlings. We could, however, do something about the efficiency with which light is used. In theory a plant should be 18 to 20% efficient in using light in the band between 350 and 700 nanometres. Only half the energy in sunlight is in that part of the spectrum. Productivity could therefore be increased if plants able to use more of the spectrum could be produced. This is a remote possibility, although a bacterium is known that photosynthesizes with light at 900 nanometres—in the dark, from our point of view. However, plants differ greatly in the efficiency with which they use light as intense as midday sunshine. Many crop plants, such as wheat and potatoes, saturate (i.e. their rate of photosynthesis does not increase with more light), when the light is only a third or a quarter as intense as full sunlight, whereas others, such as maize and sugar cane, do not. Most of the tropical grasses use strong light efficiently, but the ability is distributed erratically among species.[3] Thus members of the same genus may differ although they are sufficiently closely related to hybridize. The most obvious difference between the two groups is that triose phosphate is the main early product of photosynthesis in plants that saturate readily—hence the term C3 plants; the corresponding product in plants that use strong light efficiently contains four carbon atoms (C4 plants). The difference in the manner in which the two types of plant use light is illustrated in Fig. 1. In much of the world, light is a limiting factor because it is often insufficient; where there is abundant light that is being used inefficiently, the pseudo-limiting factor could be circumvented by using, or creating, crop plants that do not so easily saturate.

In part, plants saturate because atmospheric carbon dioxide does not reach the site of photosynthesis fast enough to use all the energy available: sometimes physical diffusion within the leaf is impeded and sometimes a necessary enzyme is deficient. One factor is easily understood. Carbon dioxide reaches the interior of the leaf through stomata and these are also the route through which

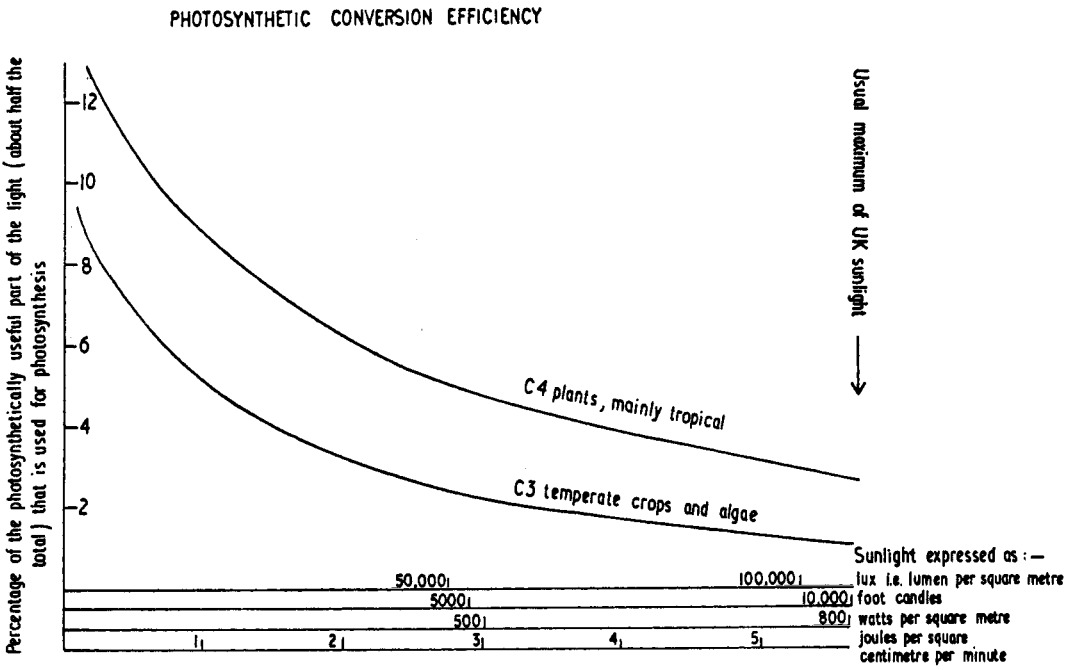

FIG. 1. Curves illustrating the difference in efficiency of plants using predominantly the triose phosphate (C3) and the four-carbon (C4) systems of photosynthesis in optimal conditions.

oxygen is exhaled and water is lost. In most plants there is therefore two-way traffic through a small hole, which is obviously inefficient. There is a group of plants in which carbon dioxide is absorbed through open stomata by night and stored as organic acids. The stomata are largely shut during the day, which conserves water, and sunlight is used to reduce the stored acids. The fact that this at first sight admirable system exists, suggests that it should be exploited by plant breeders: it is hard to understand why pineapples are the only important crop to use it.

Because of these obstacles to access of carbon dioxide, its ambient concentration is a limiting factor and the rate of photosynthesis is enhanced when the concentration is increased in greenhouses. A period of acclimatization is sometimes needed before growth is enhanced. It is not realistic to envisage carbon dioxide fertilization on a field scale immediately, but increased ambient carbon dioxide is a confidently predicted consequence of the continued use of fossil fuels on even the present scale. The long-term consequences are unpredictable. Agriculture is involved in the turnover of about one gigatonne

(1000 million tonnes) of carbon per year. The biosphere as a whole turns over a hundred times that quantity.

Plants made the atmosphere they live in, but they are not well adapted to it. Most of those that have been studied accumulate more organic matter when there is less oxygen present. Wheat grown in 1.8% oxygen[12] and beans in 5%[13] showed this effect strongly: both are C3 plants. The effect is probably the result of destruction by photorespiration, when oxygen is present at normal atmospheric pressure, of much of the product of photosynthesis.[17] It is unlikely that use could be made, in practical farming systems, of this method of enhancing yield.

An obvious limiting factor is the area farmed or used in other ways to produce food. Estimates of the potential arable area vary widely because of the different technological assumptions made. It is smaller if farming is thought of as something done by a man sitting on a tractor, rather than by a family with hoes. This is not a frivolous comment. In most countries, advertising, and various other forms of social pressure, make town life seem attractive and so produce rural depopulation and urban unemployment. An important facet of increased food production will be the reversal of this trend—not simply by exhortation but by vast improvements in rural amenities. It is probably no longer possible to persuade people to undertake such heavy hand labour as was involved in creating systems of terraced agriculture, but the outlook would be more hopeful if governments realized that really productive agriculture is a labour-intensive activity, and gave people incentives to improve villages rather than escape from them.

When as much has been done as can be done to fertilize, irrigate, illuminate and protect a crop with great growth potential, the peak rate of photosynthesis can be very great. Because of changes in light intensity during the day, experiments lasting for an hour or less, though of great academic interest, are not relevant. In experiments lasting several days, in sunny environments, some species yield more than 0.5 tonnes of dry matter, in the part above ground, per hectare per day. No trustworthy experiment has given the corresponding annual yield of 182 tonnes/hectare because complete photosynthetically active ground-cover cannot be maintained for so long a period. The record is about 80 tonnes (with sugar cane); maximum annual yields of 30 to 40 tonnes of dry matter are more usual even when growth is not stopped by periods of cold weather. In Britain the record is a little over 20 tonnes.[7]

Making vegetable organic matter is not the same thing as making food. However, these measurements establish the potential that agronomists, plant breeders and biochemical engineers can exploit. Exploitation will, and should, follow two routes. The conventional route is to select species and strains with

TABLE 1

Annual world production of edible material

Product	*Million tonnes in:*		*Million tonnes of protein in 1970*	*Energy, in joules* $\times 10^{18}$, *in 1970*
	1948-52	*1970*		
Cereals	690	1200	100	20
Pulses and oilseeds	80	155	35	3
Beef, pork and mutton, dressed carcass weight	40	80	13	0.7
Milk	260	400	14	1
Fish (salt and freshwater)	24	65	7	0.2
Potatoes (China excluded)	250	300	6	1
Sugar	37	85	0	1.4
Total:			175	27.3

increased ability to use sunlight, ambient carbon dioxide, added fertilizer and water, and to divert a larger fraction of the products of photosynthesis into seeds, tubers and other parts of a plant that can easily be made edible. This route necessarily involves a period after sowing when sunlight is unused because the ground is bare (this period can be shortened by transplanting, as with rice), and it may involve another period when sunlight is used for ripening rather than photosynthesis. The complementary route aims at harvesting leafy material which is not only more abundant but also maintains a nearly complete green cover throughout the year. This has the advantages that sunlight is used more completely so that the yield of dry matter is greater, and that the ground is never (or less often) left bare and so is less subject to erosion where that is a problem. It has the disadvantage that, in conventional farming, the material produced is not directly edible so that the gain in yield is annulled by conversion losses when the material is used as fodder. The potential of farming systems based on harvesting vegetative rather than mature growth would be realized if biochemical engineering methods were used to convert this vegetative growth into human food.

From these general aspects of food production we may proceed to discuss some specific crops. The quantities are set out in Table 1.

TABLE 2

The potentialities of Indian agriculture

	Weight of crop as harvested in tonnes/hectare		*Growing period (days)*
	Average	*Greatest*	
Rice	1.6	10	120
Maize	1.1	11	90
Wheat	1.2	7.2	120
Potato	8	41	120
Manioc	13	48	300
Yam	5.8	19	135

(From *The State of Food and Agriculture*, 1972, p. 146, FAO, Rome.)

SEEDS

More than half of the cereal total is wheat and rice: these grains are almost entirely eaten by people. They supply about half the protein eaten in well-fed countries and more than half in ill-fed countries. The other cereals are rather more important as fodder than as food. There has been so much skilled research on cereals that supplying an adequate amount of energy in this form is, in most countries, more a matter of administration, fertilizer production, demonstration and training than of research. A striking feature of agriculture, in every country, is the three-fold difference in the yields got by different farmers in the same climate and on the same soil. In India the difference is even greater (Table 2).

In countries with an overall food shortage, the primary need is for more food and, for as long as the daily energy intake is inadequate, it would be extravagant folly to advocate any great emphasis on the protein content of the food. Until energy needs are satisfied, the expensive protein would simply be used by the body as fuel. That has been obvious for half a century; it recently seems to have come as a blinding revelation to many officials. Organizations that, for a decade or more, have stressed the need for more protein and have suggested means for getting it, now issue statements tending to suggest that protein and energy are, in a sense, alternatives. This is absurd. Both are needed, but methods for increasing the supply of energy-rich but protein-deficient foods are already known. That is why the United Nations set up a Protein Advisory Group but has not seen any need for a Carbohydrate Advisory Group or a Fat Advisory Group.

Protein concentrates are made from cereal seeds by mechanical methods adapted to the manner in which the protein is distributed within the grain. In rice, protein is concentrated in a layer immediately under the bran; it can be separated from the main body of the endosperm by suitably contrived abrasion; equipment for doing this is used in various parts of the world. Starting with rice containing only 8 or 9% protein, fractions containing up to 21% protein can be separated. This process also concentrates the thiamin and riboflavin; these products are already being used commercially in baby foods. In a somewhat similar manner, coarse wheat flour is separated in an air stream into protein-rich and protein-depleted fractions. This is more convenient than the traditional wet process, developed in China many hundred years ago when gluten *(mien chin)* was separated, and introduced to Europe by Beccari in 1728. Fractions containing 30% protein can be made. De-hulled and coarsely ground oats (groats) contain 18 to 28.5% protein.[4]

Dry legume (pulse) seeds contain from 20 to 30% of protein: the precise value depends on the species and on maturity when harvested. About a third of the quantity shown in Table 1 is used as human food. This directly edible protein source is not getting the attention it deserves; there is even reason to think that interest in it is diminishing. Thus, in parts of India, the area devoted to pulses is smaller now than it was ten years ago—the pulses are being replaced by cereals.[11] In partial compensation, increasing interest is taken in processes for making human food from the residues left after expressing oil from soya and groundnuts, and from cotton. Hitherto, these residues were used as fodder or fertilizer or were even thrown away. Products made from soya are well established on the market, products from groundnuts are coming into use in India, and products from field beans *(Vicia faba)* in Britain. Twenty years ago, a good crop of field beans was four tonnes per hectare; now 14 tonnes is thought possible. This is the result of selection and the control of pests and diseases. Indian yields could probably be increased comparably.

Those seed-legumes that yield well but that are not palatable are usually processed either by heating or by extracting the protein from them by methods that have been used in the laboratory for 75 years and that were traditional with soya in the Far East. More use should be made of other traditional methods that could be used in the kitchen. One of these is fermentation with selected strains of fungus. Although these methods are ancient and widespread, they could probably be greatly improved without being made more complicated. This is a subject that deserves serious scientific attention.

VEGETABLES

Leaves, immature flowers, seeds, and tubers and other underground parts of plants, are traditional foods almost everywhere. The species selected for use are not always the most productive, or those with the most valuable balance of nutrients; they are those that are relatively free from fibre and from harmful or strongly flavoured components, and that permit convenient peeling, podding or threshing. Varieties with these qualities have been deliberately selected from among the wild plants for several thousand years in Europe, Asia and Central America. During the last century, plant breeding and selection were more advanced in Europe than elsewhere; it seems to be assumed that our vegetable species are inherently better than others and are the best starting point for developing strains adapted for use in the tropics. There is no reason to think that this is so. There are many groups of tropical leafy plants, such as *Amaranthus* and *Basella*, that have already had about as much selection as the *Crucifers* had had by 1700. They could probably be greatly improved by modern methods of selection and induced mutation. If the International Vegetable Research Institute, proposed by FAO, is set up, this should be part of its programme.

Vegetables are often put on the table for aesthetic rather than nutritional reasons, and when the reason for their use is nutritional they are thought of as sources of minerals and vitamins rather than of protein. But many leafy vegetables and immature flowers contain 20 to 30% protein (in the dry matter) and are rich sources of carotene (pro-vitamin A). In parts of the tropics where they grow readily, the consumption of leafy vegetables is even smaller than in Europe and USA (Table 3), and it seems to be diminishing. Thus, during the past 10 years the urbanized population of India increased from 80 to 110 million whereas the area devoted to growing vegetables diminished from 1.2 to 0.8 million hectares with no compensating increase in productivity. High caste farmers are unwilling to grow vegetables. This detrimental change is in part simply the result of fashion and may not therefore continue, but it is often suggested that vegetables are considered old-fashioned because of their prominence in the diets of the more primitive people in developing countries. Whatever its origin, active steps should be taken to reverse the trend away from vegetables.

Another important reason for advocating an extension of market gardens is that they probably produce a greater yield of edible protein, per year but not per man-hour, than any other conventional method of using land. There is for example more protein in the perishable pods of *Phaseolus* than in the dry beans that would be harvested later. In spite of these merits, market gardening has not caught the imagination of governments and agricultural advisers even

TABLE 3

Grams of protein, per head per day, supplied by commercially grown vegetables

Chile	3.3	Brazil	0.5
France	5.0	Ceylon	2.0
Israel	3.7	Denmark	1.7
Italy	5.1	Guatemala	1.0
Japan	5.1	India	0.1
Portugal	7.8	Mexico	0.4
UK	2.6	Nigeria	1.1
USA	3.8	Venezuela	0.2

(From FAO *Production Yearbook* 1971, Table 137.)

in countries with an unemployment as well as a nutritional problem. Unfortunately, the figures needed to substantiate these points fully are not available. It is easy to get figures for the yields, both of dry matter and protein, from wheat, rice, soya, potatoes etc., but not for vegetables. Clear statements from which dry matter and edible protein yields per hectare and year can be calculated rarely emerge even from research institutes. When these figures are published they should greatly increase enthusiasm for vegetable production and breeding.

LEAF PROTEIN

The protein-rich plants that can be eaten after no more processing than can be managed in the kitchen are not as productive as the forages. The species used as forage are however often ill-flavoured or are thought to be too fibrous to be used as human food. Opinion on the second point may be about to change. Various types of gastrointestinal disease seem to be more common in industrialized than in developing countries. The idea that this is a consequence of the relative absence of fibre from the food eaten in industrialized countries is gaining acceptance. If the idea should be substantiated, it would be reasonable to reinvestigate the use of some forages, for example oats harvested at the 10 to 15 centimetre stage, when the leaf contains more than 25% protein, as human food. In spite of this possibility, there are limits to the capacity of the human digestion to cope with fibre; this is especially true in infant feeding. There is therefore increasing interest in the feasibility of extracting edible protein from forages and from leafy material that is the by-product of some other form of agriculture—for example sugar beet, potatoes, green peas, sweet potato, ramie and jute. The extraction of useful material from a by-product

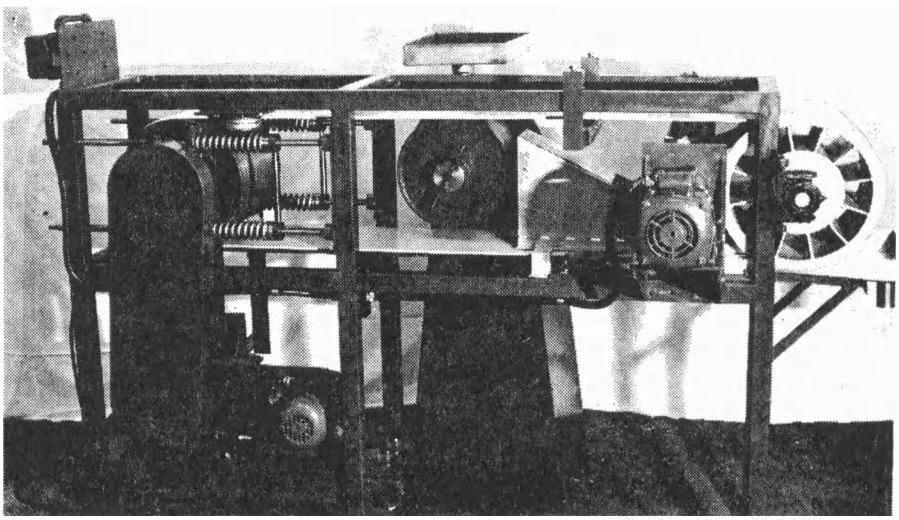

FIG. 2. A small leaf protein extraction unit. This unit can process 0.5 tonnes of forage in a day and, if the forage is of reasonable quality, extract from it 10 to 15 kilograms (dry weight) of protein. Units able to process five tonnes per hour have been made.

that would otherwise be wasted, or incompletely used, is obviously advantageous. The case for growing a crop primarily as a source of extracted leaf protein depends on the observation that the yield of protein, in the form of an edible concentrate, is greater by this form of agriculture than by any other. In Britain we can get more than two tonnes (calculated as dry, 100% protein) from a hectare in a year. In India, three tonnes has been achieved and there are claims for still larger yields.[14] The fibrous residue contains some un-extracted protein and is a valuable ruminant fodder containing much less water than the original crop. In Britain and USA, more importance is attached to leaf extraction techniques as a means for cheapening the process of drying forage for use as winter feed, than is attached to the extracted protein. The smallest unit that has been made for this purpose is shown in Fig. 2.

There is even more scope for improvement in this form of husbandry than the others discussed in this paper. The species and varieties now used as sources of seeds and tubers are the end products of prolonged selection. They will no doubt be improved, but much of the basic work has been done. There has been no similar attempt to select plants that are well adapted to protein extraction. For example, much of the work in Britain is done on cereal varieties selected for their efficiency in forming seed, but they are harvested for protein extraction when immature. Varieties rejected by plant breeders because of

their poor performance as seed yielders may well be preferable as yielders of leaf. There will be little support for the study of points such as this until agricultural administrators have grasped the fundamental proposition: systems of husbandry in which leaves are harvested yield more than others and protect the ground better.

BIOLOGICAL CONVERSION

It can be argued that translocation to the seed of substances synthesized in the leaf is a form of conversion, or even that conversion is involved when substances move around among the mechanisms in a synthesizing cell. It is because of these conversions that photosynthesis is not 100% efficient and that seeds at harvest contain less protein than was earlier present in the leaves. The merit of a crop, if assessed from the 'harvest index' (the ratio of useful to total product), depends on the efficiency with which these internal interconversions are managed. The conversions discussed here are those in which one organism converts material made by another.

Some forecasters predict the disappearance of foods based on animal products. This seems extremely unlikely. Some areas are unsuitable for arable farming: some will probably be maintained in a relatively wild state as an amenity. Ruminants can graze and browse on these areas. It is unlikely that any other species will soon surpass the efficiency of domestic cattle in a temperate environment and given carefully tended forage. In other environments this is not so. Goats manage steeper slopes, water buffaloes and bantengs do better at high temperatures, zebras, elands and kangaroos need less water, and goats and some of the deer browse on a wider range of plants.

Ruminants will probably be retained, not only to use non-arable land, but also to use straw, haulms, molasses and other by-products. These usually contain little protein, but after a period of acclimatization much of the protein requirement of a ruminant can be satisfied with urea and similar compounds synthesizable from atmospheric nitrogen. The form of animal husbandry that should disappear, or be greatly curtailed, is the use of arable land primarily to produce ruminant fodder: it would be better to use that land to produce human food with some by-products for the ruminants. Animals that are being fed on by-products will probably be stall-fed or fed on feedlots. More investigation is needed to find how best to use the dung. Too often it is now regarded as a pollutant to be disposed of rather than as a valuable resource to be used optimally.

If all wastes were used, and if range-land were fertilized and partly reseeded, the annual production of meat could probably be maintained at the present

level without using any arable land primarily to grow ruminant feed. There may be disagreement with that guess: there will be no disagreement with the statement that the pig and chicken population would diminish drastically if no arable land were used to grow their food. Incomprehensibly, FAO advises countries with food shortages to divert land to the production of pig and chicken food. It seems that most of them have had the wisdom to disregard this advice and keep no more pigs and chickens than can be maintained on scraps, or can maintain themselves by foraging.

Non-ruminant animals, when they are fed on valuable proteins such as fish-meal, compete directly with people. It is unlikely that the sustained catch of marine fish and molluscs could be more than doubled, but the amount of the catch eaten by people could easily be doubled if there were less waste and diversion, and if prejudice did not restrict the choice of edible species. Marine fertilization has only a limited application. A given amount of fertilizer would have much more effect on land, where it stays in the top few centimetres, than in the ocean where it disappears into the depths. The fertilization of lakes to encourage the growth of fish-food has greater potentiality because a larger proportion of the total volume of water is illuminated when the water is shallow. There is however no evidence that the amount of human food produced by fertilized water would be greater than the amount produced by the same area of fertilized land. Statements to the contrary are based on yields from ponds to which fish-food, produced elsewhere, was added: that is, in which the fish were comparable to pigs in a pen. It may be that fish are more efficient converters than pigs—the point has not been established. In some parts of the world fish are raised in flooded rice fields without diminishing the yield of rice; the grass carp will keep irrigation ditches and other water courses free from weeds—thus producing food and avoiding the need for herbicides. It has had recent welcome publicity[10,16] and is gaining recognition.[2] Two points seem to be clear. Existing bodies of water, fertilized where that is practicable, should be used—but it is not advisable to create new ponds at the expense of arable land. Herbivorous fish, rather than the carnivorous fish usually eaten, should be encouraged because the shorter a food chain is, the more efficient it is likely to be.

Some forecasters predict the disappearance of animal products because they pay too little attention to non-arable land and by-products. Others recognize the by-products but advocate their conversion by fermentation or by purely chemical treatments. In large-scale agriculture, which can lead to the collection of large amounts of fermentable material in one place, fermentation may have advantages. In small-scale agriculture, the material is likely to remain on the farms where it is produced; local consumption by animals is then preferable.

Ruminants are mobile, self-reproducing, small-scale fermenters with automatic temperature and pH control.

A similar argument applies to cultivation of yeasts and other microorganisms on hydrocarbons. Oil is available, until the supply is exhausted, in large quantities at the well or at the port where tankers dock. It thus becomes an attractive starting material for fermentation by the techniques of heavy chemistry in industrialized countries. Elsewhere it is less attractive because of the skill needed to manage the fermentation technique and the need to import the oil. The cheapness of oil, for the time being, is not important; the costs of running the fermentation unit are considerably greater than the cost of the starting material. On present evidence it is unlikely that microorganisms grown on oil will contribute to the food supply of those regions now most in need of food except in so far as they satisfy the demand for non-ruminant fodders in industrialized countries and so leave more of the fish-meal and legume seeds produced in developing countries to be consumed locally.

THE INPUTS

Even when attention is limited to protein supplies, the source of the carbon component of protein raises more problems than the source of nitrogen. Atmospheric carbon dioxide is the main source; it is continually renewed but it is inconveniently dilute. The carbon in oil and gas is already reduced so that, in the presence of atmospheric oxygen, organisms can grow on these substrates, but the supply is not inexhaustible. Coal will last for very much longer; it is unfortunate therefore that so little attention is paid to techniques for using it as a microbial substrate. In some parts of the world there are carbonate-rich alkaline lakes and in them a blue-green alga *(Spirulina)* grows luxuriantly and is being usefully exploited.[6] Although the cultivation of other algae has been enthusiastically advocated, they do not produce potentially edible material more efficiently than higher plants given the same conditions,[8] and it is more difficult to supply these algae with carbon dioxide and to protect them from contaminants and competitors.

The agricultural yields that have been quoted depend on the generous use of fertilizers—mainly nitrogen. Atmospheric nitrogen is abundant and constantly replenished. Industrial 'fixation' is so cheap that there is little incentive to recover the nitrogen in sewage except as a means of preventing pollution. The value of the extra crop resulting from judicious use is from two to ten times the cost of the fertilizer, according to the distance separating field and fixation-plant. But 'fixation' calls for energy, now usually in the form of natural gas,

and so will probably become more expensive. Much effort is being expended on the search for effective catalysts that will bring about the combination of nitrogen with oxygen or hydrogen without the use of extreme pressures and temperatures.[5] Processes such as these would be immensely valuable. In the meantime, 'fixation' by legume root-nodule bacteria is the main source of the nitrogen in food-stuffs.

The supply of mineable potassium salts will eventually be exhausted but it is technically feasible to separate potassium from seawater and, if enough energy is available, from clay and rock. Much of agriculture already depends on the slow release of potassium from clay minerals. Phosphorus is more of a problem. The rich deposits are more nearly exhausted and rocks seldom contain as much phosphorus as potassium. Phosphorus is however a by-product of the extraction of elements such as uranium from low-grade ores; their exploitation may postpone a world-wide shortage. Another potential source is oceanic mud, because most of the phosphorus that reaches the sea is precipitated in it—this depletion of phosphorus is one of the main limitations on marine productivity. It would be better to keep the phosphorus that we have used from reaching the sea; its recovery is therefore an important reason for recycling sewage. A temporary anomaly in our methods of dealing with the world's resources is that excess phosphorus is an important cause of the eutrophication of lakes.

CONCLUSION

There are many reasons for restraining population growth: food shortage need not be one of them if the potential is fully exploited. Exploitation depends on an unprecedented change in outlook and in the manner in which we use effort and resources.

The wet tropics are the worst-fed parts of the world and in them there is less research on the agronomy of food crops, less effort is devoted to agricultural extension (Table 4), and farmers have less prestige than elsewhere. These anomalies will have to be removed.

It may not be possible to produce familiar foods on an adequate scale. Food habits are changing now; we should advocate beneficial changes that will use those foods that could be produced abundantly.[15]

Little profit can be made from selling food to impoverished people. The community should therefore be responsible for producing and distributing the basic foods—as it is responsible for education and health services.

Those responsible for health in ill-fed countries should rely less on donated

TABLE 4

Agricultural research and extension

	Percentage of agricultural GDP spent on:		*Number of farms per:*	
	Research	*Extension*	*Scientist*	*Teacher*
USA	2.2	1.0	346	555
Western Europe	0.9	0.6	1605	822
Central America	0.1	0.5	4270	3407
South America	0.2	0.1	3846	2538
East Africa*	1.2	1.8	19 143	801
Japan	1.2	0.7	1131	433

GDP, Gross Domestic Product.
(From *The State of Food and Agriculture*, 1972, p. 149, FAO, Rome.)
* In East Africa, only a small part of the research and extension is devoted to food crops for local use.

protein concentrates and vitamins and press more actively for the local production of adequate food.

Discussion

Wiener: What has been discussed in this interesting paper is the totality of the various *elements* that enter into the agricultural production process. This is rather like describing a human being as made up of so many grams of phosphorus, calcium and so on. But we know that man is not only so much phosphorus and calcium, but something in addition, which we can call organization. The same applies to agriculture. We talk about its physical, chemical and biological components but we cannot leave out the organizational dynamics that really leads to the kind of agriculture that you say we need, in order to produce the food the world will need: the kind of agriculture that would move the low-efficiency farmer towards higher production efficiencies. You showed (Table 2, p. 104) differences of 1:5 to 1:10 between the average and greatest weights of crop harvested. Similar ratios are found almost everywhere, even in much more developed countries than India. In Israel, for example, we were investigating crop yields from the point of view of water use, and we found similar ratios in the return on water between average and best farmers. Ratios between best and worst farmers are of course still higher.

In order to get higher average yields something further is required in addition

to the factors mentioned, such as seeds, fertilizer, and plant protection. We need the organization to bring these elements to the farmer, the policies to make him use them, and the organization to handle the logistics. This seems to me to be the major problem of the development of agricultural productivity in the Third World. Research may provide extremely important improvements (new seed varieties, new fertilizer mixes, new irrigation techniques or schedules). But even with what is known already we could handle the food problems of the world until the year 2000, if we could make available the additional elements of organization and of political decision-making within the next 10 or 15 years (and I do not think we have much more time in which to do the job).

Pirie: This is precisely the point shown by Table 4 (p. 113)—the value of extension, through increased numbers of teachers.

Wiener: In that table I do not see a consistent correlation between the percentage of agricultural GDP spent on extension and what is achieved in agriculture. Japan has achieved more in its own way, in what it needed, than say the USA or East Africa. It is not simply the question of spending money on the element of extension by itself.

Pirie: Japan has achieved more agricultural productivity because it has most teachers per farm. It is doing precisely what you are suggesting.

Wiener: There is something else: Japan is among the few nations with the ability to organize extension in a way to reach the farmer as a significant information input. In many other countries, even if ten times as much was spent on the same *kind* of extension organizations that exist today, there would be very little incremental yield. It is not only the question of the number of people employed. You may have fifty extension agents in an area but they may sit around in the provincial town and not even move out into the rural area, and this is the rule rather than the exception. The all-important additional factor is orientation to the specific problems of the project by attempting to solve them one by one. It is a goal orientation which is lacking.

Wenche B. Eide: I think you are defining agricultural research too narrowly, as something concerned with, for example, plant breeding or the development of fertilizers—the traditional type of agricultural research. But if one wants to achieve this goal or project orientation, the agricultural research field has to be broadened to include the social sciences. This type of research is equally important now.

Wiener: You are right. But this is not the kind of research that can be done in universities; it is the kind that has to be done through pilot projects, studying farmers' responses, and so on. You need the social sciences and behavioural and political sciences for this, as you say. But they have to work within the framework of development projects, rather than of desk studies.

Mellander: When considering food potential we should not overlook the marine production potential. We[1] have been working on the protein content and quality of marine plankton and it is interesting to note that phytoplankton is much richer in lysine than are land plants. Of course plankton is a difficult food source because the 'soup' is so dilute; you have to filter about 800 tons of North Sea water a day to cover your own protein needs! Furthermore, the plankton may be loaded with toxins which when concentrated can be harmful. R. D. Gerard & O. A. Roels[9] came up with an interesting possibility in this connection. At a marine research station on the island of St Croix in the West Indies, where the depth is 800–1000 metres within one mile of the shore, an Antarctic current comes in at 5 °C; this cold water is pumped up into the 35 °C atmosphere, where it passes through a heat-exchanger and squeezes drinking water out of the atmosphere. The seawater then goes into a pool where it is used for the cultivation of phytoplankton. The nitrogen and phosphorus in the Antarctic water are thus directly and efficiently converted to plankton protein. Phytoplankton may like other plants contain toxic substances; these are removed in the next step, when the water, including the plankton, is pumped into another pool where oysters are cultivated using the plankton protein. Edible oyster protein is thus produced from seawater and sunshine and can easily be converted to a protein concentrate for use in infant foods, for example.

Wolstenholme: Mr Pirie referred to the sesame seed which is slightly deficient in lysine and Professor Mellander mentions phytoplankton that is rich in lysine. I believe that some of the new Green Revolution crops in India have abnormal amino acid constitutions. When magnificently increased yields of crops have been produced, no one seems to have considered that the new strains may not be entirely suitable as food for human beings.

Pirie: I don't think any of them are any worse than the less productive strains that they replaced. But the important point is to avoid thinking that a person will obtain all his protein from a single source; one always eats a mixed diet. Even in Britain we derive about a third of our protein from wheat, and wheat is not a bad source of methionine; it is a little low in lysine. In some other parts of the world, the staple, maize, supplies 70% of protein from one source. It is then that one has to ensure that the supplement being eaten is rich in what is missing. Luckily, maize is a good methionine source. Most other vegetable proteins are low in methionine; therefore they balance a maize diet reasonably well.

Wolstenholme: Professor Mellander mentioned toxicity. Has the question of contamination with toxic products arisen in the production of leaf protein?

Pirie: No. Toxic products such as alkaloids wash out. There is no difficulty there.

King: The picture I have of leaf protein is of a pasty green porridge. It could, of course, be fed to animals, but what can be done to make it more palatable to humans? Can you give us any good recipes using leaf protein?

Pirie: Palatability is no problem if you have some measure of control for the first two weeks. During the past 15 years I have had about a dozen cooks working on this for a few months at a time. According to temperament, I have had during the first week cooks who were suicidal, homicidal, tearful or mutinous; during the second week of cooking with leaf protein they have *all* become reconciled to the unfamiliar material. My colleague Dr R. P. Devadas in Coimbatore in India uses leaf protein successfully in the college canteen. But think of the diversity of human tastes: most of us would reject chicken that has gone one-tenth as bad as it is in the standard method of eating pheasant and partridge in Britain. Some of the cheeses that are eaten would be totally rejected if one hadn't experienced them before. Food habits are purely a matter of custom.

White: I am afraid that discussions of the practicability of changing food habits may be diversionary, in that they offer substitutes for grappling with what is surely the basic problem, posed by Mr Wiener. It was shown about 30 years ago that the most effective animal converter for grass and grain in semi-arid zones was the prairie dog (a rodent), and that from this point of view the prairie dog ought to replace the sheep and the cow in our diets. There has been no conspicuous progress made in that direction! Nor has there been any imaginative research to find practical ways of doing so. The actual *adoption* of new agricultural technology so far does not really suggest that the further alternatives emphasized by Mr Pirie are likely to be adopted within the next few decades. For we are not concerned primarily with the rapidly industrializing countries, nor with the sector of agriculture in low-income countries that is highly market-oriented, such as the market gardener around the city. We are concerned with a very different group of producers, namely the subsistence farmer. Very little has been said about the economic constraints on the adoption of any of these measures. I feel uncomfortable about the emphasis given, because it seems to me that in considering the esoteric and the innovative we may be avoiding the question of *why* there have been relatively low rates of change in agricultural production methods, towards using technologies that have already been demonstrated and are available.

Pirie: There is no existing technology for growing a protein-rich plant, or a plant from which a protein-rich part can be separated by simple means, in a tropical region where it rains nearly every day. If the 500 million people who live in regions like that are to get an adequate diet, their food habits will have to change. I was unaware that any serious effort had been put into popularizing

prairie dog. The amount of effort that has so far been put into popularizing even such well-known products as Incaparina and Pronutro is less than a commercial concern would put into popularizing a new brand of a familiar food—let alone a new food.

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Whither the food and population equation?

W. H. PAWLEY

The outcome of the race between food and population is one of the great issues of the second half of the 20th century. We who are in the midst of it cannot yet see it in perspective. How will it appear from the vantage point of history, say a hundred years from now? It may turn out to be a transient issue already resolved by the end of this century through a mass application of knowledge to the use of what are still undoubtedly abundant resources, combined with a drastic decline in the growth rate of population. Alternatively, it may well prove to be a long drawn-out secular crisis still unresolved by the end of the third quarter of the 21st century. A third possibility is that it may be remembered as an issue which at a certain point exploded into a worldwide catastrophe and was itself the cause of a drastic decline in population brought about by rising death rates instead of falling birth rates.

Is it possible to form any judgements about the relative probability of these alternative outcomes? An examination of the present situation and the prospects over the last quarter of this century may throw some light on what awaits us. It is to the question of the next 25 years that this chapter is addressed.

First, the present. We live in a world of 3800 million people, increasing by 75 million every year. Just over 1000 million of these are in the industrially advanced countries where, even though some are malnourished, the aggregate food supply is not a problem. For 30% of the world's people the struggle for a sufficient supply of food, which has driven man since the species began, is finally over. The production capacity of the farms in these countries is more than enough to grow all the food their people will need by the year 2000 and for an indefinite period beyond. We can leave these countries out of our enquiry.

By contrast, in most of Asia, in Africa and in tropical Latin America, the yearly struggle to produce enough food is still a dominant fact of life. During the 1960s production increased at an average rate of 2.6% per year. This

would in fact be an excellent achievement were it not for the rapid rate of population increase in these countries. The growth of population has practically offset the increase in production and there has been no appreciable improvement in nutritional levels over the last decade for 70% of the world's population. Such improvement as there has been in dietary levels has been made possible only by imports of food from developed countries.

Since population increase is the dominant factor in the future demand for food, we need to begin with an estimate of the population in the poor countries by 2000 A.D. The Population Division of the United Nations has made a number of alternative assumptions regarding fertility rates over the next three decades and has come up with a best guess that population in the underdeveloped countries will grow from the present 2700 million to 5000 million by the year 2000. This they call the 'medium variant'. They also have a 'low variant' of 4500 million, and a 'high variant' of 5650 million. All variants are optimistic in the sense that they assume that a decline in fertility begins in the near future. In the medium variant the decline in fertility in most of Asia is assumed to begin during the quinquennium 1975-1980, and the same assumption is made about Latin America. In Africa it is assumed that fertility remains at the present level until after 1985. In the low variant the hypothetical date for the onset of fertility decline is advanced five years; in the high it is delayed five years. One therefore sees how important it is that there should be the least possible delay before fertility begins to decline in developing countries. A delay of only ten years makes a difference of 1000 million people by the end of the century and a much bigger difference in the next.

In this paper I shall use the medium variant of 5000 million people in developing regions by 2000. This is perhaps the single most startling fact to keep in mind: there will be 6500 million people in the world by 2000 and 77% of them will be in countries where the agricultural revolution is only beginning and where the human and sociological difficulties remain immense.

In trying to arrive at an approximate figure for the demand for food by 2000 it is necessary to take into account, in addition to population increase, what will happen to the *per caput* demand for food. Slowly but surely developing countries are industrializing and also expanding their tertiary industries. National income per head of population is therefore increasing and there is a gradual increase in the *per caput* demand for food. Over the course of time this will lead to less dependence on cereals and starchy roots and a shift in diet towards fruits and leafy vegetables, meat, eggs and milk.

But can we say anything about the rate of growth of national income? In my opinion we can. We now have some 20 years' experience of the rate of growth which the developing countries can achieve in practice. It is unlikely

that over the next 30 years Gross Domestic Product in developing countries will increase at less than 5% a year, unless government and administration collapse under the weight of the enormous pressures that they face in developing countries. It also seems unlikely that the growth rate can average more than 6% over this period. For purposes of this paper it is assumed that growth of GDP averages 5.5% between 1970 and 1985 and 6% from 1985 to 2000. Naturally, growth rates in individual countries will differ greatly from these figures but this is a prognostication for developing regions as a whole.

These projections may be compared with the population projections to arrive at an increase of income per head. Since the population is projected to grow at 2.5% up to 1985 and to average 2.25% over the 15 years from 1985 to the turn of the century, we have an increase in income per head of 3% and 3.75% respectively in the two 15-year periods. However, the increase in expenditure on personal consumption will be lower because government expenditure for collective purposes such as transport, communications, education and health—and, unfortunately, probably also for armaments—shows a strong propensity to increase faster than personal consumption. The assumption is made here that disposable personal consumption expenditure (PCE) will rise by 2.6% a year to 1985 and by 3.25% thereafter.

What does this mean for the consumption of food? FAO's detailed demand projections to 1980 give a basis for an answer.[2] The question is by how much does food consumption increase for a given increase in disposable income? And the best answer we have is that the personal average income elasticity demand is around 0.4. To put this in other words, for every increment in personal consumption expenditure, the expenditure on food would increase by 40% of this increment. It is also assumed that a semi-log function would best describe the course of this demand elasticity, which means that it would decline slightly over time as consumers were better fed.

From these projections and calculations we arrive at the result that the aggregate demand for food in developing countries may increase by about 167% between 1970 and 2000. That is, a $2\frac{2}{3}$ fold increase in the supply of food would be needed. The required annual rate of increase is 3.3%. It is interesting to note that three-quarters of this increase would be due to population growth and only one-quarter to increase in income *per caput*. Thus the results would not be much affected by taking different rates of growth of Gross Domestic Product.

In theory, developing countries could receive a large part of their food supply from imports from developed countries, since the latter do have surplus production capacity. However, mass imports of food from developed countries have to be ruled out for three reasons.

In the first place, developing countries cannot afford to pay for large imports of food. Foreign exchange is usually a limiting factor to the development of the poorer countries and in fact they have a steadily growing external debt. In many countries the level of debt is such that payment of interest already eats up a considerable amount of the income earned by exports. It might be asked, however, why could not developed countries make large quantities of food available on a gift basis or on a semi-gift basis, as was done under the United States Public Law 480? In my judgement the public in developed countries is in no mood to take on as a permanent burden the financing of a large part of the food supplies of developing countries. In fact the developed countries are not as a whole coming anywhere near to meeting the obligations they undertook under the Second Development Decade, which was to make 0.7% of their national income available as government aid. In recent years this percentage has been falling rather than rising and at present the government-to-government aid stands at only 0.36% of the national income of developed countries.

But even if developed countries were willing to make massive food supplies available as gifts, there remain two fundamental reasons why this *should not* be done. The first of these is that imports of cheap food as the easy way of supplying consumers in the cities destroy the economic incentives of farmers in developing countries. Secondly, the rapid expansion of agricultural production in developing countries is not only needed to produce food supplies; it is also essential for providing employment in the agricultural and rural areas. Developing countries have a serious problem of un- and underemployment, especially in rural areas. Statistics are not readily available but various studies have shown that the underemployment in agriculture may be equivalent to a quarter or a third of full-time unemployment of the labour force.

In this connection it is to be noted that one of the most serious problems facing developing countries is that the agricultural labour force must continue to increase for a long time to come. This is of course contrary to the situation in developed countries where the agricultural labour force is not only declining as a proportion of the total but is declining, and quite rapidly, in absolute numbers. Estimates recently made by FAO show that the agricultural population in developing countries is likely to grow from 1650 million in 1970 to 2150 million in the year 2000. The agricultural *labour force* is projected to increase from 670 million to 840 million. The problem of overcrowding in the agricultural areas is particularly serious in Asia where there is little new land available. The arable land per head of population depending on agriculture had already fallen to half a hectare in India in 1962 and by 1985 it will be only one-third of a hectare. Since it will be about 2010 before the agricultural population reaches its maximum in developing countries, we have still some

forty very difficult years ahead. So long as an agricultural labour force is increasing in absolute terms, it is very difficult, and even socially objectionable, to introduce mechanization aimed primarily at labour-saving, because one result is to put people out of a job. Once the population of developing countries begins to decline early in the next century, it will for the first time be possible to enlarge gradually the size of farms and introduce labour-saving techniques *per se* in developing countries. Only then can agricultural incomes rise at a satisfactory rate.

This has, I hope, made it sufficiently evident that *developing countries must produce their own food supply*. They are also under the necessity to increase their exports of agricultural products. Here again a rate of about 3.3% per year is needed to finance their economic development and also to contribute to employment. The question to which we must now address ourselves is whether a 3.3% rate of growth in agriculture can be obtained in developing countries. Are the basic resources of land and water sufficient? Is there enough technical knowledge? Can the physical inputs be obtained? Can manpower be trained quickly enough? Can the institutional and social changes needed be brought about at a sufficient rate?

The fundamental question is whether the basic resources of land, of water, of climate and of genetic strains are adequate to sustain for a long period an increase in production of 3.3% a year. If not, the battle is lost before it begins. On the other hand, if these are sufficient, the ingenuity and willpower of human beings could overcome all other difficulties. Fortunately the answer for the time being is yes: resources are sufficient to sustain a growth rate of 3.3% in agricultural production to the year 2000 and beyond. It is, however, essential that population growth be slowed down in this century and brought to a halt as soon as possible in the next century—certainly not beyond the middle of the next century. Otherwise there is every danger of disaster from one cause or another. This disaster may come from sheer inability to produce enough food from the existing resources, it may be due to ecological breakdown or an energy crisis, it may come from political and administrative turmoil arising from the sheer pressures of unfulfilled expectations, or it may be simply a matter of the psychological effects of overcrowding.

For the time being we have enough arable land, which by definition means land with sufficient water supply. Only 10% of the land surface of the globe is at present cultivated. Some twenty years ago an English geographer estimated that one-fifth of the land surface was too cold to grow crops, one-fifth was too arid, another fifth was too rugged. He deducted an unspecified area from the remaining two-fifths as having a growing season too short for a crop, and other areas because of poverty of soil or excessive rainfall.[4]

Nevertheless there remains much land capable of being brought under cultivation. This is particularly true of Latin America and Africa, and in a much lesser degree even of South-East Asia, but the costs of opening up these new lands are considerable. Much basic research and experimentation is also necessary. For example, elimination of the tsetse fly in Africa or an effective vaccine against the diseases it carries to animals and man would make available some ten million square kilometres of well-watered country for crops and animal husbandry. Fundamentally, the rate at which new land is developed depends on the priorities of those who make the decisions on how the world's capital is to be spent. Tsetse could be eliminated from Africa for one per cent of the world's expenditure on armaments in one year.

In the Indicative World Plan for Agricultural Development, FAO made a study of the potential arable land in developing countries.[1] This information is set out in Table 1. According to these estimates, 26% of the land surface of developing countries is suitable for cultivation with existing knowledge, whereas 12% was used in 1962 (the base period of the Indicative World Plan). Thus by 1962 land under crops in the developing countries amounted to 45% of the potential. By 1985 this figure would rise to 53%, on these targets. If one projects the IWP proposals in regard to expansion of arable area, the proportion of the potential arable land in use would rise to 58% by 2000.

The limits are, however, much tighter than the global figure suggests, since they assume an equitable distribution of population to be fed in comparison to resources throughout developing countries. Compare for example the situation in Asia with that of Latin America. The global potential can be used only if hundreds of millions of people migrate from one continent to another or if hundreds of millions of tons of food are moved annually. There are, however, very tight limitations on the extent to which people of a given race and culture can be moved in large numbers to another part of the world. What would be more feasible is to change the international division of labour in such a way that land-rich countries in the developing regions produce surpluses for export to other developing countries and are ready in return to take manufactured goods from the land-poor countries. It is probable that the international division of labour will move in this direction, with for example Latin America exporting food to Asia and receiving manufactures in return. Nevertheless there are bound to be serious imperfections which prevent the utilization of the whole potential of arable land, with Asia running out of its landstock very quickly.

Unfortunately a recent study in FAO has shown that the developing countries are using up their potential of arable land at a faster rate than recommended in the Indicative World Plan. Asia, for instance, has increased the harvested

TABLE 1

Potential arable area compared with present and proposed arable land in 1985

Region	*Potential land area estimated to be suitable for crop production*		*Arable land*			
			Actual 1962		*Proposed 1985*	
	Area in million hectares	*As % of total land area*	*Area in million hectares*	*% of total potential*	*Area in million hectares*	*% of total potential*
Africa South of the Sahara	304	19	152	50	189	62
Asia and the Far East	252	47	211	84	223	89
Latin America	570	29	130	23	169	30
Near East and North West Africa*	19	6	19	100	19	100
Total or average	1145	26	512	45	600	53

* North West Africa only, because for the Near East Region the estimate of potential arable land could not be made.

area under cereals between 1962 and 1970 by 25 million hectares, compared with the target of 15 million hectares. Overall it appears that additional land has been brought under the plough at a rate of about 1% a year. At this rate, developing countries would run out of arable land in about 2040 A.D.

Apart from the extent of arable land, food production depends on the number of times the arable land is used per year and on the yield per hectare of the crops grown. The yield is determined by so many factors that they can hardly be listed here, let alone reviewed. They include the genetic potential of the plant, quality of soil, provision of additional nutrients, availability of moisture, good soil preparation, avoidance of losses through pests and diseases, avoidance of harvesting losses and, above all, good management to tie the many factors together.

Although the factors are many and complex their net result can be summed up in one concept: yield per hectare. In the case of cereals, which occupy most of the land area, the average yield for developing countries is about one-quarter of the national average of the most successful developed countries. For instance, the Netherlands obtains 50 quintals of wheat per hectare, developing regions 12 (one quintal = 100 kilograms). The United States has a maize yield of 55 quintals per hectare and developing regions about 14. Japan gets

55 quintals of rice; developing regions average 18. The situation is similar in the case of other crops where data can be obtained. For instance, in the most advanced countries potato yields are 35 to 40 tonnes per hectare. The average is 10 tonnes in Asia, 9 in Africa and 8 in South America. The USA harvests 4.9 quintals of cotton from one hectare, India 1.1 quintals.

The contrast in output per animal is even more striking. An analysis for 1958[3] shows that the average production of milk and meat per head in Europe was ten times the average in Asia. It was between six and seven times the average for all developing countries including Latin America. Since there has been much progress in livestock yields in developed countries in the last fifteen years it is probable that an analysis of recent data would show a still wider difference between developed and developing countries.

Of course it may be said that soils and climate are superior in developed to developing countries. It would require a detailed examination of an immense amount of data either to sustain or to refute such a contention. It is more probable that over such large areas advantages of soil and climate tend to even out. It may even be that one day the tropical lands, with suitable growing temperatures all the year round and the possibility of growing two or three crops a year where moisture is adequate, may produce more per year than the temperate lands.

Let us, however, suppose that there is a biological ceiling at four times the present average yields in developing countries. How soon would that ceiling be reached? If we take the trend of an increase in cultivated area of 1% a year, this would leave 2.3% a year to be obtained by more intensive land use (multiple cropping) or from an increase in yields. An increase in cropping intensity of 0.3% a year would represent a good achievement. In this case fulfilment of our target of an annual increase of 3.3% in agricultural production would require an annual increase of 2% in yields.

Is this feasible? Historical examples show that it is. For instance, in Europe in 1948–1952 the average yield of cereals was 14.7 quintals per hectare. By 1971 this had risen to 28.5 quintals. This is an annual increase of 3.3%. In the United States the average yield of maize was 24.9 quintals in 1948–1951 and 54.5 quintals in 1971, an annual increase of 3.9%. These are examples drawn from major crops grown over millions of hectares under a wide range of climatic conditions and by large numbers of farmers. They show that technologically an increase in yields of 2% per annum is by no means impossible, even when yields have already reached a fairly high level.

A compound increase of 2% per annum amounts to a doubling over 35 years. On this model, crop yields in developing countries would therefore double by 2006 and quadruple by about 2040. If, although it seems unlikely,

this proves to be somewhere around the biological limit, developing countries would run out of capacity to increase their yields at about the same time that they run out of capacity to expand the arable area. With our existing knowledge a food production ceiling may be reached about a third of the way through the next century. It is clear that in terms of resources and techniques there is no great difficulty in producing enough food in developing countries to feed the expected population up to the year 2000. The proposition looks feasible for a generation beyond that. Farther we cannot see.

If one asks whether agricultural production in developing countries *will* increase at not less than 3.3% per annum, the answer must be that there is no way of knowing. The sociological, institutional and economic obstacles are tremendous and it may be that the rate of 2.6% achieved during the 1960s is about the maximum possible. Everything depends on the effective performance of fragile societies operating under nearly unbearable pressures.

Discussion

Llewelyn-Davies: You gave figures referring to the expected growth of rural populations. Do they take into account any movement of population away from rural areas into the towns?

Pawley: There is expected to be considerable movement of the agricultural population into the urban areas, but that has been allowed for in these estimates. The fact is that there is no conceivable rate of increased movement out which could prevent the absolute numbers in the agricultural areas increasing for another 40 years or so.

Llewelyn-Davies: Secondly, you left us with the tremendous unanswered question of whether there is any way of increasing agricultural productivities without mechanization and yet maintaining these increasing numbers of people on the land in progressively smaller farms. Do you feel that there are ways of coping with this problem?

Pawley: Yes. There are many ways of increasing productivity: for instance, a crop with a high genetic potential will probably lead to greater labour requirements, but its main effect will be to increase the productivity of labour as well as of land. I definitely see hope here.

Wiener: The figures given by Dr Pawley confirm what we discussed previously, that we now possess all the knowledge to grow the food we need until the year 2000, and, as he claims, even beyond that. We do not depend on the development of new technology, although we hope there will be technological

progress that will help us to improve the effectiveness of our operations. But the question is how to bring about this kind of growth in the developing countries. I think we all feel that developed countries can take care of themselves without any intervention by government; developing countries cannot. This problem of production efficiency is closely connected to the problem of economy of scale. Most agricultural operations add relatively little to their efficiency as their scale increases; only a few processes, like harvesting and preparation of soil, are scale-dependent.

You mentioned that selective mechanization should be part of the scheme because it would increase the employment of labour, up to a certain point. A few years ago, a Presidential Commission in the USA surveyed the world food situation and what ought to be done in physical terms in order to achieve targets very similar to yours. The Commission estimated the costs of two major types of interventions. One was improving the inputs in agriculture: fertilizers, pesticide and other plant protection material. The figure arrived at for the developing countries was of the order of $20 000 million for the 15-year period 1970–1985. The second figure related to additional irrigation needed; irrigation is certainly one means of increasing yields but it is one of the most expensive ones and requires considerable human resources. They estimated that $200 000–$300 000 million, or 10–15 times as much, would be required.

Nevertheless, most development in the agriculture of the Third World has been in capital-intensive irrigation projects. Something is wrong in existing planning approaches. Why has so little progress been made over the last 20 years? As you mentioned, in output per head, the developing countries have made hardly any progress since 1945 and some areas, like Latin America, are producing less per head than before 1945. The missing element needed to achieve progress is what I would call 'transformation'—transformation of the agricultural production process at the rural level. One of the reasons that so little progress has been made is the overemphasis on irrigation, which is the most expensive and most difficult development task and requires more human resources and organization than any other type of development. In many cases (this applies mainly to Latin America) irrigation projects included the major resettlement of rural settlers—a notoriously difficult operation. We have paid much less attention to programmes aimed at producing and distributing the right kind of inputs (seeds, fertilizers and plant protection material) and we have almost completely neglected rural transformation. In the big funding institutions, awareness is growing that priorities must be changed and that in the near future transformation and 'minimum package' type of programmes ought to have top priority. Considerable sums will be needed in the next 15 years for transformation, and these sums will have to be found if we

wish to solve the basic structural problem of the Third World—the lagging behind of the rural sector. Incidentally, a considerable part of this money can be mobilized within the countries, since this type of intervention requires only a limited amount of imports and consists mainly of dissemination of information on basic production techniques and the provision of some simple inputs. If we succeed in shifting priorities from capital-intensive hardware to capital-extensive transformation over the coming 15 years, I think we can achieve the targets set out by FAO.

Victoria Garcia: Dr Pawley, do we know the positive or negative impact of agrarian reform on food production?

Pawley: This is a difficult question. On the one hand one has to conclude that in many countries, particularly in Latin America, no real breakthrough in agriculture can be made without land reform. On the other hand, land reform is usually carried out by a very left-wing government, and they also want to alter the existing structure. The first results seem usually to be a decrease in agricultural production. Moreover, these governments are of such a nature that there is a flight of capital, and sometimes boycotting by vested interests around the world, which makes their problems more difficult.

White: In considering the practicability of extending the arable land, what consideration has been given to (1) the prospect that the environmental effects of such efforts may result in a net degradation of the physical resources rather than an enhancem ent, as illustrated by experience with many irrigation projects; and (2) the prospect that the increasing application of technology may lead to increased exposure to the catastrophic kind of events that result in widespread disorganization, and perhaps to slowing of the process of improvement?

Pawley: In making these calculations the FAO/UNESCO soil map of the world was used, and climatic and topographical maps were superimposed so that the potential arable land could be worked out area by area. Those making the calculations were aware of the spectres you mention.

On the risk of catastrophes, every time we make our society more complex, we increase this risk. It could be enough in an urban area that the garbage workers go on strike, and one could have an outbreak of plague perhaps killing many people. A small number of people can bring about a catastrophe in a highly complex organized society.

Geigy: In calculating the potential arable area, did you spare National Parks or potential ones? We cannot make the whole world arable; we must keep some free land for National Parks!

Pawley: We certainly left the National Parks untouched. Whether we left enough potential natural areas, I don't know.

A. Eide: You pointed out that a substantial number of the population will

remain in agriculture, which means that it will largely be a question of feeding the agricultural population. This means that to some extent subsistence economies will be perpetuated, rather than cash economies. This raises the question of the extent to which the increase in yield per hectare that you quoted is related to heavily capital-intensive development, with provision of fertilizers and technology and so on, and how that can be compared to the possibilities for a more or less subsistence economy.

Pawley: All these cases of high yields are capital-intensive, being based on the availability of fertilizers, machinery, and water. The fact remains that in developing countries one can have pockets of capital-intensive farming, but clearly under this labour situation one will not be able to go in for full capital-intensive farming for some time to come. On the other hand, the number of people being fed per farm is growing, because if one excludes transfers of food from the developed world to the underdeveloped world (taking this to be only marginal), then in 1970 there were 1600 million people feeding 2700 million people in the underdeveloped countries, which is a low ratio. But by 2000, there should be 2100 million feeding 5000 million, which is an improvement. It is still low but the number of people being fed per farmer, or per head of agricultural population, is gradually growing.

A. Eide: Yes, but money must be available to buy the food, and my question is whether people *are* able to buy it, in the developing countries.

Pawley: I took account of this in my figures for what will happen to Gross Domestic Product per head. My assumption was of a 5.5–6.0% increase.

Bradley: Your figures suggest that there is good cause for concern about pushing to the limits the agricultural potential areas in Asia and the Far East, and you suggested a possible way of coping with this by food imports from South America. This seems to have all the objections that have been raised to exporting food from developed countries to Asia, together with the added problem that the main reason that there is more land to spare in South America is that the population is smaller. Thus unless everyone in South America is to buy 1500 shirts made in the Far East, it is difficult to see what basis such a trade could take, particularly since South America is more industrialized than Asia.

Pawley: I don't think this possibility is open to all the objections to importing food from developed countries, because the developing countries are very short of hard currencies. There are many possible products which could be exported: you could have two shirts and 1000 or 2000 other products! I am not making predictions, but this would make a more rational division of labour among developing countries. If it is not done, we shall very quickly run into a barrier in Asia in terms of land area.

Wiener: One could also make an opposite point. In the developed countries, such as the USA and Canada, agriculture has become one of the most capital-intensive, mechanized, and sophisticated industries. I could imagine that within the next 20 or 30 years agricultural products will be among the most important exports of these countries. On the other hand, certain industries (e.g. textiles), which can no longer be supported in developed countries because of their high labour requirements, will have to move to the developing countries; as a consequence, the international division of labour might have to be completely rethought within the next 20 years.

Let us keep in mind that we are here talking about two types of agriculture. Your point is well taken that in the Third World we have to keep a certain part of the population in agriculture until, say, the year 2000 or so when there ought to be sufficient employment in industry and services. This is one kind of agriculture, an agriculture which is labour-intensive and capital-extensive. But we also have a different kind of agriculture in developed countries, which is capital-intensive and labour-extensive and capable of producing large quantities of cheap food for local consumption as well as for export.

Wolstenholme: Dr Pawley, would you care to hazard a guess about the prospects from the oceans?

Pawley: We studied this in the Indicative World Plan. At that time, in 1962, about 60 million tons of fish were being harvested per year. The Fisheries Department at FAO came to the conclusion that the potential catch, so long as fishing continues to be a form of hunting, does not exceed 140 million tons. We thought that by 1985 production would be up to about 112 million tons, and at this point we should be pushing very hard on the potential. Of course one can make more revolutionary changes and convert fishing from hunting into farming. I have no idea what the potential is for that; it would probably be enormous, but this is not yet practicable except for small bodies of water.

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Food supplies for physiologically vulnerable groups

DERRICK B. JELLIFFE and E. F. PATRICE JELLIFFE

Malnutrition in the main physiologically vulnerable groups—pregnant lactating women, and children in the first two years of life—is the result of many varying stresses, including the nutritional burden of infections and parasites, poor intestinal absorption, psychological stress (as in sudden weaning), and over-large family sizes with too closely spaced children, all reinforcing the ill-effects of an inadequate diet. Malnutrition in these groups is never exclusively due to the inadequate diet but, at the same time, it is usually based on dietary lack of protein and energy (calories), with varying deficiencies of vitamins and minerals.

A preventive programme can, therefore, only be logically devised after an 'ecological' dissection has been made of the different factors responsible for malnutrition in the particular area. The programme should include various measures designed for health protection, for the early management of the main locally important infections, for appropriate spacing of births, and for village improvement, including water supplies and food production. Nevertheless, major approaches to the prevention of malnutrition must always include ways of providing diets of appropriate nutritional adequacy that actually reach the women and young children concerned.[9]

SOURCES OF FOOD SUPPLIES

Increased and improved food supplies for the physiologically vulnerable groups can be sought through three over-lapping channels: the increased availability of food, the distribution of food supplements, and the better use of existing foods.

Increased availability of food

Plainly, the nutritional status of pregnant women and young children can be expected to be at least to some extent related to the availability of inexpensive nutritious foods in a particular area, although the distribution within the family of various foods, particularly protein sources, is well recognized as often being related to cultural attitudes.

Nevertheless, in any rational food and nutrition policy, efforts to improve food supplies for mothers and young children must emphasize the increased production, storage and marketing of key nutritional items related to local deficiencies—such as, for example, legumes. In addition, at least in urban areas, economic betterment with increased purchasing power can be expected in the long run to lead to the availability of a wider range of food items, including more nutritious foods, particularly expensive high-protein items.

Supplementary feeding programmes

Over the 25 years since World War II a wide range of different kinds of food supplement have been used in many parts of the world to combat malnutrition. Recent appraisal has suggested that these are, in fact, extremely expensive, not only to the donors, but also to the recipient countries in terms of the cost of storage, supervision and distribution.[9] Moreover, many such programmes have depended too much on foods imported from overseas, which are sometimes culturally inappropriate and sometimes have a disruptive effect on the local pattern of breast-feeding, and whose supply in most cases is unlikely to continue in the long term. Such programmes have also often had the effect of distracting attention from other activities, such as nutrition education, immunization, nutritional supervision by weighing, and family planning.

Short-term supplementary feeding programmes plainly need priority in natural and man-made famines and disasters. However, long-term supplementary feeding programmes, based on foods provided from outside the family, and issued free or at low cost, need to be considered most carefully, the advantages being balanced against the various limitations and difficulties mentioned.[9]

Modern supplementary feeding programmes for young children need to be based on a carefully thought out and clearly defined policy on the purpose, selection, age-group, length of issue, form of packaging and distribution, method of preparation and value in nutrition education of the preparation of the foods concerned.[9]

In areas where malnutrition in early childhood is common and is mainly related to lack of food, at least limited supplementary feeding is needed for selected children or families for certain periods of time. Thus, at-risk children who are substantially underweight (for example, after measles) may need food supplements until they have recovered; at-risk families of large size and low economic level may need food supplementation for longer periods. Supplementary feeding programmes need not only to be selective, but also to take into consideration the distribution facilities available (including funds for storage and transport) and to be related to the main local nutritional deficiencies. They should be culturally and physiologically appropriate, acceptable to both parents and children, digestible and easy to prepare, and without disruptive effects on the local pattern of infant feeding, particularly breast-feeding. Supplementary food programmes should be linked to local efforts to increase the production of food suitable for the domestic preparation, in the village, of 'multimixes'[11] (see below and p. 138), and also the production of the ingredients needed for processing similar food mixtures at national level.

Supplementary feeding programmes for young children should be primarily an instrument of nutrition education—by demonstration, by home visits, and by all other means. They are more likely to be required by urban slum dwellers and by impoverished communities within a money economy. The issue, free or at low cost, of supplementary foods through health services can be best related to the availability of the same product on the local market.[9]

In the past, the goal seems to have been the rather widespread distribution of high-protein supplementary foods, particularly dried skim milk, which was then partly a by-product of the butter industry in Western countries, including the USA. The fact that the rather widespread distribution of dried skim milk has not solved the problem of malnutrition is well illustrated by the socially excellent, but nutritionally ineffective, programmes undertaken in the last few decades in Chile.[20]

More recently, the food supplements most often used have been 'multimixes', such as the commercially produced triple mix CSM (corn–soya–non-fat milk) or the double mix of AK-1000 (two-thirds corn: one-third red bean flour).

Three categories of these food mixtures can be recognized, depending upon whether they are imported from overseas, prepared nationally on a large scale, or made at local regional level on a small scale—like the Hyderabad mixture, based on Bengal gram, ground nut and cotton seed flour.[7]

Plainly, it is difficult to generalize, but in most less-developed countries some supplementary food will be required for the treatment of severe protein-calorie malnutrition (protein-energy malnutrition), whether such children are treated in hospital, in nutrition rehabilitation centres, or at home. In addition,

a varying amount of supplementary food mixtures would be needed for the rehabilitation of children with second-degree malnutrition, and for distribution at low cost, or purchase in shops, as a weaning food for urban children.

In brief, food supplements can play a significant part, especially in acute, severe food shortage or in communities that are becoming urbanized. More often their role may be minor and in all cases their use needs very careful definition when a feeding programme is set up.

Improved use of existing food resources

Recent work in various parts of the world has indicated that a major way of improving the diets of pregnant women and young children is by ensuring that the foods already available are used to best purpose and actually reach these groups. For example, there seems little doubt that much of the protein-calorie malnutrition seen in southern India could be greatly reduced if mothers in these areas could be persuaded to feed their young children from the second six months of life onwards with appropriately prepared mixtures, based on the local rice and legume foods that are available and customary.

In relation to the world's present agricultural, economic and political situation, this approach makes much sense, but it needs massive scientific endorsement as a valid and modern approach.[1,5,11,15] It lacks the space-age glamour of, for example, amino acid fortification, which has no chance at all of affecting the nutritional scene significantly in most of the world.

This type of approach underlines the need for the increased local production of food, including at village level. It has the economic advantage of emphasizing national self-reliance, and the political gain of not depending on any other country's food production and foreign policy.

The mainstays of this approach are *human milk* for the infant and *multimixes* for the weanling (especially the 'secotrant'[12]—the second-year transitional) and for the lactating and pregnant mother (with her resident fetus).

Human milk. An unfortunate trend in the West over the past few decades has been the decline in breast-feeding. Still more unfortunate has been the fact that this unbiological trend in child rearing has been exported to developing countries, especially to cities and peri-urban areas, such as Singapore and Kampala.[3,11] This has been related partly to women working, but more to a lack of understanding by health workers and to ill-advised commercial exploitation.

This trend has numerous nutritional and economic ill-consequences. Firstly,

in any part of the world bottle-feeding with cow's milk formula costs more than the extra nutrients needed by the lactating mother, which can be provided from everyday foods. Secondly, human milk has unique nutritional and anti-infective properties.[13] Thirdly, the convenience and logistic distribution of human milk give it an irreplaceable advantage in terms of cost-effectiveness, in industrialized and technically undeveloped countries alike.

Furthermore, on a macro-economic scale, widespread failure to breast-feed represents a loss of a national resource. For example, it has been calculated that in Asia there are approximately 60 million infants in the first year of life, and if all are breast-fed, this means some 16000 million litres of milk a year. If there were a very rapid change from human milk to cow's milk for infant feeding, and assuming current milk yields in the area, a herd of 114 million cattle would be needed—a 40% increase in milk production in Asia.[10]

Similarly, in 1950 in Chile the potential production of breast milk was some 57 000 tonnes of which all but 2 900 tonnes (5%) were realized.[3] By 1970, 78 600 tonnes (or 84%) of 93 200 potential tonnes were unrealized. In Kenya, where the decline in breast-feeding has been less dramatic so far, the estimated annual loss in breast milk of $11.5 million is equivalent to two-thirds of the national health budget or one-fifth the average economic aid.[3] In Singapore, between 1951 and 1960 there was a decrease from 71% to 42% in the numbers of children in low-income families breast-fed for at least three months. The implied loss from the rejection of mother's milk for babies under one year was $1.8 million.[3]

In addition, a decline in breast-feeding in the average circumstances of developing countries leads to a *rise* in the incidence of marasmus and diarrhoeal disease, as the formula used can never be given in adequate quantities and will be fed from a contaminated bottle and nipple. For example, it was calculated a few years ago that in Uganda to feed a three-month-old baby adequately on one of the available processed milks would take about one-third of a labourer's basic wage.

The rise in incidence of marasmus and diarrhoeal disease has, in turn, economic relevance nationally, as it implies the need for therapeutic services to treat these malnourished infants, notoriously a slower and more long-term concern in marasmus than in kwashiorkor.

Thus, the full financial cost of malnutrition in the English-speaking Caribbean was calculated in 1968 under various headings,[6] particularly the costs incurred in connection with treating the clinically malnourished children and the costs in terms of children's lives lost. The result suggested that in this population of 4–5 million the expenditure of some $10 million (£4 million) had been wasted, from this point of view, over the last decade. In fact, as one item alone, in

patient treatment for children with malnutrition was assessed as being between 1% and 5% of the various countries' health budgets.[6]

Multimixes. Recent investigations have shown that the requirements for protein, energy (calories) and other nutrients can be met by mixtures of vegetable foods, preferably, however, with additional small quantities of animal products, at least at intervals, to supply missing vitamin B_{12}.[1,5,11,15] For example, it has been shown that at least the less severe cases of kwashiorkor can be cured with vegetable protein mixtures, as has been done in Haiti, using corn: bean 'double mix' (p. 135).

Although in some areas of the world, particularly during climatic crises, there may be an actual lack of the basic food items, in most developing countries there is no doubt that the nutrition of pregnant women and young children could be considerably improved *with the foods available now.* The main need is to devise scientifically based, economic and culinarily feasible multimixes based on the local cultural pattern, combined with *effective* nutrition education[1,5,11,15]

Multimixes are mutually complementary combinations of common food items. They are based on the community's staple, preferably a cereal grain combined together with a legume and, if possible, with small quantities of animal product, dark green leafy vegetables (as sources of vitamins and minerals) and, if possible, for young infants compact calories in the form of fat or oil.

Such weaning multimixes can in fact be prepared at low cost, either by mixing together ingredients from the family pot or by preparing them separately for young infants. The scientific basis for their nutritional value and various matters concerning their preparation have been given elsewhere.[1,5,11,15]

From an economic point of view, multimixes are feasible even in poor countries. The costs of their use by village mothers will at most include only the price of appropriate inexpensive cooking utensils, such as perhaps a small saucepan or a sieve. However, if we are to persuade mothers and motivate them sufficiently to use these simple-seeming food mixtures, we need to give the main emphasis to different forms of nutrition education, particularly in the home, in the clinic and in the nutrition rehabilitation unit.

TENTATIVE COSTINGS

It is plainly extremely difficult to calculate the cost of a programme designed to eliminate malnutrition in mothers and young children, because conditions vary so greatly from country to country and area to area. Obviously, there will

be special needs in a region that is overpopulated and with limited potential for food production as a result of advanced soil erosion. Likewise, special circumstances will indicate the necessity for a specific programme; for example, in drought-ridden areas. Also, the percentage of the population recently urbanized will be a factor tending to increase the need for supplies of processed foods.

However, as a generalization and for the purpose of this chapter, it will be assumed that the majority—80–90%—of the population of the less-developed countries of the world are still in rural areas. Among most of these areas, we assume that the main emphasis needs to be given to increased food production at village level and the optimal use of the foods already available, especially breast milk and multimixes for both young children and pregnant and lactating women, but that supplementary foods will be needed for certain situations.

Approaches

Basic to major efforts to eradicate malnutrition in the physiologically vulnerable groups is the active acceptance and promotion by governments of a rational food and nutrition policy, including for agricultural development, which emphasizes national food production, with special reference to more nutritious items, and also economic development, with due emphasis on income distribution. Such a policy should emphasize the significance of human milk as a national resource and the reversal of the current trend away from breast-feeding as a major economic issue.[3,10] Also, imported processed infant foods would need to be screened in order to exclude those that have a destructive effect on the pattern of breast-feeding and those that do not conform to the social, cultural or economic constraints of the community.[3,10,11]

In addition, and as part of a food and nutrition policy, nutrition programmes geared to the needs of mothers and children must be implemented through a low-cost, uncomplicated network for mother and child health, based largely on auxiliaries and village level volunteers, and with functions covering the basic aspects of health protection for mothers and young children, including nutrition and family planning.[9,14] Such programmes are already being attempted in different parts of the world: for example, at Danfa, in Ghana.[21] The importance of such approaches is increasingly being appreciated by people working in the different disciplines concerned. From a nutritional point of view, the Zagreb Guidelines of the International Union of Nutrition Sciences are concerned with this type of activity.[9] The family planning programmes advocated by Taylor & Berelson are moving in a similar direction.[24] Likewise

the American Public Health Association is associated with at least eight projects which, once again, are concerned with low-cost, rural networks delivering health care, family planning services and nutritional help in an integrated system.[2] Lastly, a recent conference organized by the Dag Hammarskjöld Foundation in Addis Ababa viewed the matter from a more paediatric vantage point under the title of 'The dilemma of the cost, quantity and quality of child health services in Africa'. In fact, all these different endeavours are moving in a similar direction.

Within such networks of mother and child health care a major emphasis must be on education, including nutrition education.[9] Primary topics will plainly be breast-feeding and weaning multimixes. Neither of these imply additional expenditure, except, of course, for the considerable funds required for the development, planning and maintenance of the envisaged network.

Cost of supplementary feeding programmes

In attempting to calculate the food needs, in addition to locally available foods at the village level, for young children in less developed countries, we have to make certain approximations and assumptions. About 2600 out of the world's population of 3600 million (1970 figure) live in less-developed countries. Of these, some 20% (520 million) are infants or pre-school children, up to five years of age. Within this group, about 30% (140 million) are at especially high risk between six months and two years.

On the assumption that supplementary feedings will be undertaken selectively only and for defined periods of time, three main categories are identifiable: *(i)* severe protein-calorie malnutrition, probably requiring therapy with a liquid preparation based on dried skim milk, *(ii)* severe protein-calorie malnutrition treatable with a semi-solid, high-protein processed multimix, and *(iii)* moderate protein-calorie malnutrition requiring smaller amounts of processed multimix.

On this assumption, two supplementary foods seem to be required: (1) a locally processed multimix of a vegetable protein, or vegetable protein plus animal product (prepared either nationally or regionally). Examples include Faffa, Incaparina, Superamine and AK-1000. For purposes of calculation it will be assumed that such a processed multimix would contain 20% protein and would cost 40¢ US per kilogram; and (2) dried skim milk, containing 35 grams of protein per 100 grams and costing US$1.9 per kilogram. We can then calculate the costs for each of the three suggested categories of need:

(i) In *severe* protein-calorie malnutrition (PCM), requiring liquid food based

on dried skim milk, if two grams/kilogram per day are given (and assuming a one-year-old child weighing 10 kilograms) then 20 grams of protein will be needed, costing 11¢ per day. If oil and sugar are added as calorie enrichment the cost may be 15¢ per day. If an eight-week treatment is envisaged, the total cost will be US $8.4.

(ii) In *severe* PCM, treatable with semi-solid multimix in a nutrition rehabilitation unit and/or at home, again assuming a one-year-old, 10-kilogram child receiving two grams/kilogram per day of processed multimix (used in a diet with local foods), the cost will be 4¢ a day and for an eight-week period of treatment the total cost would be US $2.24.

(iii) In *moderate* PCM, for a one-year-old, 10-kilogram child, one gram of protein/kilogram per day may be given in the form of 50 grams of processed multimix, together with a diet of other appropriate local foods. The cost per day will be 2¢ and for a six-week period the total cost would be 84¢.

One can make a rough estimate of the total costs, assuming that 140 million children aged between six months and two years will be at risk. By means of health supervision, particularly by the use of serial weighing in rural mother and child health outposts and during home visiting, it will be possible to screen out the moderate and severe cases of protein-calorie malnutrition.

(i) Severe PCM (liquid diet). If it is postulated that 1% of these children will be suffering from severe PCM, of these 0.1% may be suggested as being in need of treatment based on a liquid diet, probably made of dried skim milk. This will mean 140 000 children needing therapy costing $8.4, or a total of $1 176 000.

(ii) Severe PCM (semi-solid diet). If 0.9% of these children are suffering from severe PCM treatable with semi-solids made of processed multimix, 6.3 million children will need therapy costing $2.24 each, or a total of $14 112 000.

(iii) Moderate PCM. If it is assumed that about 30% of these children, or 42 million, will be suffering from moderate PCM, then this number of 84¢ dietary supplements will be needed, totalling $35 280 000.

Thus, the grand total for the complete supplementary feeding programme for children with severe and moderate protein calorie malnutrition would be $50 568 000 per annum, or approximately 1.9¢ a head for developing countries, or 1.4¢ a head for the world population. Alternatively, it would be 5¢ per head per year for the population of the industrialized, more affluent regions of the world.

There are, obviously, many sources of error in such calculations, and plainly there is a need for much more competent assessment. Numerous sources of variation not taken into account include the needs of mothers and the percentages of children living in urban slums. Also, in some areas of the world

moderate PCM may be dealt with best by the use of locally prepared multimixes rather than by means of a processed food mixture. Also, in the expenditure 'equation', considerable savings will need to be included from *(a)* the conservation of human milk (and limited expenditure on breast-milk substitutes) and *(b)* the substantially decreased financial wastage resulting from malnutrition.

It is also obvious that such a supplementary feeding programme can only be envisaged as a small but important part of an overall mother and child health network adapted to the local ecology—including the particular forms of malnutrition present, the geography, the agricultural potential, the population distribution, and the culture.

Nevertheless, an approach of this type is plainly feasible, at least in theory, within a period of five years. During this time, the necessary training and development needed for the deployment of a mother and child health network, with a special reference to the nutrition of mothers and children as envisaged in the Zagreb Guidelines,[9] would need to be paralleled by the development of the government-sponsored, low-cost processing of appropriate foods, at a national or regional level.

The implementation of such a scheme to include all developing countries will be a gigantic task. However, the main difficulties are undoubtedly those of political priority and emphasis, and also the conceptual need to appreciate that the dietary improvement of nutrition in developing countries, among mothers and young children, seems most likely to be achieved by the better use of what is available, particularly human milk and multimixes based on locally available foods; by the exclusion of the nutritionally undesirable by the restricted importing of inappropriate and harmful processed infant foods; and by the limited production of uncomplicated, low-cost, processed multimixes for selective use for limited periods. Equally, the improvement of the diet of these vulnerable groups is only one facet of a programme designed to prevent malnutrition. Immunization, health supervision (particularly by serial weighing), the early management of infections and family planning are all as important, if not more so. In all instances, whether the measures are dietary or non-dietary, the prevention of malnutrition can best be undertaken through adaptive mother and child health services, integrated with the real needs of villagers and situated in rural areas. These are the channels for dietary improvement and, at the same time, for other health activities whose benefit is both directly and indirectly closely related to improved nutritional status.

Discussion

Pirie: It always puzzles me, when I am told that human habits can't be changed and that we have a built-in conservative principle about food, how it has come about that as a result of meretricious advertising and the offering of jobs in towns, and following the bad habits of developed countries, the practice of giving human milk to babies—which has all the aesthetic, emotional, religious and medical virtues—has been given up so easily. It is extraordinary that people have thrown out the habit of breast-feeding over a period of a few years in spite of every advantage in its favour, and for next to nothing.

D. B. Jelliffe: I think there are several reasons. One is that the main impetus in health, in medicine, and in life as a whole, in the modern world, dates from the middle of the last century; and from the point of view of health, the great marvels (and they were marvels) were technological—X-rays, bacteriology, aseptic surgery and the like. The health profession has not helped in this regard, because the doctors were the ones who introduced—and the word is correct—'formulas'. The milk preparations made at the beginning of this century and the end of the last were literally formulas much bigger than Einstein's. So the overemphasis on technology is one reason. Secondly, I think people have moved towards bottle-feeding, in both industrialized and developing countries, because it is regarded as symbolic of or appropriate to modern life: in a technological world, one should feed a child technologically. It is essentially a down-grading of biology and an up-grading of technology. I see this changing now. The situation in the United States has altered very much in the last few years with the La Leche League, and there is a resurgence of interest in breast-feeding among the more educated, at least. If this is so, there is every possibility of the same trend being exported overseas, because, rightly or wrongly and very often wrongly, people in other parts of the world tend to take what goes on in an industrialized country as a model.

Potts: I share totally the enthusiasm for breast-feeding, for both nutritional and contraceptive reasons. People working in family planning have been over-enthusiastic in pointing out the possible failure of lactation as a contraceptive method. It is a relatively effective method. There has been a misinterpretation and an undervaluing of the role of lactation as a contraceptive, although it is widely appreciated by women in developing countries, who deliberately prolong lactation for this purpose. However, for a well-nourished Western woman, one might be wise to advise using another contraceptive method early in lactation if she wants a high degree of protection.

I have two other minor points. One is in relation to advertising, which is a remarkably and frighteningly persuasive way of changing people's attitudes.

I cannot help comparing the advertisements current now in East Africa and encouraging bottle-feeding, to the reaction of the same community to recent efforts to advertise condoms by means of bold advertisements which as far as can be seen were totally acceptable to the rural community. But the social élite objected, and said that people were trying to get rid of condoms like lollipops—which, basically, I thought was the idea! It is unfortunate that there is resistance to advertising things which common sense suggests are in the health interests of the community, while no mechanism exists for preventing thoroughly misleading and dangerous advertising.

A second point is that the cost to the Philippines in dollars of abandoning breast-feeding is as much as the world budget of the International Planned Parenthood Federation!

D. B. Jelliffe: The Protein Advisory Group of the United Nations has a committee, on which I serve, concerned with feeding young children. The committee has been holding a dialogue over the past two years with the food industry, with the aim of obtaining some sort of overlap between nutritional adequacy, modest profit, and a mass market. I don't think we shall get far with this, and some other group may have to take a more aggressive, Nader-like stance in this regard. On the financial dimensions, Berg in *The Nutrition Factor*[3] has discussed the economic consequences of the type I mentioned, and the figure for the Philippines is his. He compares it, rather as you have done, with aid to various countries, or to a percentage of their total health budgets.

King: What fascinates me about advertising is that it should be so easy to stop. If the correct legislation, which might be very simple, were brought in to prohibit undesirable advertising, its evil influence might end overnight. It might even be possible to encourage breast-feeding through advertising. In Zambia the manager of the government's Dairy Produce Board agreed to print, on the tins of powdered milk that it was selling, a statement to the effect that 'human milk is better than this or any other kind of powdered milk'.

Victoria Garcia: I would strongly support the view that we, the doctors, are to blame for the reduction in the length of lactation. Last year, in a 'knowledge, attitude and practice' study in Chile we demonstrated that the period of breast-feeding has been on average three months during the last decade. We discovered that we have helped to create a generation who depend on the increasing amounts of free powdered milk offered by the national health service to feed their babies, instead of making efforts to breast-feed them. We had the opportunity of observing what happens in a medical consultation. If a mother claims that she has insufficient milk, nobody encourages her to make any effort; she is simply given a prescription for free powdered milk. And this happens in a country where a safe water supply is not always available for

people living in the marginal areas, and where food-handling is not always hygienic. It is not surprising that we have a high rate of infant morbidity and mortality due to diarrhoea.

D. B. Jelliffe: The health profession is totally ignorant on this subject. We have the absurd situation in the West where the paediatrician, the obstetrician and the nurse receive little information about lactation during their training, and yet the mothers turn to them. They receive vague advice, or advice which is really not based on modern knowledge. The mothers then are most influenced by women's magazines or by other sorts of advertising, and one can understand how it happens that they don't breast-feed. I think we must emphasize to the medical profession the scientific advantages, which are likely to appeal to them—the host resistance factors and the biochemical merits.[13] These are required in this scientific age to endorse the scientific superiority of this particular product, which is so self-evident from a practical point of view.

Katherine Elliott: The lack of knowledge among health professionals is frightening. Most midwives, nurses and certainly medical students are taught very little about how they can help and encourage inexperienced mothers to breast-feed successfully. In consequence, faced with the combination of a hungry howling infant and a mother desperate with anxiety about her maternal adequacy, most people not surprisingly see bottle-feeding as the simplest and most scientific answer, since the intake can actually be seen and the composition of the mixture in the bottle is known and can be varied at will. There are comparatively simple ways of assisting lactation. In the Bangla Desh refugee camps Dr Roy Brown[4] found he could restore the confidence of the mothers, and hence lactation, even in the most difficult circumstances, by giving a tranquillizer for not more than three days, provided this was combined with the stimulus of frequent suckling and of course sufficient fluid intake. His success surprised the nurses and delighted the mothers and must have saved many infants.

There is great need for better and more widespread education about the superiority of breast milk as food for small babies, together with reassurance that initial difficulties and even setbacks later are not insuperable. And this education should be given not only to health professionals but also to expectant parents—fathers as well as mothers!

We ought not to forget the possible connection between breast milk and brain development and intelligence. It has been suggested that any country which regards the education of its children as a national obligation ought to be prepared to take the feeding of its mothers and young children out of an economic context. This might be extended to include promoting breast-feeding among national responsibilities as the ideal way to give children the optimum start.

Wenche B. Eide: Dr Jelliffe notes that mothers are influenced by advertising and by women's magazines. A particularly disgusting advertisement which recently appeared in a medical journal shows a beautiful woman in bed shortly after giving birth, holding a small baby, and the text states that 'she is inhibited and doesn't know it'. This sort of advertisement for a suppressant of lactation is really unjustifiable.

I would like to add one point to the comments on the economic loss to a country represented by the reduction in breast-feeding. If breast milk were included in statistics such as the FAO Food Balance Sheets, it would in terms of protein appear as very little per head. The total amount produced daily is something like 50 million litres. But even if this is perhaps negligible in terms of protein, and per head, it is nevertheless so important as *the* food for infants on a world scale that it ought to be shown somewhere, and why not in the Food Balance Sheets?

Patrice Jelliffe: My husband and I have also been of the opinion that more publicity should be given to the use of human milk in data on food production in different countries. For example, few food composition tables list human milk as a product consumed by the young segment of the population: animal milks—cow, goat, ass, etc.—are listed and their nutrient content per 100 grams is clearly stated. Anyone consulting one of these tables, whether dietitian, physician, nurse or lay person, could be led to believe that because breast milk is not included by those responsible for formulating these tables, it is a food commodity of little moment or importance.

When the question of including breast milk in the Food Balance Sheets is considered, the main problem faced is how to measure accurately the kilograms of milk produced. It is much simpler to give specific figures for animal yields. It is known that a well-fed, healthy woman produces approximately 850 millilitres of breast milk a day. However, this is very much an individual pattern of production, being dependent on many factors that are psychosomatic and cultural. It must be ascertained accurately what is meant by breast-feeding—that is, whether it is full, uncomplemented breast-feeding or with the addition daily of complementary feeds of cow's milk or even gruels, or the introduction of semi-solids as well as a token breast-feed. It is well-known[13] that the fewer breast-feeds given, the less stimulation there is of the breast, and thus there is impairment of 'the let-down reflex' and diminution of the output of milk.

The economic value of breast milk gives this food commodity an important place in national food production programmes. Less money will be spent on drugs and hospitalization of breast-fed children who are less prone to disease (such as diarrhoea, respiratory infections and otitis media) than bottle-fed

babies,[8,25] and there will be a lower expenditure on costly imports of processed animal milks used currently as 'breast milk replacers' in many countries.

The economic aspect to the individual family must also be stressed. In a study in Kingston, Jamaica, McKigney[19] calculated the relative cost of feeding the lactating woman or bottle-feeding the infant. His results showed savings of between US $0.22 and $1.74 a week, depending on the milk or diet chosen: a considerable saving for a family of six living on maybe $4 a week.

It has also been estimated[10] that if all the 60 million infants in Asia needed to be fed on cow's milk, 114 million cattle would be required, or an increase of 40% of the total present milk output for the continent.

A place does exist for breast milk on national food balance sheets. When a successful breast-feeding programme exists in a country, the monetary value of this milk can be partially equated with the savings made on the imports of powdered milk that would have been needed to feed the infants.

Wenche B. Eide: Women have started seriously to discuss the decline in breast-feeding in Norway, and there is now a fairly active group, comparable in several respects to the La Leche League International in the United States. The group is particularly concerned about the loss of what could be termed a 'women's culture'. Unlike the earlier extended family, which no longer exists in Western society, very few women are around now to teach the young mother how to breast-feed, since mothers, aunts and grandmothers often live far away. This is important, because we know how much lactation has to do with psychological factors. And it is not only that nobody helps the woman. It has been said that nurses are not trained to promote breast-feeding. I would say that in Norway many are in fact discouraging it. Yet the hospital is the place where breast-feeding has to be encouraged, because if the woman gets no help there, she gets even less when she goes home. Groups such as those now emerging in Norway are trying to substitute for the extended family, where experienced women taught the others. Now, young women who have had children and have breast-fed them could be called upon to advise young mothers.

D. B. Jelliffe: One of the most interesting recent developments in this field has been the awareness of what makes for success or failure in lactation. Basically, it is found that lactation results from an interaction of reflexes on the baby's side and on the mother's side. The key is the psychosomatic 'let-down' reflex. This is dependent basically on confidence, which ultimately depends on information and group support.[17] As Dr Eide says, the absence of this in our type of culture, or the obverse of it, is what makes for failure. An interesting recent concept is the *doula* theory of Dr Dana Raphael, based on work in social mammals and traditional societies, including Western communities until recently. In all of these it has been found that an individual, usually a woman,

sometimes more than one, acts as a doula or female assistant at the end of pregnancy, during childbirth and in the neonatal period, to supply information and emotional and psychological support.[22] This is one of the main features which makes for confidence and hence a successful let-down reflex. As Dr Eide says, the La Leche League and similar groups in other parts of the world act as the doula surrogates of the mechanized, modern world.

Patrice Jelliffe: Dr Raphael has recently published a book called the *Tender Gift: breast feeding*[23] which elaborates the doula concept.

The education of mothers by nurses about breast-feeding is usually rather incomplete.[16] In many countries great attention is paid in the antenatal period to the care of the breasts and advice, often not economically relevant, is also given about the diet of the pregnant woman. But as soon as the baby is delivered this excellent advice is not put into practice. The child is isolated from the mother and given a glucose-water feed as well as a cow's milk feed, on the pretext that the mother's milk is as yet insufficient in quantity.[16] Obviously the physiology of breast-feeding is only partially understood by medical and nursing personnel, as this behaviour is inconsistent with their theoretical teaching of mothers on this vital subject.

I am now analysing the results of a survey by questionnaire which I have undertaken in 750 hospitals around the world, on the content of nutrition in the curriculum of nurses in training. It will be interesting to see how much time is devoted to the preparation of artificial feeds and to the physiology of lactation and encouragement to breast-feed. The lack of awareness of the need to emphasize this important subject is seen, very often, in the curricula of both medical and nursing students. Unless a concerted effort is made by all cadres of medical and para-medical personnel, with the current world situation of rising food prices, including those of artificial milk preparations, we are likely to see an even higher rate of morbidity and mortality from malnutrition.

Equally the need exists for governments seriously to monitor the type of advertising for infant formulas and weaning foods permitted in the mass media: unless we can pull at the economic heartstrings of administrators, giving hard figures on the cost of malnutrition and the cost of importing processed milks compared to the lesser cost of protecting the lactating woman with an adequate diet and medical care, we as medical scientists will not succeed in our endeavours, because we do not have the large financial backing that commercial firms possess.

Wenche B. Eide: Concerning weaning foods, Dr Jelliffe stressed the need to use what is locally available. But I would like to mention an interesting study made by James Levinson[18] in the Punjab, the state which has been called the bread basket of India. Nutritional studies were made in a group of villages

where the population could be divided into two groups, landowners and landless labourers. The result was very clear that almost all children had some degree of malnutrition, but while it was possible to solve the problem with education in the landowners' families, this was not so in the landless labourers' families, because there simply wasn't enough to eat—these people did not have enough money to buy the right food. Don't let us forget this aspect of maldistribution as a sociopolitical problem, even if we must continue to insist that educational programmes can go a long way towards ameliorating the situation, whenever the other conditions are favourable.

Tewari: In discussing breast-feeding we have emphasized one aspect but so far ignored this other extreme, which is closely linked with the problem of malnutrition, and is very much a fact of life in developing countries where it is difficult to get babies weaned. This situation is being accentuated now by the family planning programme which emphasizes prolonged lactation and is advocating that breast-feeding should be continued much longer than is nutritionally desirable. The problem is not so much to promote more breast-feeding but to get the baby weaned and replace breast milk with supplementary foods.

Such supplements have a secondary function: they also provide a vehicle for the delivery of health services which would otherwise be very difficult to bring to the mothers. They attract mothers and children to health centres. It is the general experience that attendance at health centres falls suddenly when supplementary foods are discontinued. If supplementary feeding is restored, attendance shows a sharp increase.

At the same time, there is another problem. Our experience in many places has been that to prevent abuses processed milk has been delivered, rather than the skimmed milk powder, and as a result the attendance falls. The milk is really meant for mothers and children but in fact others in the family, not entitled to the milk, are getting it instead. This happens on a very large scale.

Another point to note is that the Green Revolution has directed attention away from the production of legumes and towards cereals. This is important not only in regard to the ease with which high-protein foods can be made available to mothers and children, but also because legumes have higher contents of lysine and other nutrients. More of these legumes are now being incorporated into supplementary foods, as far as possible made locally rather than from imports from outside.

D. B. Jelliffe: I agree with Dr Eide that one must consider the needs of, for example, the landless labourers who are unable to buy food; it is necessary to work among at-risk families in different communities. The mother obviously needs to be fed. Dr Tewari is quite right and I should have mentioned the situa-

tion where the child is breast-fed without supplementation for too long, which leads to a late form of marasmus. My reaction to this would be to feed the mother and introduce supplementary foods, but continue lactation as a small but important additional protein supplement. Recently, in Egypt, I was overwhelmed to see a large number of children with what I was assured was 'contraceptive marasmus'—marasmus in children whose mothers' milk had declined because of the use of oral contraceptives.

Lindblom: The decline in lactation in the industrialized world is essentially an economic and political problem related to the value a family puts on having the mother working. It is especially a question of the value estimates of women and what they want for themselves. In the industrialized world it seems as if breast-feeding is being abandoned because the mother prefers earning her own money and therefore goes out to work. The social problems in this area are the critical ones.

Wenche B. Eide: You are implying that breast-feeding has to be done in the home, in the family, with the woman not working outside the home; but this is not true. This is the prevailing attitude of the society, which assumes that she has to stay at home in order to be able to breast-feed. Actually it is a matter of creating the opportunities for women to work *and* to breast-feed their children. Establishing crèches and nurseries would no doubt have a greater impact on nutrition, in many places, than the refined laboratory research behind a new supplementary food.

Lindblom: I agree with you. The woman should be given the opportunity to feed her child, at work, and this requires the support of the sociopolitical system.

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Human Rights in Health
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Health services and medical education in China: a brief report

O. MELLANDER

Development by any definition is subject to certain barriers. Some of these are 'absolute', meaning that development is not possible if they are not eliminated. In Table 1 some examples of such absolute barriers to development are given. Sufficient knowledge is available to eliminate some of these obstacles; others are more difficult to handle. As indicated in the table, pre-school malnutrition can be considered as an absolute barrier to development which could be overcome.

Many ecological factors are responsible for malnutrition, and especially pre-school malnutrition, in a community. Some of these are listed in Table 2. The conventional ones are generally recognized and accepted as a background in most applied nutrition programmes; the other factors are often overlooked. It is a well-known fact that the efficiency of most nutrition projects—national as well as bilateral ones, or those supported by the UN—is rather low in terms of the number of children covered and the number whose nutrition is improved by the projects. I found it interesting to study the reasons for this lack of efficiency and have done so especially in the Middle East, as a nutrition adviser to WHO, and also in Ethiopia in connection with the Ethio-Swedish nutrition project. Recently I was also able to make a similar study in South Korea and in The People's Republic of China.

This latter visit was much shorter than the others (three weeks only). It was used mainly to study the factors most often found to be limiting in other developing countries, especially health services, medical education and the availability of food. I should emphasize first that I saw no signs of malnutrition in children during my visits to city and rural hospitals, clinics or health centres. Breast-feeding was generally reported to predominate, including in the big cities, and cow's milk was surprisingly enough reported to be generally available for children in the weaning period, either fresh or powdered.

TABLE 1

Examples of absolute barriers to development

	Degree of feasibility of elimination on present level of knowledge
Health-related barriers	
Pre-school malnutrition and ill-health	+++
Inadequate water supplies	+
Overpopulation	+
Other	
Extreme and general poverty	?
Political instability	?
Incompetent and/or politically dishonest administration	?

TABLE 2

Ecology of malnutrition

Conventional factors

(1) Underproduction of basic foods
(2) Restrictive dietary practices (especially concerning weaning foods) and early weaning
(3) Extreme and widespread poverty
(4) Explosive population increase without corresponding increase in food production

Factors often overlooked

(1) Level of competence and recruitment principles in administration
(2) Medical education: its quality and adaptation to local needs
(3) Existing health care: general standard and coverage, adaptation to local conditions, and use of health aides in preventive work

TABLE 3

General principles of the organization of health services in China

(1) Priority for prevention
(2) Priority for rural areas
(3) Basic health care is maximally decentralized and minimally resource-dependent
(4) Equal status for Western and traditional medicine
(5) Follow-up education on all levels
(6) Complete integration of health services in local labour system
(7) Medical research only if 'serving the masses'; priority for research in acupuncture and herbal medicine, and for cancer and virus research

TABLE 4

A comparison of health services in China and in other developing countries

	Developing country under Western influence	*China*
Priority for prevention	Usually poor	Absolute
Priority for rural areas	Usually poor	Absolute
Availability	Limited geographically and economically	General
Technological level in existing preventive work	Good	Good
Unit-cost	Often undefined	Very low (self-reliance for each commune)
Coherence	Often poor with separate projects for family planning, mother and child health, malaria, etc.	Very strong
Level of confidence	Questionable	Good
Attitudes of health workers to consumers	Technical superiority	'Learning from each other'
Administration	Usually centralized	Decentralized
International assistance	Considerable	None
Integration into national development-planning	Technical if any	Ideological only
Primary health care	Often less than 20% coverage by health centre activities	Apparently very high coverage by personal contacts
Front-line health personnel	Usually doctors and nurses	Barefoot doctors

HEALTH SERVICES

The health services in China are organized according to certain general principles, as indicated in Table 3. In Table 4 some important aspects of the health services in China are compared with those in developing countries in general. Of special interest was the role of the so-called barefoot doctors in the rural health services.

These services are organized in the general way described in Table 5, where it can also be seen that the barefoot doctors carry the responsibility as front-line personnel. I met and interviewed several of these doctors. The training under-

TABLE 5

An example of the organization of rural health services in China

Production team	*Health room*
100-300 persons ↓ Leading group	Barefoot doctor
Production brigade	*Clinic or health centre*
10-20 production teams 1000-3000 persons ↓ Revolutionary committee	1, 2 or 3 barefoot doctors Production of herbal medicines Vaccination programme Sanitation
Commune	*Health station or hospital*
10-20 production brigades 40 000-60 000 persons ↓ Revolutionary committee	50 beds 70 medical workers 16 Chinese traditional doctors 17 doctors with Western type of training 4 with extra paediatric training 3 with extra ear, nose and throat training 8 nurses 6 midwives Admissions: 1400 per year Out-patients: 270 per day Since 1969 more than 120 barefoot doctors trained in 3-month courses Production of herbal medicines covering 40% of all medicines used in out-patient departments Production of glucose and salt solutions for intravenous use Regular visits of mobile team from regional hospital

gone by one of them is shown in Table 6. From Table 5 it is also evident that the proportion of nurses on the staff of rural hospitals is very low.

An interesting innovation with implications for public health is that equal formal status is given to traditional and Western medicine. Old and experienced traditional doctors seemed to be working in the hospitals together with ordinary doctors. Young traditional doctors were working in the villages and were given repeated periods of intensive training in modern aspects of public health.

TABLE 6

Training programme of a barefoot doctor

Graduated from primary school	1961
Farm work	1961-1965
Public health course given by mobile team (3 months)	1965
Hospital training in Peking and political education	1966
Rural health work mixed with farm work	1967-1971
Chinese traditional medicine (4 months; lectures and practice)	1971

In this way the number of medical workers available could be very rapidly increased in the countryside and the considerable capital of public confidence in traditional medicine was not lost.

Another very interesting innovation is the extensive use of mobile teams for educational and advisory purposes. Up to one year of rural work every third year was said to be compulsory for all city hospital doctors. They go out in teams of a few doctors, representing different specialties, and are used for teaching local staff and barefoot doctors from the commune as well as medical students from the medical faculties who follow their teachers for special training. Naturally, the city doctors are required to take part in the daily hospital work.

MEDICAL EDUCATION

The medical curricula and training in developing countries in general are usually not at all adapted to the actual need, which is for a system of medicine centred on public health. The system found is usually a copy of American or European systems but without similar resources in teachers, hospital beds and equipment in general. This lack of orientation to the problems of development is certainly an important factor in the ecology of malnutrition. It is therefore extremely interesting to study the system of medical education now being tested out in China. Here the guiding principle is that prevention comes first, and rural public health has a very strong position. Some important differences between the Western and the Chinese systems of medical education are set out in Table 7, and a more detailed account of the Chinese curriculum is given in Table 8. It will certainly be very interesting to follow developments in this field and the implications for the medical manpower situation in China in the next few years.

TABLE 7

A comparison of medical education in China and in other developing countries

	Developing country under Western influence	*China*
Entrance	By examination	Selection by production team members and by ideological and intellectual screening
Previous factory or farming work	Very unusual	Compulsory
Previous medical experience	Very unusual	Frequent (70%)
Curriculum	6 years (including 2 years pre-medical)	3 years
Subjects studied	Around 30	15
First patient contact	In the third or fourth year	In the first year
Priorities	Diagnostic and curative aspects	Prevention
Integrated teaching	Increasing	Usual
Separate nutrition course	Seldom	No
Rural hospital internship	Unusual	6 months; compulsory
Active participation in public health work	Insignificant	Predominant
Standard of audiovisual material and laboratory and other medical equipment	Very variable; often poor	Poor
Traditional medicine included in curriculum	Very rarely	Always
Political and ideological training	Unusual	Always
Cost of education to students	Often high	None
Postgraduate education	Not compulsory	Planned to be compulsory
Fate of graduates	10-50% loss by emigration	Controlled distribution with priority for rural areas

AVAILABILITY OF FOOD

The proportion of a standard family income that has to be spent on food can be a rather useful index of the availability of food. I had too little time to make a detailed calculation in China but the proportion seems to be around 50%. This is far less than in most developing countries and is about the same as in low-income groups in Sweden (Table 9).

TABLE 8

A three-year medical curriculum in China

First year

4-6 months of lectures and practical classes in basic sciences (anatomy, chemistry, physiology and physics) and English

4-6 months of training in rural areas in small hospitals (topics are related to public health problems)

Second year

Lectures and clerkship in clinical departments in university hospitals

e.g.	Paediatrics	1½ months
	Medicine	3 months
	Surgery	3 months
	Ear, nose and throat	2 weeks

Third year

Lectures and clerkship in clinical departments continued for 6 months

Rural hospital internship 6 months

Subjects included in curriculum:

English
Medical physics and chemistry
Body functions and structure: anatomy, histology, biochemistry, physiology
Pathology
Pathogenesis: bacteriology, virology, parasitology
Pharmacology
Traditional medicine
Diagnostics: physical examination, radiography etc.
Public health
Medicine (including psychiatry)
Surgery
Obstetrics and gynaecology
Paediatrics
Dermatology
Ear, nose and throat

CONCLUSION

To sum up: availability of food, absolute priority for prevention in health services as well as in medical education, and the existence of a front-line health personnel who really live among the people and share their daily problems—all these together combine to make up the difference, I believe, between China and other developing countries where malnutrition and ill-health in children are still major problems, despite all the various types of nutritional and health projects.

TABLE 9

The relative amounts spent on food in countries at different stages of development

Cash economy

Cost of food related to disposable family income in low-income groups

Present cost	*% of income*	*Trend*
Developed country	50-60	↗
Developing country	90-120	→
China	40-50	→

Subsistence economy

The same relation expressed as a % of total work output

Developed country	25-30
Developing country	very variable: 25-100
China	40-50

Discussion

A. Eide: I would like to refer to what I think of as the two stages in the containment of China. In the first stage the Chinese revolution was seen as an expansion of the Soviet empire and it was a question of containing this expansion and preventing it from influencing neighbouring countries. Military and other means were used for that purpose. However, after more examination, we have come to consider China almost as a miracle. In this second stage we say that the success of China is unique; it is said to be based primarily on traditional Confucian philosophy and therefore something which cannot be replicated elsewhere. I see this also as an attempt to 'contain' China, and I think it is important not to be taken in by this any more than by the former theory. The problem is to use China as a model which certainly cannot be completely reproduced elsewhere but from which we can draw a number of conclusions about how to do things, that can to some extent be applied elsewhere.

To me the most important aspect of the Chinese model is that it is rural, with priority for rural development. Secondly, it is not a capital-intensive technology. Thirdly, it is a peripherally generated rather than a centrally generated technology. This means that it is generated on the basis of the needs at the periphery, although of course influenced from the centre in various ways, but with emphasis on the people at the periphery developing their own requirements and an understanding of those requirements. I think we are, in

the world as a whole, faced with two entirely different models of development at present, to which I have referred already (p. 55). One is centre-generated (and centre-generated also in terms of the international system), originating in the heavily industrialized, heavily technological parts of the world, and is penetrating into the developing countries with a logic developed in highly industrialized countries. The other model is of peripherally generated development, based on the needs of the developing population and on understanding those needs.

It is not only a question of looking at the two different models but also of understanding the political, economic and other interests which propagate one or other model. Thus in regard to various points discussed earlier, it is possible to understand, for instance, why breast-feeding is declining, where there is an interest in seeking profit, in transforming things into a money economy: mothers' milk is difficult to sell and to market. (I imagine this might be done to some extent, and I know Dr Jelliffe has been thinking about it, but it is a complex thing to do.) But if you have a government interested in using a country's resources to improve the conditions of the people, not in raising the GNP per head, then mothers' milk is highly relevant to that purpose.

These two models apply to other questions that have come up: for instance, the tremendous differences of income in the different parts of a country, as found in Latin America. This is a consequence of the fact that if development is generated from the centre, one is betting on the strong. One is making use of those who can most easily be taken into the money economy and can most easily convert to a more capital-oriented development, instead of improving subsistence economies or a collective, 'small circle' kind of economy. Thus, much of this can be understood in terms of processes going on in the international system. The symposium so far has been extremely useful for me because I study these matters from the point of view of these forces in the international system, and I did not know so much about the nutritional and medical aspects. It has been revealing to see how this fits in with the general model on which we are operating at our Institute, among other places.

Mellander: In trying to understand and examine the success of China in specific segments like public health and nutrition we must keep in mind certain basic differences between the Chinese community and Western communities. Consider, for example, the collective ambitions and definitions of aims, instead of individual ones; complete loyalty to the state instead of criticism and personal freedom; moral motivation for work instead of economic; self-reliance instead of support by public resources; and so on. Again, in the West we rarely have contacts with our administrators or politicians without controversy. Contacts between different working groups, for example workers in

a factory and the economic experts of the factory, are usually on the basis of confrontation. You don't find this in China: there is a spirit of collaboration. They save a lot of energy this way! There is also the idea of 'self-reliance', which is the message that Chairman Mao has given in a poetic way. And the very method of using poetic terms to express practical advice makes people respond very strongly, because the Chinese people seem to have a unique feeling for poetry; so the message goes in, immediately. Thus there are many things to support the view that the Chinese experience cannot readily be duplicated elsewhere, because the background philosophy does not exist elsewhere.

Lindblom: At present, China is a static country in that it is an agrarian country, and is likely to remain so for some decades. But, when China turns into a consumer country, like the rest of the world, one wonders what will happen.

King: I am interested to know what you found imperfect in China, Professor Mellander. From all that one hears the country is so wonderful that one is forced to conclude that they must have found the remedy for original sin. I am aware of some criticisms—for example, that China is the ultimate expression of the team, an enormous human antheap. What is so worrying is the possibility of the whole system suddenly becoming aggressive through a change in leadership at the top. China appears to have fewer of the forces promoting equilibrium than are possessed by politically less homogeneous societies. If Chinese leaders set out for territorial expansion, would countervailing forces be generated within the country?

Mellander: I don't think I would be justified in basing any general criticism of the society on my own scattered experiences from a short visit. Many observations and comments were difficult to understand; for example the reference sometimes made by responsible persons to the necessity of 'class struggle', since I could observe no classes. My interpretation finally was that they were talking about potential classes and the necessity of constantly fighting tendencies towards centralization and bureaucracy, as they began to do in the Cultural Revolution. This type of activity is considered as revolutionary and I realized that the word 'revolution' has a different meaning in China. We might call it opposition to the party in office. Another difficult thing to understand was the recruitment procedure for university studies and especially the lack of influence of the individual student on his own future. Everybody seemed to be happy about it, however.

Evang: I visited China 13 years ago. I wonder whether you observed changes in this very dynamic situation in which China finds herself now, in this respect: in 1960 they were trying to integrate traditional Chinese medicine with Western

medicine, and unlike the situation in some other underdeveloped areas of the world, they did not separate them. We felt, moving mostly in larger cities, that there was some preference for Western medicine and that the idea was gradually to integrate traditional medicine *into* Western medicine. Is this still going on, or is there now more emphasis on traditional medicine?

Mellander: Equal status is now given to traditional and Western medicine. This made it possible at one stroke to increase the front-line medical personnel enormously. The younger traditional doctors, who are adaptive and placid, are re-educated and given additional medical education on how to vaccinate, how to give mother and child health advice, and so on. The older traditional doctors are taken into hospitals where they are in charge of the very small departments of traditional medicine. I visited several of them and found that usually they were treating cases whom I would consider impossible to treat by modern methods. So I think this is a clever way to use these people. They have got round a major controversial situation very successfully.

Wolstenholme: In confirmation of that, in 1965 we were told in China that when equal status was given to the traditional doctors and the Western practitioners, and they were no longer competing for prestige, the traditional people—acupuncturists—were crowding into physiology and anatomy departments avid for information that would enlighten them about the procedures they were using by tradition.

Evang: My second question is perhaps more difficult to answer. We found that a highly ideological conscience was developed in China, as in the Soviet Union also, and unlike Western countries. One of the ideologies was along these lines: we are too big a country, and the individual disappears; he gets no feeling of participation. How can we split our country up into small units to prevent this loss of individuality? We found that even large cities of over two million people had been divided into peoples' communes. In other words, communes were not established in rural areas alone: wherever the social unit was big enough, it was subdivided, and much emphasis was put on this need to produce small enough units. Is this still so?

Mellander: Yes, I think so. The question of how an individual man or woman can make his or her voice heard is a vital one for all societies. I would say that the commune member in China, especially if he is a member of the leading group of the commune, has more to say about affairs in that commune, for example on education, than a Swedish professor has to say about university education! There is a kind of 'grass-roots' democracy with a lot of input the whole time, in China.

Wolstenholme: This was my impression also. I had wondered whether the cost of all this achievement was conformity and the lack of individual ex-

pression, but never in any other country did we find this sense of personal importance; every individual—liftman, porter, waiter, bus driver—seemed to feel that he was making a personal contribution of value; he was not just being employed by somebody else.

Geigy: Do the Chinese have any problems with their youth, being for example less Mao-minded? Are they having similar difficulties to those we have in Europe and in the Soviet Union?

Mellander: I did not hear anything about this, so I cannot answer your question.

Tewari: The concept of the 'barefoot' doctor is catching on in other developing countries (including India) and is creating a demand for the same thing, but often based on inadequate knowledge of how the scheme works in China. I gather that the course of training is of some duration (Table 6, p. 157), although it is widely thought that it consists of only 1–3 months training before they are sent out into the villages. In India now we are resisting a proposal, probably inspired by some of these ideas, to take some of our traditional doctors, train them for a month or two, and send them out as barefoot doctors. Am I correct in understanding that the training in China is more than just for a month or a couple of months?

Mellander: It varies. The girl I referred to in Table 6 received basically a three-month course given by a mobile team—which might consist of a paediatrician, an internal medicine specialist and a gynaecologist coming out to do hospital work, and at the same time, giving, so I was told, very intensive training. She also had one year of hospital training, although some of the others did not; but they instead repeated the three-months training several times.

Katherine Elliott: There is also constant 'in service' training for these Chinese peasant or barefoot doctors. This was described by Dr Joshua Horn in his book[2] in 1969 and more recently by Dr Victor Sidel.[4]

Tewari: Is the success of this multi-purpose type of health worker due mainly to his inherent competence, or to the support of the local political leaders which enables him to get so much done? And how is it possible for a person with such limited training in a large field to be accepted? This is relevant to the question of whether we can produce conditions in other countries in which the same political support can be ensured for health care workers.

Mellander: The barefoot doctors outside the hospitals chiefly concentrate on preventive medicine, but fully qualified doctors are also available in the communes (see Table 5, p. 156); they work in prevention or in curative medicine. The curative work is done in the commune hospitals. At this level there are several Western-trained doctors as well as traditional doctors.

White: My impressions of the People's Republic are in general very similar to Professor Mellander's, but I would disagree on this point. All the barefoot doctors to whom I spoke did curative work. We got estimates from the doctors in their commune hospitals of how much of the curative work the barefoot doctors did, and the estimates run from 60% to 80%. The barefoot doctors told us that they treated gastroenteritic complaints and respiratory complaints (very common in the north), gave first aid, and in some places performed abortions; in other places we were told they never did abortions. But we met no barefoot doctor who did not claim to do, and was not said by a doctor in his or her hospital to have done, some curative work. This is not necessarily inconsistent with what Professor Mellander has said, because one of the great observations one makes in China is the tremendous diversity in the way in which, at the local level, the general norms are satisfied.

Geigy: Many Chinese doctors have come out to Africa to look after workers on the railway being built by the Chinese in Tanzania and Zambia. We have noticed how highly specialized these doctors are. They occasionally come to the hospitals at Ifakara and Dar es Salaam; even the surgeons are specialized to do only this or that operation, or internists are specialized for particular diseases. These doctors told me that they had been trained like that. Did you observe this early specialization?

Mellander: I understand that for example in paediatrics there is already very early specialization before graduation.

Patrice Jelliffe: Regarding statistics relating to China: recently at a meeting in Ethiopia, Chinese paediatricians quoted the infant mortality for Shanghai as 5.2 per thousand. We were, however, unable to discover how this extraordinarily low figure had been achieved, and felt that possibly the neonatal mortality rate was not included. I wondered if Professor Mellander could comment on this point?

Mellander: There are no reliable figures on infant mortalty in China.

Katherine Elliott: According to Dr Han Suyin,[1] infant mortality in China has fallen in the past few years from roughly 250 per thousand to 100 per thousand in rural areas, and from 40–50 per thousand to below 20 per thousand in cities.

Edsall: To return to general nutritional questions, I was interested in and surprised by the figures given by Professor Mellander on the percentage of total income spent by people in developing countries on food. In some places it was said to be 100% or more of income. The conventional teaching is that expenditure on food in developed countries is in the range of, say, 25–40% of income. Could you expand on the reality of what sounds like an impossible figure and whether you think this is due to, say, inflationary conditions in

most developing countries, contrasted, let us say, with price control in a country with a strong central regulatory policy? Or is there some other factor? This is vitally important to understand in terms of developing countries.

Mellander: Obviously if one says that one needs to have 120% of one's income to cover basic needs, this means that one *cannot* cover one's basic needs. And in terms of time, it means that unemployed and low-income people in the fringes of big cities in developing countries are spending the whole day trying to obtain money to buy food. They don't succeed, and furthermore they have no time for any other kind of activity.

There can be no social development, and no interest in political affairs, as long as such a situation exists. It is a fact in many developing countries that people do not earn enough money to cover their basic needs in fairly big population groups.

Tewari: A study made in India by the economic section of the Reserve Bank tried to define the poverty line. The criterion ultimately adopted was the income level at which a person would be able to purchase enough cereals to provide him or her with 1600 kilocalories daily. On that definition 40% of the people were below that line. One can make a deduction from that as to how much this food costs.

Patrice Jelliffe: On the question of the percentage of total income spent on food by families in developing countries, a recent survey (1971),[3] undertaken by the Caribbean Food and Nutrition Institute and the government of Barbados in Barbados, gave the following results. The mean annual income per head in local currency was $600 and the median, $372. Income at the 10th percentile was $94, and at the 90th percentile, $1500. When expenditure on food was evaluated it was found that at the 10th percentile level 94% was spent on food as opposed to 64% at the median level, 39% at the 90th percentile level, and 51% at the mean level. Usually the lower the income, the higher the expenditure on food. The figures obtained from Barbados are quite close to data I have seen in some other countries.

It is important to remember that for poor families, expenditure is relatively higher per unit of food, as they do not have sufficient money in hand to buy foods in bulk. They very often make purchases daily from small stores which will give them credit, and they buy small amounts of food at a time: two ounces of sugar, or one egg. In Nigeria, a so-called 'tonic food' (Ovaltine) was sold by the teaspoonful in the market.

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Human Rights in Health
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The control of communicable disease: problems and prospects

GEOFFREY EDSALL

A century and a half ago, Jeremy Bentham objected to proclamations of 'natural rights' because 'he thought that they took the place of ordinary and effective legislation'. His argument was that governments which issued declarations of the rights of man were merely making rhetorical utterances which cost them nothing, instead of getting on with the real work of reform.[1]

However, the problem goes deeper than this, since the concept of rights can be broken up—from the pragmatic point of view—into those rights which can be effectively established by legislation and those which, despite legislation, remain no more than good intentions until far more fundamental changes have taken place. As Cranston[2] points out, it is all very well for the United Nations' Universal Declaration of Human Rights to declare that everyone is entitled to periodic holidays with pay (Article 24), but these are empty words until every economy is prosperous enough, every society is willing enough and every government is strong enough to convert such a dream into reality.

Certainly, however, we all agree about the dream. M. J. Rosenau, in his valedictory address at the University of North Carolina some years ago, said 'Preventive medicine dreams of a time when there shall be enough for all, and every man shall bear his share of labour in accordance with his ability, and every man shall possess sufficient for the needs of his body and the demands of his health. These things he shall have as a matter of justice and not of charity. Preventive medicine dreams of a time when there shall be no unnecessary suffering and no premature deaths; when the welfare of the people shall be our highest concern; when humanity and mercy shall replace greed and selfishness; and it dreams that all these things will be accomplished through the wisdom of man. Preventive medicine dreams of these things, not with the hope that we, individually, may participate in them, but with the joy that we may aid in their coming to those who shall live after us. When young men have vision the dreams of old men come true'.

So our goal in this symposium—as I see it—is to determine what we can do to make these dreams come true. As far as infectious disease is concerned it is obviously impossible to do justice to the problem in its full scope. Not only is the global problem of illness and death due to infectious disease enormous, but infectious disease is so diverse in its aetiology, its mechanisms of spread, its impact on man and its susceptibility to control, that whole conferences can be held, and are held, many times a year simply on one aspect of any one such disease; complete coverage would require half a semester rather than half a week to do justice to the issues involved. When one considers the differences necessary in the approaches to the control of tuberculosis, cholera, acute respiratory diseases, weanling diarrhoea, measles, trachoma, the pneumonias and schistosomiasis—all of which are among the chief causes of disability or death in the world—one can appreciate the vast size of the problem.

It may help, however, to attempt to define the relevant details of the problem of the spread, and hence the control, of infectious disease. Regardless of the aetiology of an infectious disease, its control can be broken down into a clear-cut series of mechanisms[7] which may be re-stated and simplified as follows:

(1) *Eradicate the cause of the disease.* This is, of course, what has been attempted for malaria, what is on the way, we hope, to being done for smallpox, and what has been done, in a regional sense at least, with a variety of animal diseases such as foot-and-mouth disease, brucellosis and rabies.

(2) *Break the chain of transmission.* Most malaria control is based on this approach, urban yellow fever has been conquered this way, and the virtual elimination of typhoid fever in the developed countries has largely depended on this type of control.

(3) *Isolate the victim.* This has generally been a measure of individual urgency (as in the case of frail persons who must be protected from outbreaks of influenza) or else a measure of desperation as in the days when whole communities fled to escape epidemics of smallpox, plague or yellow fever.

(4) *Strengthen the resistance of the victim.* Here belong the major specific approaches, other than those based on community sanitation, to which we currently pin our hopes for real progress in control. Here we think of immunization, chemoprophylaxis, techniques of inducing the production of interferon in the body, and perhaps other methods not yet discovered, which may protect the susceptible individual from the harm that can be done by a prevailing infectious disease. Here—as also in the interruption of transmission—we may hope, in some cases at least, to achieve not only the protection of the suscep-

tible people in the community but also the elimination of the disease agent itself. This has happened in Sweden and is nearly at hand in several other countries as a consequence of the widespread use of poliomyelitis vaccine. It has been a dramatic by-product of the sanitary control of typhoid fever, and in some communities it appears to be an emerging consequence of the effective application of whooping cough immunization. But elimination is a dividend, not an essential prerequisite; for example, the tetanus bacillus will remain forever present on the globe as we know it, yet tetanus could in theory be totally and completely eliminated as a disease of man by effective application of currently available methods for its prevention.

But it would be a dangerous over-simplification to regard each of these categories of control as being straightforward and simple, as I have made them appear. In particular, the second category—breaking the chain of transmission—is probably the basis for the efficacy of many subtler, more indirect mechanisms for the reduction of certain communicable diseases. For instance, it is well recognized that the incidence of tuberculosis is exacerbated by crowding and it is generally accepted that improved housing reduces crowding, so one may therefore assume that improved housing will lead to a reduction in the incidence of tuberculosis. I mention this primarily to illustrate the complexity of the problems of communicable disease control; the common lay concept that infectious diseases can be controlled by developing, in each instance, the appropriate magic bullet leads only too easily to the assumption that a problem has been solved each time a shot is heard.

However, it does no good merely to say that the problems are complicated, elusive and difficult of solution. We are here to try to define tangible goals that *can* be discussed realistically, whether or not the answers are within our immediate range of vision. What are the major problems that might be regarded as soluble? No ideal source of such information has come to my attention. However, a useful compendium of information about the major diseases of the tropics can be found in *Tropical Health: a Report on a Study of Needs and Resources*, put together a decade ago by Williard H. Wright and his associates under the aegis of the US National Research Council.[11] Tables 1 and 2, adapted from this book, present data assembled by the World Health Organization on the reported incidence of cases and deaths of major infectious diseases in 1957, in about half of the world population. Obviously, these figures are grossly defective in numerous respects. Not only is reporting very incomplete, but the degree of incompleteness unquestionably varies enormously, not merely from country to country but also from disease to disease. Also, there is no dependable relation between reported cases and deaths. (Note, for instance,

TABLE 1

The number of cases reported for specific infections in a population of 1 204 501 000 in 1957

1. Yaws	12 588 252	18. Smallpox	93 363
2. Influenza	12 566 849	19. Leprosy	90 235
3. Tuberculosis	6 150 866	20. Meningococcal infections	43 748
4. Malaria	4 153 250	21. Typhus	15 384
5. Trachoma	1 080 354	22. Poliomyelitis	14 807
6. Bacillary dysentery	767 070	23. Hydatid disease	14 770
7. Pneumonia	693 886	24. Leishmaniasis	11 473
8. Ancylostomiasis	656 707	25. Trypanosomiasis	11 442
9. Measles	551 663	26. Relapsing fever	7 661
10. Cholera	534 106	27. Onchocerciasis	7 567
11. Syphilis	425 818	28. Paratyphoid fevers	6 109
12. Whooping cough	413 732	29. Infectious encephalitis	4 672
13. Amoebic dysentery	388 714	30. Dengue	801
14. Filariasis	264 872	31. Plague	662
15. Schistosomiasis	216 183	32. Leptospirosis	478
16. Mumps	168 786	33. Yellow fever	70
17. Typhoid fever	110 613	34. Rabies	–

Total cases: 42 054 963

that all but five of the reported cases of cholera died!) Surprisingly, only 25% of the reported cases of tuberculosis seem to have died; for many years it has been common to see tuberculosis statistics in which the deaths exceeded the cases. Nevertheless, these data do give us something to get our teeth into, and I have used them, *cum grano salis*, as an ancillary guide to the selection of the major problems with which we must deal. With considerable trepidation, I have chosen ten of these as useful examples in planning the strategy for significantly bettering the health of people in the less privileged areas of the world. These ten are:

Tuberculosis	Onchocerciasis
Malaria	Cholera
Diarrhoea and dysentery	Typhoid fever
Trachoma	Leprosy
Schistosomiasis	Whooping cough

Many other diseases might have been included, but what I have tried to do is to prepare a short list of presumably 'controllable' diseases which impose a hazard of death or disability chiefly in the prime of life, since, in the world as it exists, the well-being of a family depends so tremendously on the good health of the provider. To say this is to admit that I have set my own goal short of the ideal of health for all. Yet I am firmly convinced that if we try to solve all

TABLE 2

The number of deaths reported due to specific infections in a population of 1 204 501 000 in 1957

1. Tuberculosis	1 571 585	18. Trypanosomiasis	1 058
2. Cholera	534 101	19. Infectious encephalitis	810
3. Malaria	310 842	20. Rabies	783
4. Bacillary dysentery	192 163	21. Ancylostomiasis	533
5. Pneumonia	104 218	22. Schistosomiasis	529
6. Smallpox	48 085	23. Yaws	387
7. Influenza	37 397	24. Plague	320
8. Measles	22 425	25. Leptospirosis	105
9. Whooping cough	22 251	26. Mumps	82
10. Typhoid fever	10 466	27. Relapsing fever	66
11. Meningococcal infections	8 276	28. Filariasis	53
12. Amoebic dysentery	8 081	29. Yellow fever	34
13. Leprosy	4 534	30. Hydatid disease	26
14. Leishmaniasis	3 304	31. Onchocerciasis	8
15. Typhus	2 436	32. Trachoma	4
16. Poliomyelitis	1 560	33. Syphilis	–
17. Paratyphoid fevers	1 263	34. Dengue	–

Total cases: 2 887 785

problems we shall solve no problems, and that the only way to make progress is to set priorities that we might conceivably hope to see achieved. In addition, I have omitted certain diseases for special reasons: measles because its control has become largely a financial and logistic problem; smallpox and yaws because the means for their control appear to be in sight; syphilis and filariasis because they appear to me to fall short of belonging among the 'top ten' or because the approaches to control do not appear to be clear enough to discuss. But the point is really not whether I have made the correct choices but—given any reasonable choices—is there anything worth saying about the diseases chosen for attention? Let me attempt to set forth what I think *is* worth saying.

Tuberculosis is almost certainly the greatest killer, except perhaps for infant and weanling diarrhoea. Certainly it causes an enormous amount of disability and non-productivity. We have, in theory, the means for its control, and a great deal is being done to implement what we know. Naturally, the failure in the worldwide control of tuberculosis is due in very large part to inadequate resources for prophylaxis, diagnosis and treatment—an economic and political problem that we can tackle only indirectly. But from what I have been able to learn, there is also considerable room for more efficient case-finding based on simple rather than sophisticated techniques; there is a need for a simpler method of administering what hopefully may some day be a more effective vaccine;

and other technical improvements may be identifiable. But over and above all technical advances in tuberculosis control, one has the feeling that major progress must depend upon economic and political advances that lead to better implementation of existing control measures and—most important—better housing and living conditions in general.

Malaria presents numerous special problems, the full understanding of which is beyond my competence. Nevertheless, it would seem fair to say that various setbacks in the control of malaria that have occurred in the past decade—the development of drug-resistant strains of *Plasmodium*, the development of insecticide-resistant strains of *Anopheles* mosquitoes, and possibly the existence of extra-human reservoirs of the disease—all highlight the overwhelming need for continued intensive research on these problems. It is little short of tragic that some of the greatest resources for the prosecution of research on malaria have been unpredictably turned on and off like a water tap, so that sustained, productive research in this field has always been a Cinderella, with the hands of the clock always poised at midnight. However, the existing tools for malaria control are grossly under-utilized, and surely we must, in this symposium, ask ourselves how can governments be assisted in doing those jobs for which the tools are at hand. Moreover, much of the success of a malaria control programme depends on the intelligent cooperation of the affected population; hence better malaria control will necessarily go hand in hand with improved educational programmes and policies.

Diarrhoea and dysentery represent a collection of disease entities with numerous specific causes, but, in general, one overall cause: lack of sanitation. They afflict all age groups in all societies but hit hardest at the very young and the very poor. Once again, the key to their elimination appears to lie in socioeconomic progress. It is interesting to note the remarkable parallelism in their disappearance as a cause of death in New York City 75 years ago and in Mexico today, as shown in Fig. 1, for which I am indebted to Professor Jorge Olarte of Mexico City. While no one can say exactly what factors caused the steady fall in incidence in each place (but with a half-century gap in the timing) I believe that the most plausible explanation is that on the whole the general sanitary conditions under which these people live have been improving slowly but steadily. Furthermore, there is very real evidence that this problem can be largely brought under control by the provision of a more liberal and more accessible supply of usable water, as already discussed in this symposium. Meanwhile, however, genuine but slow progress is being made in the development of vaccines for the prevention of some of these disease entities. Far more support is required if these efforts are to succeed in a reasonable time.

Trachoma is said to be responsible for blindness or purblindness in approx-

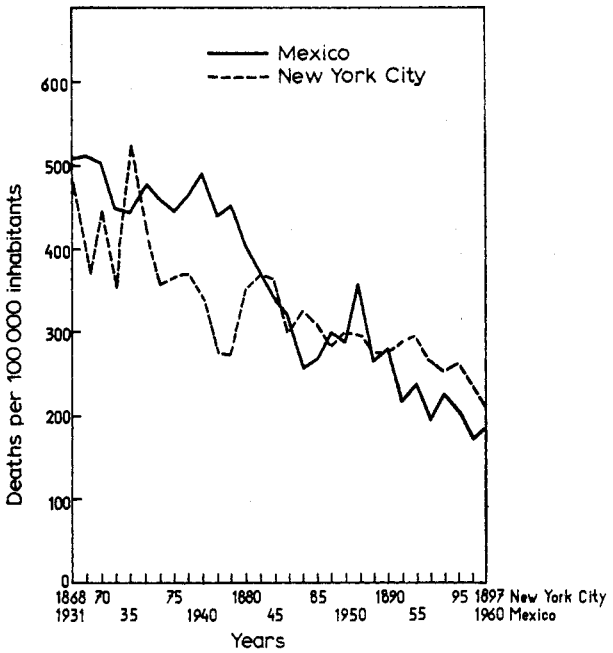

FIG. 1. Crude mortality in all age groups from gastroenteritis and colitis in Mexico and in New York City. (Reproduced by courtesy of Professor J. Olarte.)

imately 20 million people in the world today—people who thus are non-productive and dependent on others for their survival. It has been shown that improved sanitation can bring trachoma under control and has probably eliminated it in some areas. But we cannot wait for a sanitary world to arrive, and the hope of a trachoma vaccine still remains probably the best prospect for control in the meantime. The fact that 15 years of effort failed to yield such a vaccine—as highlighted by the recent closing of the Medical Research Council's trachoma programme—probably means only that we do not know enough about the fundamental biology of trachoma and hence that research in this area should be intensified.

Schistosomiasis has been for over a decade the target of some of the most intensive control efforts that have been mounted against any infectious disease, and rightly so, for much of the world's badly needed increase in food supply depends on the development of lands which can only be so developed at the risk of spreading schistosomiasis through irrigation, and the disability caused by the disease is enormous. Yet, as far as I can learn, the scope of the problem has hardly changed in the last 10 years. What hope is there, then, for real

progress unless it is through further research? Clearly, this is a top priority item from any point of view. Let me note that it has been a top priority item for years with WHO and several research-granting organizations. Perhaps the greatest need here is to find ways to recruit more and better brains into the excitement and gratification of research on such paramount problems—I started to write 'problems of the developing countries', but this phrase would presumably exclude Japan, which has a major problem with schistosomiasis; perhaps our Japanese colleagues will in due course take the lead in tackling this problem.

Onchocerciasis should be mentioned, although I have no first-hand knowledge of the nature of its problems or its control. It is a vital problem for human health and productivity, however, and the technology of its control has, as I understand it, reached the point where the expenditure of many millions of dollars on large-scale multi-national field control is now being undertaken in Africa. Perhaps the programme will succeed, and perhaps also it will point the way to the funding of other needed health programmes; time will tell.

Cholera has been a drain on the health resources of India and Bangladesh for ages and has struck at over 40 other countries in the current pandemic. At long last, various cholera vaccines have been tried—in properly run controlled studies—in the last decade; and for the most part they have been found wanting. Indeed, Dr Cvjetanović has been largely responsible for showing that sanitary improvements can be more effective than vaccination in controlling endemic cholera.[3] What does this signify for the implementation of health rights? Dr Cvjetanović is better qualified to answer than I am, but I would venture to guess that, first, it points once again to the overriding need for more effort and more expenditure in the provision of at least the elemental necessities of sanitation; and secondly, it calls for sustained, uninterrupted effort in the development of a vaccine good enough to give adequate, prolonged protection wherever sanitation cannot rapidly be brought up to an acceptable level.

The inclusion of *typhoid fever* in the list may be arguable, but it can reasonably be estimated that there must be easily a million cases a year in the world; it is a disease that afflicts many adults as well as children with a prolonged illness, except when adequately treated with a suitable antibiotic; and recently there have emerged drug-resistant strains of the germ in the Americas which may well create a worldwide problem in treatment of the disease. Thus, it may once again assume the degree of importance that it had before chloramphenicol came on the scene. Furthermore, there is a fairly good vaccine against typhoid fever—but not good enough; and it causes rather marked and frequent reactions. It is a crude preparation containing many antigens probably quite unnecessary for immunity, it is not easy to administer, and the immunity it

affords is not always as lasting as would be desirable for use in an effective public health programme. Therefore, the need at this time is for sustained further research on better and more acceptable vaccines. Fortunately, this is and long has been a major objective of WHO; but WHO is—especially from the financial point of view—largely a catalyst, and a catalyst needs an ample supply of substrate to act upon or else its action soon ceases. In other words and in plain language, funds for the support of extended research on typhoid vaccine are needed, and in this one instance I am willing to guess that with adequate support the means for control of typhoid fever without undue expenditure of personnel and scarce resources could be in our hands in less than a decade.

Leprosy is a major problem not so much in terms of the numbers of people affected but in the prolonged—often lifelong—physical and social handicap that it imposes on its victims. Although available chemotherapeutic means of treatment appear to be extremely promising, the goal of an effective vaccine would seem to be the logical one to aim for. Results with vaccination to date have not been good enough to offer a solution, perhaps because we still lack sufficient fundamental knowledge of the pathogenesis of the disease. Hence, continued research on both pathogenesis and immunity are essential, pending the Utopian day when environmental progress eliminates the disease, as it undoubtedly did in Europe in the past.

I have brought *whooping cough* into this discussion for a special reason. Perhaps it is not among the top ten killing or disabling diseases, although it surely ranks higher than the data would indicate. But what it does represent is a disease for which we now almost universally give a less-than-adequate vaccine, a vaccine administered in a mixture with two other better vaccines and for which the immunization programme could clearly be simplified, were it not for the inadequacy of the whooping cough vaccine component. Immunization procedures *must* be simplified if they are to be made available to the population of the developing world, where present resources do not make it possible to carry through the elaborate rituals that we consider essential in the affluent countries. The poor antigenicity of whooping cough vaccine is the chief barrier at present to such simplification. Hence, in my view, there is a very great need for first-class efforts at preparing a purified, highly potent whooping cough antigen which will produce a high level of immunity against this disease with only one, or at the most, two injections.

All through the discussion of these ten examples that I have selected there have run four primary themes: the need for better sanitation, the need for better housing, the need for implementation of existing means of control, and the need for research on specific problems that constitute the road-blocks to

real progress in the control of these diseases. I have not tried to estimate the time-span required to bring even this limited list of diseases under control, for I know better than to predict the date when either a research problem or a socioeconomic problem will be solved. If I had in addition discussed the problems surrounding the control of, say, influenza (let us have a really rapidly available, highly effective vaccine soon after the next major pandemic begins!), filariasis (*can* we vaccinate against worms?), or pneumoccocus pneumonia (we doubtless have, in principle, a vaccine—but where do we put our priorities?), the discussion would have become even more involved, and to this extent less quantifiable. So I would like to conclude by recommending that, if the problems of the major communicable diseases are to be brought within bounds, we must see progress along the lines just mentioned, or the hoped-for solutions will become a fading dream. I shall therefore end by re-emphasizing what appear to me to be the paramount approaches to the progress required:

(1) The development of simplified methods of implementing existing methods of control. This could include simpler immunization schedules, the substitution of oral for parenteral immunization, and the development of less costly and more easily installed privies.

(2) The pursuit, unremittingly, of fundamental problems which must be solved if adequate control methods are to be obtained. I have hinted at several of these: they range from biological methods of controlling malaria mosquitoes, to purified typhoid and whooping cough antigens, to a better understanding of the immune response.

(3) The advancement of sanitation and housing, which must be given major priority if even a fraction of our goals is to be achieved within the remainder of our professional lifetimes.

(4) The search for means to aid, abet and foster existing useful measures for control, measures which in some cases (e.g. tuberculosis) would rapidly repay many times over the effort and money spent in making them effective.

These four points are merely signposts, not mileposts, for they do not indicate the distance that must be travelled to reach these goals. But surely it is a truism that if we can establish useful signposts pointing to some realistic goals, the other necessary steps are more likely to be taken.

Discussion

Cockburn: At WHO Dr F. Assaad and I have been contrasting the behaviour of communicable diseases in three groups of countries: highly developed, rapidly catching up, and developing countries. Table 1 shows the changes in infant mortality rates in recent years in these groups. Group III (the developing countries) shows the greatest reduction, followed by Group II. Even in the highly developed countries there has been a considerable change in the past 10 years; there has been a further fall in an already low infant mortality rate but decreases in birth rates have also occurred. In countries in Group II birth rates have remained more or less static. In Group III countries, though there was some reduction in rates of birth, they still remain much higher than in the other two groups. The consequence is an enormous increase in the number of children up to 14 years of age in the Group III countries, where in eight out of nine countries 40% or more of the population are under 14 years of age (Table 2). These are the ages at which communicable diseases are common, and so in these areas there are enormous numbers of children susceptible to communicable diseases.

Another study is as follows. Every four years or so countries are asked by WHO what they consider to be their most important problems in terms of health. Let us take the African region, excluding North Africa, as an example (Table 3). What do the governments themselves consider the most important problem? From 1957 to 1960, apart from malnutrition, all the countries selected communicable diseases; and 10 years later the answer was almost the

TABLE 1 (Cockburn)

Infant mortality in selected groups of countries

Infant mortality rates per 1000 live births	*Number of countries in:*					
	Group I (highly developed)		*Group II (intermediate)*		*Group III (developing)*	
	1957/8	*1967/8*	*1957/8*	*1967/8*	*1957/8*	*1967/8*
< 20	2	10	0	0	0	0
20-29	8	4	0	3	0	1
30-39	3	0	2	5	0	1
40-49	1	0	2	0	0	1
50-74	0	0	3	1	4	4
75-99	0	0	2	0	4	1
100 and over	0	0	0	0	1	0

TABLE 2 (Cockburn)

The percentage of children (0-14 years) in the total population in selected groups of countries in 1967/8

	Number of countries in:		
% of children	*Group I (highly developed)*	*Group II (intermediate)*	*Group III (developing)*
20-25	8	5	0
25-29	3	4	0
30-34	3	0	0
35-39	0	0	1
40-45	0	0	5
45 and over	0	0	3

TABLE 3 (Cockburn)

Diseases considered by the governments of developing countries in Africa (excluding North Africa) as public health problems

1957-1960	*1965-1968*
Malaria	Tuberculosis
Tuberculosis	Malaria
Malnutrition (including anaemias)	Leprosy
Intestinal parasitosis	Schistosomiasis
Schistosomiasis	Onchocerciasis
Yaws	Intestinal parasitosis
Leprosy	Measles
Venereal disease	Diarrhoeal diseases
Trypanosomiasis	Venereal diseases
Smallpox	Poliomyelitis

same. Similar answers came from South-East Asia and South and Central America. As a check, we looked at the principal causes of death, and again taking Africa as an example we see that most of them are communicable diseases (Table 4). But there is a difference when one compares the two sets of data, and those diseases present in Table 3 but missing from Table 4 are those which do not kill readily, like leprosy, schistosomiasis, the parasitic diseases and so on. So that, as far as WHO is concerned, the communicable diseases are still by far the most important problem in most parts of the world.

One can look at this problem by dividing the diseases into those which can be controlled fairly rapidly, and those where either a great deal of economic

TABLE 4 (Cockburn)

The principal causes of death in developing countries of Africa (excluding North Africa)

1957-1960	*1965-1968*
Respiratory infections	Diseases of the newborn & early infancy
Diarrhoeal diseases	Diarrhoeal diseases
Malaria	Senility & ill-defined conditions
Tuberculosis	Tuberculosis
Diseases of the newborn & early infancy	Cardiovascular diseases
Malnutrition (including anaemias)	Accidents (including violence)
Tetanus	Malignant diseases
Cardiovascular diseases	Respiratory infections
Accidents (including violence)	Malaria
Senility & ill-defined conditions	Malnutrition (including anaemias)

and social development is needed, or more research. For example, research on parasitic diseases is particularly necessary. There is a large group of communicable diseases in childhood which could be modified very rapidly and dramatically by adopting, and adapting, the measures (eg. immunization) already used in the developed areas. (Often one cannot take a procedure from a developed country and use it unmodified in a developing area.) So far as immunization is concerned, some of the problems have been mentioned: organizational and administrative difficulties, lack of personnel, lack of transport, lack of supplies, lack of health centres, lack of a coherent plan. The result is that possibly not more than 10% of the susceptible age-group in the developing countries have any opportunity to obtain immunization against diseases such as diphtheria, pertussis, tetanus, poliomyelitis, tuberculosis or measles. Other problems, as Professor Edsall said, are entirely technical ones. How can the administration of that immunization be simplified? Take smallpox vaccination: the change from the multiple pressure method to the bifurcated needle method immediately simplifies the whole situation. There are many other things that we should be looking into in order to simplify administration. How can vaccines be made more stable at tropical temperatures? With yellow fever and measles this is one of the main difficulties, because if you want to run a campaign from the coast up into the Sahara in Africa, you need a cold chain all the way, and it must be a cold chain which functions, and not one that breaks down at the week-end. So can we make our vaccines more stable?

Then one has the more unexpected problems: why does poliomyelitis vaccine not 'take' in 30% of children in the tropics, whereas it takes in over 90% of children in temperate climates? We in WHO want to look into these problems and to contribute what we can to their solution.

Victoria Garcia: In Chile, BCG immunization is compulsory for the newborn, combined with oral polio vaccine. In Mexico there have been big BCG campaigns. In both countries we are using the new oral typhoid vaccine; it is under trial, with good results and no side-effects.

Edsall: I am glad to hear that this is going ahead. Obviously, BCG is one of the keystones of immunization procedures for countries where the incidence of infectious tuberculosis is high, and where you have to start early in order to protect against it. We can look back on technical improvements here; some 10 years ago, primarily in England, methods were developed for stabilizing BCG vaccine so that it could be carried around in the country on mule-back or by Landrover to get it where it was needed.

D. B. Jelliffe: I would like to endorse what has been said and to stress the need for the 'intermediate technology' kind of approach to this field as well. One of the blocks here may be the pharmaceutical companies, because the health needs really are those of countries where the profit from sales of products is likely to be small. For example, there is a tremendous need for a one-dose approach towards immunization, just as there is now a mono-dosage of repository penicillin. This approach has been successful to some extent in the prevention of neonatal tetanus, giving one dose of toxoid to the mother. But this type of research is required, and it is encouraging to hear that it is being done.

Other types of research are needed on what might be called a 'minimal interference' approach. I am thinking particularly of malaria where there is the possibility of giving an anti-malarial drug during early childhood to ward off infection, and yet to permit the child to achieve his own immunity at the same time.

Often the difficulty in this welter of infections is to decide what to select for attention. At a meeting in Kampala some years ago, the criteria for selecting diseases which one could realistically try to prevent were considered. We came up with about 20 criteria:[5] the prevalence of the infection, its mortality, its morbidity, the cost of cure, the cost of long-term consequences (as with polio, for example), and—very important from the paediatric point of view—the consequences in terms of the infection as a conditioning factor, measles being important in regard to malnutrition. Other aspects were the cost, feasibility and practicability of prevention, and the number of dosages and attendances required to produce a reasonable degree of immunity. A last factor was the awareness and the fear, in the local community, of a particular disease. This seemed to be important, not only because of the anxiety of the community as such, but because this would provide an opportunity to introduce immunization against other diseases, which the local community were not so aware of or so apprehensive about.

Edsall: The question of simplifying immunization by using single-dose schedules is important. A number of us more or less simultaneously selected tetanus as a possible example where this might be achieved, and as a good model to work with. In one small study[4] in Cali, in Colombia, we have had a group of girls who carried a protective anti-tetanus titre for one year after a single dose of tetanus toxoid that was made up to be slightly more potent than the average, but not so potent that it produced ill-effects. At the same time, Veronesi[9,10] in São Paulo has been working on this; Michel Rey[6] has worked on it in Dakar with Dr Diop Mar and others. So a good deal is being done in the direction of developing one possible model. Stanfield & Gall[8] did a study in Uganda on the immunization of neonates by giving tetanus toxoid during pregnancy to the mother, comparing the effects of giving one and two doses of toxoid. They found that the amounts of antibody after a single dose remained very different in the mother and infant, whereas with two doses, as the maternal antibody level rose the infant's titre went up in parallel and was much closer to the maternal level after the second dose. Evidently there is something happening here that we do not understand; if we are going to use a single dose, and if antibody is not crossing the placenta into the infant, this is not going to work very well. So here we run into a strictly technical, scientific problem that has to be solved. Is it because one particular subtype of gammaglobulin gets across the placenta better than another? Or some other reason? We are starting to study this with a colleague in Malaysia. We have to find out what is wrong scientifically with a particular procedure before we can go ahead with implementing it.

Cockburn: Professor Jelliffe mentioned the question of availability—the commercial side of the problem. This has two aspects. One is that in recent years, most of the vaccines, or the strains from which they are prepared, have been patented by the firms which first produced them, so that measles, rubella and mumps vaccine are in general not available for production by countries unless they make an expensive payment to the firms concerned. That is one aspect of it, and a bad one. On the other hand, with poliomyelitis, BCG, diphtheria, pertussis and tetanus vaccines, we do not have this problem. Secondly, a major problem is that countries can afford local currency for vaccines but not international currency. We are hoping at WHO to look into the possibility of reducing this difficulty.

Edsall: On the question of the unavailability of products that do not make a profit, I spent 20 years running a state biologics laboratory, or a similar laboratory, in Massachusetts (one of the few states in the USA that still has such laboratories). We had the good fortune to pioneer the development of several products for which there was no great market and which nobody

else would undertake. Some of these projects never came to fruition, but the point is that one can do this where the determinant is not the economic factor but the need. You have pinpointed a real need for the fostering of government-supported laboratories where research can be done without having to consider the return on investment. I agree that it is a pity that the best of the measles strains, and of the rubella strains, to a large extent have been developed through patentable processes. But in the long run we should recognize that we shall eventually need more things than we can foresee and that it is well to maintain active working government support, or at least non-profit-making support, in communicable diseases, keeping these developments in the pipeline. This has an important place in the large view of development.

Evang: I was pleased that you underlined the fact that each of these 'big killers' of men is a separate problem, because we are pressed now by our friends the economists, strongly supported by the politicians, to develop a model for handling *all* communicable diseases, and as you clearly stated, this is impossible. Or, to put it another way, you can develop a model, but then only in general terms. As soon as you start to work with one of the communicable diseases you find that it has its own individuality with very complex relationships, both ecological and social. As a health administrator, I discovered that people found this very difficult to understand. Of course, technology must be further developed, but one should not lose sight of this fact that each disease has its own individuality.

You did not also underline, as you might have done, that technology has perhaps produced more in saving lives as far as communicable diseases are concerned than in any other field of disease. There is a good example of this. John E. Gordon of Harvard was the head of the American Medical Services in Europe in the Second World War. He told me that of approximately three million Americans in the European theatre of war, the total number of deaths from all enteric infections together was precisely five—an extraordinary contrast to the First World War. My point is that technologically, and scientifically, the fight against communicable disease by prevention had a breakthrough in the Second World War that was unprecedented. And, as a matter of fact, we are now being asked by economists and politicians why we cannot prevent the man-made pathogenic agents—which cause cancer, coronary artery disease, traffic accidents—in the same way as we prevented the nature-made pathogenic agents.

An increasing difficulty now is that in the underdeveloped part of the world, the communicable diseases we have been discussing are still the important diseases. On the other hand, in the more developed part of the world, technically and economically, the man-made pathogenic agents are the dominant

ones. And we have both these situations to deal with, globally speaking.

Edsall: The man-made diseases have necessarily been left out of this symposium, because we are not discussing cardiovascular disease and cancer so much as the problems of developing countries, but many of the same basic scientific approaches that have led to a good understanding of infectious diseases are now close to giving us breakthroughs in understanding many of the chronic diseases, the diseases of old age, or in fact the processes of ageing and malignancy, and we may see progress in these areas too before long.

Geigy: I would like to hear more about schistosomiasis. Perhaps Dr Mellander can tell us the position in China, where I believe they were successful in eradicating the disease. My own experience is in Madagascar, where, over a five-year period, we tried to protect an area of about 10 000 hectares, where 6000 labourers worked in a cotton plantation with a large irrigation system. By examining each labourer entering this area, curing them with Ambilhar (CIBA-GEIGY) when they were sick on arrival, and keeping out the host with Frescon (Shell) we completely protected this area. We had one outbreak, probably caused by molluscs brought in on the feet of aquatic birds. There was a small outbreak in children in one village in the compound, but we got rid of it. When these severe measures are taken one can protect a considerable population of labourers living in a special area. But from this to go on to eradicate schistosomiasis in an entire country is quite another problem.

Mellander: I asked about schistosomiasis when I was in China. One answer was that there is almost no problem any more, and another was that they still have some cases.

Evang: In 1960 in the Shanghai area their approach was as follows. They studied the two main types of the disease, and also the snails in the area, working out the life cycle and the time when the snail left the water and dug down into the soft soil of the bank. Then they 'changed the surface of the earth', to use their own expression, by using thousands of workers with spades who turned the soil. No chemicals were used, but they killed so many snails that transmission was reduced practically to nil in 1960.

Wolstenholme: Unfortunately, this method of eradication is not, I understand, so effective in many other areas of the world, where the snail behaves differently and is hermaphroditic; and this complicates the issue enormously.

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Cost-effectiveness and cost-benefit aspects of preventive measures against communicable diseases

B. CVJETANOVIĆ

Man has the right to expect that the resources he has created will be put to the most effective use for his benefit and well-being, including his health. For this purpose, the discipline of health economics has been developed, and methods such as cost–effectiveness and cost–benefit analysis, devised by economists for other purposes, have come to be applied in the field of health.

The available financial and other resources of any community are insufficient to meet the many health, educational and other requirements for improving the standard of living. Thus there is a need for the use of cost–effectiveness analysis in the planning and delivery of health services in order to achieve the highest attainable level of health with the available resources. Cost–effectiveness analysis may also be applied to achieve the most efficient allocation of resources for the control of communicable diseases.

One preventive measure may not only prove to be more effective per unit cost than another (in the sense of protecting more people at risk per unit of resource) but may also bring more economic benefits if that protection results in greater productivity. Cost–benefit analysis can theoretically be used, therefore, to show whether implementation of a given preventive measure has brought, besides benefits in health, an increase in production which may in turn be used for further improvement in health and/or a rise in the general standard of living. Clearly health is one aspect of welfare and the problem of any government or planning authority is to determine the most efficient allocation of resources for the improvement of welfare. It is thus important to establish the *indirect* effect of health expenditures as well as the direct or immediate effects. This is always exceedingly difficult, conceptually as well as practically.

Without a detailed account of the costs and benefits of an investment in health *and a similar account for any alternative investment*, a scientific decision

on the use of resources for the health services is impossible. Furthermore, those responsible for such a decision have to take into consideration basic philosophical issues and political concepts, the aims of the community, and the responsibilities and rights of individuals, including the right to health—and none of these variables are readily quantifiable. As concepts and socioeconomic structures vary greatly from one community to another, there is no single approach to the problem of determining the relative importance of health and the ways and means of achieving the desired level of health in given conditions.

There is, however, one basic element common to all systems and concepts: once the priorities and aims in health have been decided upon, the allotted budget must be used in the most efficient way, in order to minimize cost per unit of 'health care' achieved. The purpose of this chapter, accordingly, is to discuss ways and means of making the best use of resources available for the promotion of health. I shall ignore the unquantifiable aspects of different socioeconomic systems, and their respective merits and disadvantages for health. These are indeed of great importance, but at present we lack a methodological framework to do them justice.

PREVENTION OF COMMUNICABLE DISEASES

Before cost–effectiveness analysis can be applied to preventive measures against communicable diseases, the aims and role of control of these diseases in the promotion of health must be specified. It is customary to assess morbidity by measuring the frequency of diseases in the community, and that of infectious diseases in particular. The disadvantages and fallacies of this method are obvious. The effect of infections on health could not be measured by the incidence of infections and frequency of illness and death alone, even if exact data were available. Morbidity and mortality figures are inadequate for the measurement of the numerous deleterious effects of infections on the functions of various organs and of irreversible damage leading to the impairment of the normal physical and psychic adaptability of individuals to environmental stress. Various disabilities caused by infectious diseases (less obvious than, for example, paralysis resulting from poliomyelitis) reduce the level of health and well-being, creativity and productivity to the detriment of the social and economic progress of the community. Since our knowledge of the biology and pathology of infections is still too incomplete to allow a full assessment of their effect on health, it is difficult to estimate the *benefits* derived from the prevention of communicable diseases. These important limitations must be kept in mind in further considerations of the problem. If an enteric infection results in

malnutrition, or *vice versa*, the ill-effect of such a combination may be much more serious and longer lasting than that of the infection alone.

It can be asked whether preventive measures against infectious diseases can be considered as capital investment in the same sense as, for instance, a road or a hydroelectricity scheme. Can cost–effectiveness and cost–benefit analysis serve as a guide in deciding the best way to invest efforts and resources so as to obtain a lasting improvement in health and an overall improvement in general welfare?

Cost–effectiveness analysis requires exact data on the costs of preventive and curative measures and on the impact of these measures on mortality and morbidity. While costs can be relatively easily determined, the assessment of the effectiveness of preventive measures is a considerable problem, for, by definition, exact data on the effects on health and the economic effects of the prevention of disease cannot be obtained.

The data demands for cost–benefit analysis are even greater. For how can we determine the full *economic* benefits resulting from a given change in morbidity and mortality patterns? The usual, but very crude, approach, developed originally in quite different contexts, is to sum the earnings-streams that have been made possible by the improvement in health and then discount these to derive an aggregate net present value. There are many objections to this technique, the details of which need not detain us here. It is enough to note five main difficulties:

(i) We do not know with any precision the earning-streams to be discounted.

(ii) The discount rate is important but arbitrary.

(iii) The benefits (and costs) included are only the direct ones; the benefits do not include the multiplied effects of the earning (and expenditure) streams. The costs do not include those associated with a higher rate of growth of population.

(iv) No economic benefit is attached to social variables, such as the saving of a mother's life.

(v) This technique assumes that a given health programme is an investment, to be judged by the same criteria as other investments. But a preventive (or curative) programme has a large (perhaps predominant) element of present consumption. This can theoretically be fitted into a cost–benefit model but we then need to know the *value* of that *present* consumption. This poses immensely difficult problems which an earnings-streams approach misses.

For these reasons it is more sensible, if less satisfying, to put prime emphasis on cost–effectiveness and regard cost–benefit analysis more as an invitation to review health expenditures in a broader perspective than as a call to analytical rigour—a call to which, at the moment, we cannot adequately respond.

EFFECTIVENESS OF PREVENTIVE MEASURES

The effects of preventive measures are best ascertained by controlled field trials,[11] but few of them have actually been evaluated by this method. Most of the vaccines in current use have been subjected to field trials, in which their preventive effect has been assessed by comparing the incidence of illness in an immunized and a control group. However, as the exposure and infectious dose vary under different conditions, one cannot be sure that in other trial populations and circumstances the effect of such measures would not be different. It was found that the incidence of some infections, such as enteric fevers, differs greatly in volunteering and non-volunteering populations, being considerably higher in the latter.[3] The actual effect on the overall incidence of infectious diseases of mass vaccination campaigns based on voluntary participation may therefore not be as good as one might assume from the protective effect of vaccination in controlled field trials where both the control and the vaccinated groups were volunteers. This indicates that, even with such measures as vaccination with a vaccine of known potency that has been well studied, it may be difficult to ascertain the effectiveness of the immunization programme and consequently to make an accurate cost–effectiveness analysis. Much less exact is our knowledge of the effect of measures such as health education, or general education, or cultural background, or socioeconomic status and other factors, which may play an important role. It has been shown that healthy living habits (regular sleep, regular meals, weight control, active sports and/or exercise, no [or moderate] drinking, no smoking [or little, without inhaling]), which are believed to be due to a higher level of education and the specific attitude of some groups of people, result in a higher level of health and longer life expectancy.[2] A preventive measure may be more effective among such people than in less health-conscious groups of the population. Since health is more fully attained by health-conscious individuals, health education makes preventive measures more effective, and in fact should be an integral part of disease control programmes.

Because the effectiveness of preventive measures is related to educational standards, measures that require the active participation of the population, such as sanitation and personal hygiene, may be less effective in developing countries with low levels of education than in developed countries. In developing countries such measures are not only less effective but also, as a consequence, relatively more expensive per unit of 'output'. An underprivileged, illiterate and poor population is likely to benefit relatively less from a given set of preventive measures than would a better-off and better-educated group.

However, in developing countries where there is a high incidence of infectious

diseases, preventive measures will greatly reduce their frequency. That this will bring economic benefits is certain, even if those benefits are not scientifically quantifiable. As the incidence decreases, so the efforts and resources needed to reduce it still further will increase. Finally, at a certain point, it will be very expensive to maintain a low level of incidence of infectious diseases that cannot be eradicated. For eradicable diseases, the need is to establish the cheapest and speediest way to achieve eradication. Again, economic benefits will flow from eradication, perhaps particularly in the longer run.

COST-EFFECTIVENESS AND COST-BENEFIT ANALYSIS

The common theme of cost–effectiveness and cost–benefit analysis is that each tries to establish an optimizing pattern of expenditure. In the former, the intention is to minimize cost per unit of health output (however that may be defined); in the latter, it is to minimize cost per unit of economic benefit. Both therefore require detailed data on costs and both require that we know the physical results—short-term and long-term, positive and negative—of a given programme.

As an extension of cost–effectiveness methods towards cost–benefit analysis, we have developed a simple method, using nomograms,[10] which indicates whether expenditure on prevention would be compensated by savings on the treatment of cases. For this purpose, it is necessary to have data on the costs of preventive measures and treatment, as well as on incidence.

This method is based on a comparison of the cost of treatment and the cost of prevention of one case. Accordingly, it is possible to ascertain whether at a certain level of incidence it is cheaper to treat or to prevent infection. The consumption effect of prevention should also be taken into account, as we may assume that any community will be ready to spend some of its resources purely for health and well-being. However, in the search for a more effective and economical use of resources for preventive measures, we leave the consumption element aside and consider only the direct relationship between costs of treatment and costs of prevention.

As an example, a nomogram of the cost–benefit balance of immunization against typhoid in developing countries is illustrated in Fig. 1. This presents graphically on log-log paper the relationship between incidence (abscissa), cost of treatment (ordinate), and cost of immunization (45° slope line). These relationships have been developed from mathematical formulae[10] which show that a point of equilibrium or indifference (i.e. when costs of treatment are the same as costs of prevention) can be defined as

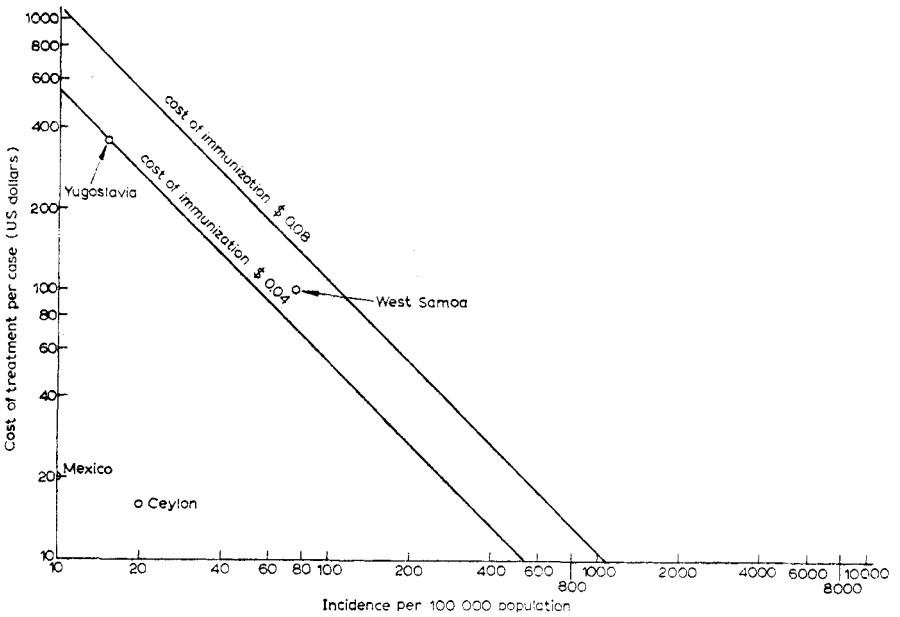

FIG. 1. Nomogram for determining the cost-benefit balance of immunization against typhoid, using an 80% effective vaccine giving immunity lasting for five years, and assuming costs of immunization of US $0.2 and $0.4 per head ($0.04 and $0.08 per head per year).

$$C_t = \frac{C_v}{E_v} \times \frac{1}{i}$$

where C_t = cost of treating one case
C_v = cost of vaccinating one individual
E_v = vaccination effectiveness
i = incidence of cases.

By solving this equation for given values of C_v and plotting the values of i and C_t, we can demonstrate 'profits' and 'losses' for various values of C_t and i. The area below and to the left of the given 45° indifference slope line represents loss, while the area above and to the right of the line represents benefit. Accordingly, the data (collected from several countries[4]) show that, at a cost per head of vaccination of US $0.04 per year (calculated on the basis of costs of vaccine, manpower, supplies and transport, and a duration of immunity of five years) and with 80% effective vaccine, there will be neither an economic loss nor a gain from immunization in Yugoslavia at an incidence of 15 cases of typhoid

per 100 000 population and a cost of treatment of US $360 per sick person. In Western Samoa (at a cost of treatment of US $100 and an incidence of 75 per 100 000 population) there will be a benefit if the cost of immunization per head is US $0.04 and a loss if it is US $0.08. In Mexico and Ceylon vaccination seems to bring no economic benefit because of the extremely low cost of treatment and low incidence. However, the low cost of treatment also means a low level of health services and a high fatality rate. There is probably also much under-reporting of typhoid in these countries. One should not draw the conclusion that immunization in these developing countries is not beneficial because treatment facilities are poor and the reporting system inadequate.

Many other aspects have to be taken into account in the evaluation of immunization programmes.[4] Immunization procedures may be rendered less expensive by technical improvements such as *(a)* adjuvant vaccines; *(b)* combined vaccines; *(c)* larger vaccine containers; *(d)* smaller doses; *(e)* speedier immunization by jet injectors; *(f)* better use of transport and manpower; and *(g)* selective immunization of high-risk groups.

There are other even simpler, but still valuable, ways of calculating the costs and benefits of immunization programmes[1 3] than the nomogram method.

The simple nomogram method for determining the cost–benefit balance is limited by the fact that it permits only short-term analysis, namely of the situation at a given moment, and does not take into account its possible evolution. For this purpose, epidemiological models should be used, such as those we have developed for typhoid[5] and tetanus,[6] and similarly for cholera and cerebrospinal meningitis. These epidemiological models of acute bacterial diseases permit projection and simulation of the natural evolution of the infection as well as the results of long-term control programmes. Thus, when the incidence and costs of treatment and prevention are known, the relative effectiveness of various preventive measures can be ascertained and the most effective and least expensive measures selected for implementation.

As an example, the results and cost–benefit balance of three different control programmes for typhoid have been simulated and are presented in Fig. 2, which is based on actual data from Western Samoa. The figure displays the cost and effects of a long-term programme of *(i)* immunization (consisting of 75% coverage with an 80% effective vaccine, every five years); *(ii)* sanitation (construction of privies for the whole population during a 10-year period); and *(iii)* immunization and sanitation combined *(i + ii)*. The results of *(i)* and *(ii)* are similar, but the simulation shows that sanitation, because of its cumulative effect on the amount of infection and the relatively low cost of maintenance in comparison with the high maintenance cost of immunization, should be both more effective and less costly in the long run.

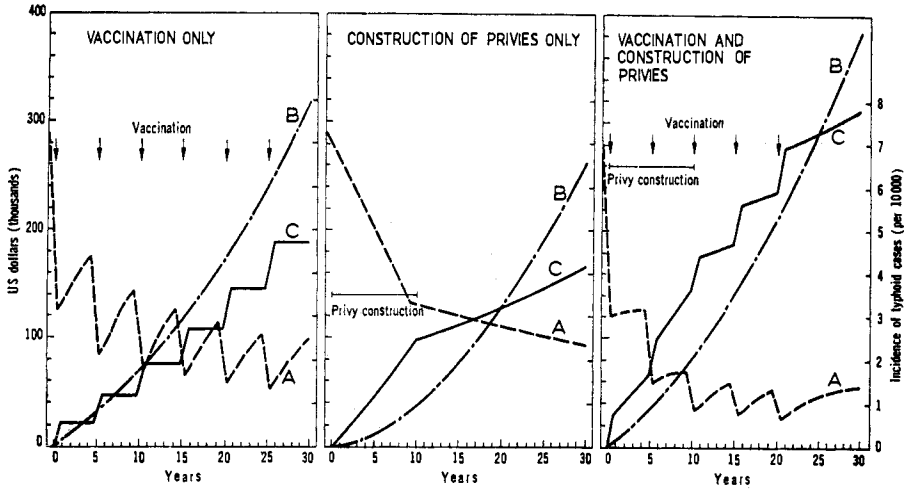

FIG. 2. The impact of three different control programmes on the incidence of typhoid and on the cumulative costs *(C)* and benefits *(B)*. *A* is the incidence of cases of typhoid per 10 000 population. The cumulative costs are calculated from the costs of vaccine, equipment, manpower and transport required for the immunization programme, and from the costs of constructing privies for the sanitation programme. The cumulative benefits are calculated as the difference between the savings on the treatment of cases, as a result of prevention, and the cost of the control programme in each case.

Similar models have been developed for chronic diseases such as tuberculosis.[16]

The methods described here are now coming into frequent use. They enable public health administrators to determine which control measure will be most effective. In this way, the budget of the department of health can be put to better use and the national health programme can be better constructed.[1] These techniques, for example, were used in planning a typhoid control programme in Western Samoa.[5] As it had been found there (see Fig. 2) that the immunization programme and the sanitation programme did not differ greatly in effectiveness, an attempt was made to make vaccination less expensive. It was found that if combined vaccines could be used, vaccination would be made cheaper than sanitation per unit reduction in morbidity. Research on combined vaccines was set up and DPTTy (diphtheria, pertussis, tetanus, typhoid) quadruple vaccine was developed,[7] which allowed a programme to be designed consisting of a combination of immunization and sanitation in selected areas and among high-risk groups that made immunization much cheaper but still very effective. Nevertheless, in view of the fact that sanitation represents a lasting investment with cumulative effect, priority was given to sanitation in

plans for the future. Other models have been used for similar purposes, for example, for allocating resources for the control of tuberculosis.[9,12]

DISCUSSION

Techniques of cost–effectiveness and, in the limited sense intended in this paper, of cost–benefit analysis have reached a fairly advanced stage of development and can be used in the planning of disease control programmes. Although certain methods are simple and only approximate, they nevertheless have considerable practical value because they do not require much mathematical knowledge or expensive computing equipment. Other modelling techniques that require electronic computers are evidently more sophisticated, particularly in their ability to handle long-term variables, but may not be accessible to all health workers and health services.

The accuracy of all these approaches depends on the accuracy of the basic data on costs and on the effectiveness of preventive measures. We must constantly bear in mind the frailty of our conclusions; much careful and critical study is needed to ascertain the real values of such approaches.

In spite of the advantages that are being derived from cost–benefit and cost–effectiveness analysis and other similar procedures used in health economics it should not be forgotten that although economics now play an important role in life, human health should not be unconditionally subjected to the verdict of economic and financial analyses. Humanitarian principles demand that man be treated as a human being and not as an economic unit or monetary value. Some attempts to assess the value of human lives[14] for the purpose of cost–benefit analysis, if pushed to the extreme, could lead to the dehumanization of medical services and society. Ultimately, an individual who happens to be unable to provide financially for the preservation or restoration of his health, and for whom the community (on the basis of cost–benefit arguments) is unwilling to do so, may be deprived of his fundamental right to health. There are limits to what can be achieved in health, as in other fields, but let us set these limits in accordance with humanitarian rather than economic principles.

CONCLUSIONS

Cost–effectiveness and cost–benefit analyses facilitate the proper use of available resources in health programmes. They permit selection of the most effective and least expensive control measures so that human rights in health are more quickly and more efficiently attained, and therefore should have a prominent place in health planning.

Discussion

Potts: I do not follow the logic of Dr Cvjetanović's concluding remarks. As a doctor I feel that one of my responsibilities is to use available resources to the greatest effectiveness. I do not look upon cost–effectiveness analysis as something which economists force upon the medical profession but as something which we are obliged to use in order to help the greatest number of people, with the available resources. I can press for greater resources, but I have to be a realist, and I accept that I won't be given all the resources I want. I do not see the conflict with human rights which has been implied. I often find, when I visit developing countries, a terrifying misuse of available resources to the detriment of the community, and I feel that if we had more analysis we might not make so many mistakes.

Cvjetanović: There is a 'conflict' between different areas and branches *within* the total system of health services, which are competing for the same funds. One wants to know which area can use the funds most effectively and to the best advantage of the health of the community. Certainly we find in every community that the actual needs and the rights which people want to attain are far beyond the available resources. So within the field of health there is a dilemma: for example, should we let a man die of cancer in order to save a hundred children from diphtheria?

Potts: The answer to this would be an unequivocal *yes*.

Cvjetanović: The second dilemma is that economists tell us that health will continue to receive a certain small percentage of national income. Yet large sums are being spent in providing television, say, or armaments. This is another area of conflict.

We know that we must make the best possible use of the funds allocated for health, but it is difficult for the doctors to say what this allocation should be. This decision should be left for the community itself to decide—because if we propose any ceiling we have accepted the limitation that will prevent somebody from achieving health aims that he may consider very important. Therefore the population itself should decide on the priority that it wants to give to health.

C. Elliott: In Fig. 1 (p. 192), Dr Cvjetanović illustrated his technique by which he can tell whether or not a programme is worth mounting, from the cost of vaccination and the cost of treatment. I would have thought that one also needed data on the incidence of treatment before one could draw any conclusion from the data presented, because one cannot assume, as this technique does, that everyone who contracts the disease is treated. Almost certainly a small proportion only of those who contract the disease are treated. So I would doubt whether those three bits of data are adequate.

Secondly, and more fundamentally, the argument was made that if one can show a saving to be expected as a result of a particular programme, then the programme would be beneficial to the country. That is correct. But it does not follow, as Dr Cvjetanović seemed to imply, that the programme should be carried out. An economist would need to be convinced that this was the most beneficial use that the money could be put to. There may be many other programmes in health, in environmental engineering, in sanitation or water supply, which would have a higher return than this particular programme. So this rather limited approach would not convince economists that a programme should be implemented. One would need to look at a series of other possibilities before that choice could be made. Economics is a science of making rational choices and, therefore, one needs in theory (one seldom has it and that is why economists are using these techniques less now than in the past) a list of possible projects among which to choose what seems to be the most beneficial one. I am delighted that the medical profession is asking the question that Dr Potts is putting, of what is the best use we can make of the available resources, because this is a question that would be very easy to avoid, and has in the past sometimes been avoided; but I would argue for a very careful application of economics in the approaches that are developed.

Cvjetanović: Our nomograms have of course only limited use, namely to provide information about the most beneficial use of funds allocated for health services, and therefore they cannot give an answer to the complex problem of the best economic uses of the total national resources.

White: Cost–benefit analysis in the public sector was first and most extensively used in the management of water resources, and from that experience, which is now a somewhat jaundiced experience, there are lessons that can be pointed out.

Cost–benefit analysis in a way is like a blunt scalpel: in the hands of a poor surgeon at a provincial hospital it can perform monstrosities; in the hands of a very skilful person in the most auspicious circumstances it may serve the public good. One way in which cost–benefit is susceptible to misuse is in its failure to specify the assumptions that are ploughed into it. An assumption just noted is that all viable alternatives have been examined. Usually this is not so; there is some arbitrary selection of alternatives and the others have been ignored. Another assumption is that certain kinds of action will necessarily follow, for example the auxiliary activities related to an irrigation project. It is assumed that these will be put into effect. Often they are not, and the anticipated flow of impact doesn't materialize. Again, it is often assumed that people's attitudes are equivalent to their behaviour, but if there is anything we know from behavioural sciences it is that you cannot equate attitudes with

behaviour. And one is finally concerned with behaviour—what is done—rather than with articulated aspirations or preferences.

The second thing we can learn from the application of this technique is that there is a mystique of quantification; by and large, modes or attributes that can be quantified are given a different kind of weight from those that cannot be quantified. This shows itself in several ways. If some ingenious person comes up with an estimate of the value of the human life, for instance, there is a tendency to fasten on to that figure and use it. Then if someone can't put a value on human misery, it is given a value of zero. When we come to the matter of quantifying anticipated impacts, we run into extreme difficulties of multivariate analysis, as exemplified by the report[17] on the impact of schistosomiasis among certain groups in St Lucia, where after considerable investment of money and time it was concluded that there was almost no perceptible or quantifiable impact of schistosomiasis on income in the population studied.

The third lesson that we can learn, especially from water management, is that finally the decision is a political one. It is a decision of the responsible political agency as to what are the values that this group honours and wants to advance. In this regard we have to be very careful that the benefit–cost and cost–effectiveness analysis illuminate and help to clarify that basically political decision rather than constrain it and force it into an arbitrary mould. Bearing all this in mind, can we think of cases where there has been an exemplary application of benefit–cost or cost–effectiveness analysis in the public health sector, with a thorough progression from scientific observations to economic analysis to its application to a real public decision?

Llewelyn-Davies: An example (not in the field of health) which is probably the most heroic, conscientious and thorough example of cost–benefit analysis ever made was the attempt to select the site for a third London airport. This analysis cost a million pounds, took two years, and included the quantification of items such as pulling down a Norman church and losing a wild-goose breeding station. The report eventually came out and recommended a particular site; the choice was then reversed by the government, who chose a different site. The moral is that when one looks at methods of quantification or distrain of benefits and costs it is useful to step back from one's technique and ask oneself whether, if this was presented to a political debate at an appropriate forum in parliament or to a community, it would carry conviction. If the answer is negative, it is probably not a good technique!

Bradley: I would like to pursue this one stage further back, to where we formulate a problem, and the picture we present to ourselves of it, if we are on the medical side. I am concerned by the way in which mathematical techniques are used. Dr Cvjetanović gave two examples: the first was the nomogram,

and I think this has the rather wider implication of treating variables as constants. In other words, if one presents to an economist a choice between the present cost of treating tetanus and of the vaccination programme, one is implying that there are only two possibilities whereas, as Gilbert White has just said, one needs to look at other possible situations. Thus if in fact all the babies with tetanus who receive treatment are nevertheless dying, then at least one other choice is not to spend money on treating people who are going to die: look after them, but not at that expense.

When we come on to more complicated mathematical models within the health field, such as the effect of providing privies on the amount of disease in the second example, it is important that we treat these models as hypotheses. In medicine I can't think of any major mathematical model of any complexity which has proved really useful as yet; this is not because the approach is unsound but because the techniques haven't been developed far enough. At the moment a mathematical model is a hypothesis, not a self-evident statement of what must follow.

Cvjetanović: Mathematical models of epidemics have been developed primarily to study the natural course and the effect of interventions such as preventive measures, and to simulate the effect of various control programmes. They have been used for cost–benefit and cost–effectiveness analysis subsequently in order to assist in studies of health economics, but since they have not primarily been designed for this purpose they of course often fall short in giving answers which would satisfy hard-boiled economists! Yet in the practice of health planning, these models are being used every day more frequently.

Wiener: We have been talking about a number of different mathematical approaches, with some danger of confusion. Three basic approaches have been mentioned: the cost–benefit approach, the cost–effectiveness approach, and mathematical models. They all have their place, but we should keep them apart. The cost–benefit approach comes in in cases where simple benefits can be satisfactorily expressed in monetary terms. This approach may be a satisfactory way of choosing the best of two alternative means of reaching such simple objectives; however, it does not result in an optimal solution of how to use an allocation of funds in order to achieve broad and complex health objectives. The difficulty with the cost–benefit approach is that the most important things, in life and in projects, are usually the unquantifiable ones, and since we cannot introduce them into our cost–benefit calculations, either the method breaks down or we have to quantify unquantifiable variables in a very subjective way.

When we move to cost–effectiveness we operate within a much more general framework, comparing various ways of reaching broad goals (like improving

health) that we cannot express in terms of economic benefits but can quantify by using non-monetary units of benefits, such as lives saved. This approach can, for instance, be used for optimizing the use of funds allocated to a health department.

Mathematical models are another kind of technique based on selective mapping of the interrelationships between the several variables of a system. They can be used to evaluate the outcomes of alternative strategies. I do not think we have the data yet for this much more sophisticated approach in the context of health measures.

Finally, a comment not directly connected with evaluation procedures. I think the political process is a much maligned process; in my experience, many bad decisions attributed to the political decision-making process were due to bad professional advice. If badly advised, the political process makes bad decisions.

Burton: It seems to me that making political decisions, or the choices of the kind we are discussing, is often a very embarrassing exercise, because the choices are unpleasant and they often imply negative things in one direction as much as they do positive things in another. It is, therefore, tempting to go through these kinds of quantitative analysis because they provide a useful peg on which to hang the unpopular aspects of a political decision. They can form an excuse, because the person who is put in the unfortunate and uncomfortable hot seat of making that choice has a rationale that he can present. If it happens to coincide with what we might otherwise decide as being good judgement, that is very well, and perhaps it is helpful and constructive; but if it constrains and acts as an impediment to good judgement, instead of as a support to it, it can be dangerous.

The title of Dr White's paper (pp. 35–51) included the phrase 'good or right', and this made me wonder what the boundary is between a 'good' and a 'right' and when we should think of something in one category rather than the other. I took his remarks, at least in relation to water supply problems, to say that here was a point at which we should take something that we have been accustomed to think about in one category and put it into another and perhaps it is a question of the appropriate time at which to do this. After all, if we had done a benefit–cost or a cost–effectiveness analysis of the institution of slavery a hundred or 150 years ago, we would probably have been able to convince ourselves that slavery was a good allocation of resources and that abolition was a foolish thing to do. Perhaps we have arrived at the critical moment for some of the provisions of health care and environmental engineering investments at which we can consider these no longer entirely as questions of the *good*, but as matters of *right*. If we do that, we would gain the advantage of

mobilizing a certain spirit—the way in which we go about things—which would have beneficial results in terms of the energy and enthusiasm that can be brought to bear on these problems. If we remain at the stage of agonizing about the allocation of resources, and saying 'it is a good, but how good is it?', we shall be involved in a great deal of concern and analysis but make very little progress.

Evang: Professor Burton's point is highly relevant. We know that the use of certain economic techniques in the field of medicine is declining, because it is the process *before* the Ministry of Health gets its money that is the important one. Economics may be the science which enables us to make a rational choice, but Dr Burton is reminding us that *before* the allocation is made to health, you should try to force your way into the decision-making process. You need the enthusiasm to fight for the largest allocation, and you do not do that through economic techniques but because of your firm belief in the right of the human being to be healthy.

Bradley: It is important to stress that though some economic techniques are being applied less to medicine now, the use of mathematical models, which are ways of handling the technical complexity of, for example, a particular disease or group of diseases, is increasing. Such models allow one to tackle processes of great complexity, though too little has been done for them to be of much practical use yet.

Llewelyn-Davies: There is in fact an increasing sophistication in the development of quantifiable ways of displaying some of the choices which come before society; some of these are developing in other fields than health, such as the 'robustness' theory in decision-making,[15] but might well be applied in this area. Very often when one is dealing with social systems one cannot define the goals, as one can for situations such as putting a man on the moon or defeating a nation in war. With social systems the goals are often contradictory and there is a trade-off: the more you have of one goal, which is a good one (perhaps even a right), the system may be such that you have less of another. There are quantifiable ways of showing the trade-off between the goals.[8]

Wiener: There are now techniques available by which to optimize programmes with two or more objectives. One can list various solutions that are characterized by specific levels of achievement of objectives and then select from this list the most appropriate solution according to one's judgement; every selection represents, of course, a set of trade-offs between objectives. This approach relies in the final analysis on subjective judgement, but it forces the planner to scan all eligible alternatives and to compare trade-offs before making that final choice.

Llewelyn-Davies: However, that kind of formulation polarizes the situation into a part of a problem which is quantifiable and another part which is removed from quantifiable consideration. This does not take account of the dynamics by which the thought is developing in these areas.

C. Elliott: There are indeed a whole series of new techniques which might be useful; but having said that, one also has to say that all these techniques depend on the quality of the data, and in the past we have suffered from not having an adequate data base with which to do anything at all sophisticated. What depresses me, visiting Third World countries, is how little effort is being devoted to getting data that could improve the decision-making process, whether those decisions are made by doctors, economists or politicians.

D. B. Jelliffe: Any final judgement will inevitably be made on the combination of quantity, which is measurable, and quality, which may not be so. I have always felt this myself and am encouraged to hear the same thing from more numerate people. For instance, in doing a survey in the field, one certainly has to measure the prevalence of the condition, say malnutrition, but one has at the same time the qualitative input of what one *sees* in a village, without which one cannot apply any of one's results adequately. Another example is on the microscale of the paediatrician in a developing country who is faced with problems of children coming into the ward. He can work out the cost–effectiveness, if you like, of the use of the beds, and he *must do so;* but ultimately he has to come to a decision which balances cost–effectiveness and his value judgement as a physician in relation to other factors; and it always is a balance between these two.

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Human Rights in Health
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The basic human right to the means of controlling fertility

MALCOLM POTTS

The human reproductive system appears to have been programmed by evolution to produce an average of approximately ten live-born deliveries in a lifetime. However, some restraint on fertility is achieved in nearly all human societies. The regulation of fertility is not a novel practice of industrialized nations, but an almost universal element in civilized living.

Sociological factors, such as the delay of marriage, or the practice of prolonged lactation, help to reduce the average total number of conceptions in a fertile lifetime. Once a potentially fertile union has been established a number of elements are involved in deliberate family limitation. The reversible methods of contraception have an essential role to play, but they all have a measurable failure rate, both as a result of mechanical or physiological failures and as a result of incorrect use or lack of use. On the one hand, even the poorest method can extend the average time taken to conceive from a few months to a year, but on the other hand, even the best method is inadequate to control fertility over a fertile lifetime within the goals set in most developed and many developing nations (Table 1). It is misleading to consider a contraceptive as some sort of tap controlling the transport of sperm, or like a set of traffic lights commanding the release of the ovum. Contraceptives are best understood as procedures which reduce the statistical probability of a pregnancy occurring or, put another way, extend the time taken to conceive. It is essential to recognize that induced abortion is the basic element in the regulation of human fertility and has been used by every community that has attempted to regulate its fertility, although it remains against the statute law in many countries. Male or female sterilization, if available, is widely acceptable in a variety of cultures and can be made a constructive part of fertility regulation. In this chapter the means of controlling fertility are taken to include abortion and sterilization as well as the reversible methods of contraception.

TABLE 1

Births averted by insertion of intrauterine devices

Age of acceptance	*Additional pregnancies in absence of contraception*	*Additional pregnancies if IUD inserted (and reinserted in same pregnancy interval)*	*Births averted*
22.5	7.14	6.48	0.66
32.5	3.10	2.24	0.86

(Data from Potter 1971.[6])

The United Nations, under Article 55 of the Charter, is required to assist nations to achieve a higher standard of living, to help solve economic, social and health problems, and to create universal respect for human rights and fundamental freedoms. Resolution 18 of the International Conference on Human Rights held in Teheran in 1968 stated that 'couples have a basic human right to decide freely and responsibly on the number and spacing of their children and a right to adequate education and information in this respect'. The Secretary-General of the United Nations was even more straightforward when he spoke in 1967 of the 'right of every family to information and to the availability of services' in the field of family planning.

THE PRESENT SITUATION

Organized programmes of family planning have been relatively disappointing in their results. No doubt the novelty of the enterprise and its previous controversial history have contributed towards the relative lack of achievement. At most only five national programmes have had any measurable impact on fertility[3] and even these results have been disputed. In the large populous countries of the world such as Indonesia, Brazil, India and Nigeria the number of couples accepting family planning through organized programmes does not equal or exceed the additional number of women who are at risk for pregnancy each year, as a result of the young age-structure of the population.

In the late 1960s India was spending 0.1% of its Gross National Product on family planning, or US $48 million or $0.09 per head per year.[2] In the developing countries of the world, but excluding the People's Republic of China, donor communities and the governments themselves are now spending perhaps

US $400 million a year on family planning. At the research level, the World Health Organization spent US $6 million in 1973; the National Institutes of Health, in America, about $10 million.

Family planning, more than agricultural development or industrialization, is subject to controversy, involves a great many social variables, and is susceptible to greater uncertainties of political commitment. Aims can become confused and essential elements among the means to control fertility are overlooked for religious and political reasons. The aim of reducing birth rates and the aim of fulfilling the basic human right of a family to control its size are not necessarily congruent. In practice, at present and for the forseeable decades, achieved family size is greater than desired family size in nearly all countries which have high rates of population growth. Therefore, in practice, at present both aims can be met together. Many current family planning services are under-utilized, so there is much debate within the organizations attempting to provide family planning services about the allocation of resources to the expansion of current services, the provision of new forms of service, educational and motivational efforts, and economic incentives. It is a major thesis of this paper that fertility control is more than contraception, and that the available services are more limited, unattractive, ineffective and inconvenient than is commonly realized.

THE TWOFOLD PATH

The evolution of family planning programmes and services has been coloured by the controversial past history of the subject.[7] Currently it is acceptable to administrators and politicians to visualize the control of human fertility mainly in the framework of family planning clinics, which are conceived of in medical terms, capitalizing on the unwritten principle that doctors are the one group within the community having the right of access to the human sexual organs without taking part in coital activity. Medically based methods of family planning are offered in such clinics with the minimum of publicity. For technical reasons the major methods happen to be oriented towards the woman. The use of condoms is largely overlooked and the role of coitus interruptus treated with a giggle or a blank stare. The exceptionally important methods of sterilization and abortion are largely omitted. Sterilization is still treated in basically medical terms—the woman must have medical indications or a minimum age or parity to 'qualify' for sterilization. A great many groups and individuals in the family planning movement go to considerable lengths to disassociate their activities from anything that might be connected with abortion.

Often activities are hopefully presented as reducing abortion rates. When abortion is considered, its possible physical and psychological ill-effects are given considerable emphasis.

Services of this type have not attracted more than a small minority of married fertile women in any country, and in most of the world they have reached only 1 or 2% of the population or less. The response to disappointing results has often been to put increasing sums of money and human resources into so-called 'motivation', rather than to change the service.

The second path that could be followed, and which is just beginning to emerge on a small scale in a number of areas, has a different philosophy and a different profile of methods used. An attempt is made to break out of the medicinal philosophy and the thinking and vocabulary of marketing is often found attractive. Instead of a 'patient' you may have a potential 'consumer'. (Semantically, the word 'patient' when used in family planning implies that sexual activity is pathological.) Instead of a clinical method to be prescribed when there are no contraindications, you have a product which can be packaged. It may be a coloured condom with a fancy shape that is advertised in new and amusing ways; or it may be a technique of vasectomy made available on the railway stations of Bombay and 'packaged' in a form that is culturally acceptable to the community. The doctor ceases to be a judge making decisions and dispensing services on medical indications, but becomes a servant of the community. In some ways the doctor's role in family planning is simplified to that of a technician whose work in the community is like that of a carpenter (perhaps we should remember at least one carpenter who became highly and widely regarded by a large part of the world's population). The consumer's choice becomes of paramount importance. Methods are available electively. Practices, regulations and laws are drafted in the interest of the community, not in the interest of medical trade unionism. There is reality about the need for sterilization and compassion about the role of abortion in the control of fertility. A vigorous effort is made to integrate these methods into the services and to make it as easy as possible for the couple to change from one method to another, to decide on sterilization, and to integrate abortion with the reversible methods of family planning.

An unfortunate argument has arisen about the relationship between family planning and health services. Nortman[4] has written: 'thus far [family planning] programmes have been structured so that family planning is a by-product of health services, and not health improvements a by-product of family planning'. The problem can be answered in two sentences: (1) family planning is a necessary and valid part of health care; (2) health services never have been and are unlikely to become the exclusive, or perhaps even major outlet for family planning.

In several countries the time is now ripe for an expansion of the already important role played by the typical commercial and other non-clinical distribution of contraceptives.[1] Sometimes sales could be enlarged by merely improving the promotion of products and altering the profit margins. In other situations the cost of contraceptives needs to be subsidized at some point between their manufacture and their retailing, in order to bring their price within range of the bulk of the community.

The subsidized marketing of contraceptives is one example of simple, but potentially cost-effective, methods of expanding the use and acceptance of family planning. The principle being followed is to build on simple, local, indigenous channels of distribution which are outside government health services, do not require special clinics or bodies of specially trained personnel, but can be created within the resources of the urban or village community. A number of possibilities conforming to this philosophy are available, and need to be investigated and exploited. Such simple means of distribution might involve pharmacies, local stores of any type, the use of barbers for the distribution of male methods of contraception, the use of traditional health personnel for both condoms and (where legal) oral contraceptives, the use of traditional midwives (the dukun, bedan, dayar, helot), the use of the newly literate local leader who can be made into a depot-holder for contraceptives. It is also recognized that private medical practitioners already supply much of the family planning advice in many countries and are respected by the community, and that their input could be expanded. In many of the examples given, the possibility of financial gain to the distributor is likely to improve distribution.

The advantages of this approach are those of simplicity, the minimum number of administrative steps between the donation of international support and its usefulness at the field level, a lack of competition with already overstrained health services, the avoidance of long latent periods while institutions and establishments are created and, possibly most important of all, *cultural acceptability*, as family planning will be made available from within the familiar domestic resources of the community. The disadvantages are that family planning methods may be misunderstood and that it is not known whether continuation rates will be the same as, or less or greater than, with methods made available through more highly structured services.

THE HEALTH COSTS

Mortality and morbidity in pregnancy, for both mother and child, are high at the extremes of fertile life and rise with parity. They are also sensitive to

changes in socioeconomic status. Declining maternal and infant mortality in Western countries is partly the result of increasing use of techniques for the regulation of fertility, which have greatly reduced pregnancy rates in older, parous women, and partly the result of improved obstetric services. Therefore, family planning services are an appropriate and (most people would claim) an essential part of maternity and child health services.

Today, as every day, 70% of the deliveries taking place in the world will be without the assistance of a trained person. The task of extending maternity services is considerable and if in any way family planning services can precede improvements in maternity services, without competing with those services for significant funds, then the health of the community will benefit.

Simple methods of distribution, not involving clinics and doctors, would allow contraceptives to reach most parts of the world. However, there is an almost unshakable belief that doctors do something useful when supervising the distribution of contraceptive pills and an impression that it is unethical to suggest alternative systems. The reverse way of posing the question, namely that it is unethical to use a doctor's skills unless it can be rigorously justified, rarely seems to be asked. The International Planned Parenthood Federation made an important statement on this point in April 1973. It faced the reality that 'in many countries the regulations that are supposed to limit oral contraceptives to doctors' prescriptions are generally ignored. Those who can afford to purchase them from commercial outlets do so without medical supervision; however, national and international agencies abide by regulations, only distributing free or subsidised Pills through doctors. As a result there is discrimination against many of those most urgently in need of protection against unplanned pregnancy'. While recognizing that there are small but measurable risks with the use of oral contraceptives the IPPF believes that 'whoever normally meets the health needs of the community, whether doctor, nurse, traditional midwife, pharmacist or store keeper, can be an appropriate person to distribute oral contraceptives and we call upon our Member Associations to pioneer innovating schemes for the distribution of oral contraceptives'.

The need to justify prescriptions for contraceptives is a more correct and constructive starting point than the need to justify the removal of oral contraceptives (or any other drug) from prescription. A link between medical services and contraceptive provision would be obligatory if the non-supervised use of a method presented risks which were as great as or greater than the risks of not using the method. There are no circumstances where this is known to occur (Table 2). If we accept access to the means to control fertility as a basic human right, then we must be reluctant to accept any pattern of medical or para-medical supervision which cannot be justified.

TABLE 2

Pregnancies and deaths associated with contraception, pregnancy and induced abortion in one year (data from Tietze 1969[9])

Method	*Rate per 100 000 women of reproductive age in fertile unions*	
	Pregnancies	*Deaths*
None	40 000–60 000	8–12
No contraception: all pregnancies end in illegal abortion	100 000	100
No contraception: all pregnancies end in legal abortion	100 000	3[a]
Steroidal contraceptives	100	3[a]
Mechanical methods: no induced abortion	11 800–13 000	2.5
Mechanical methods: all pregnancies legally aborted	14 300	0.4[a]

[a] The mortality rates used by Tietze[9] in his 1969 calculations can probably be revised downwards for both oral contraceptives and early legal abortion.

THE ECONOMIC COSTS

Many countries, both rich and poor, might be criticized for not spending more on health, and the money that is spent is often poorly divided between curative and preventive medicine. But wishful thinking will not release resources and, however imperative the cause, finance is likely to be limited. Many developing countries spend less than one US dollar per person, per year, on all aspects of health care.

Of the two paths outlined the simplest is also the cheapest. Current, highly structured family planning programmes consume a great deal in overheads and in purchasing professional skills. The IPPF, which places a greater emphasis on services than most other international organizations, spent approximately US $3.2 million on commodities in 1972 (70% on contraceptives and the remainder on vehicles, audiovisual aids and clinic and office equipment). The total budget for that year was approximately $25 million. The cost of averting a birth through the Indian family planning programme fell from $100 in 1956/57 to $30 in the late 1960s, but the latter figure still represents four months income for the average Indian. At the present moment (mid-1973) government budgets for family planning are being cut in India and in these circumstances most observers would guess that it will be the effectiveness of the programme that will be decreased, rather than the efficiency increased.

Even if money were available for the highly structured programme, any

effort depending on the large-scale deployment of doctors would fail. The adverse ratios of people to physicians in developing countries, especially in rural areas, do not need emphasizing. For example, there are more Indian doctors working overseas than there are engaged in rural medical practice in India.

Among large developing countries only the People's Republic of China appears to have made useful progress in extending a meaningful family planning service to its people. Total review of a programme in a land so large is not yet possible but the testimony of those who have seen some part of the programme is unanimous in its enthusiasm and sense of excitement. No doubt, the profound changes which have taken place in the community contribute to a greater or lesser extent to the success of the programme and some people might even argue that they were a prerequisite for success. The programme has the characteristics of the simple pathway outlined: the indigenous resources of the community are used in training a great corps of barefoot doctors, and highly structured, culturally inappropriate health and family planning services have not been attempted. The rational distribution of simple reversible methods of contraception, including the distribution of oral contraceptives by barefoot doctors, combined with free access to sterilization and abortion, is a unique and welcome feature of the programme.

The Chinese programme could be, and perhaps should be, a model for the rest of the world. Guesses are that the Chinese population growth rate is now at or below the world average. William Draper, whose vigour and persistence has established the major part of the budget for the IPPF and the United Nations Fund for Population Activities, has suggested that a world plan of action might be based on the Chinese experience. In 1964 Chou En-Lai proposed that China reduce its then estimated population growth from 2½% to 2% by 1970 and to 1% by the year 2000. Draper has been the first person bold enough to tentatively spell out the cost of such a programme. Concentrating on the developing world—but assuming that China continues its own indigenous effort—Draper estimates that at the present moment US $200 million is contributed annually to family planning by bilateral and multilateral agencies (more than half this sum coming from the United States) and that an equivalent sum is contributed from the budgets of developing countries themselves. If it is assumed that population growth in the developing world falls to 1% by the end of the century, the target population would rise from the present 2000 million to 3400 million. This might require a rise in contraceptive use from the present estimated 10% of couples to 50% of couples by 1990. On international markets oral contraceptives cost 13¢ to 17¢ a cycle and condoms from less than $2 to $2.50 a gross. The direct cost in contraceptives of supplying

125 million couples at approximately $2 a couple per year in 1980 would be $250 million, and in 1985 to supply 240 million couples at $1.50 each per year (a fall of cost is assumed with rising volume), $360 million. In other words, the total projected contraceptive costs for more than a decade ahead are less than the current world expenditure on family planning. Draper allows two to three times the cost of contraceptives to run the distribution system—and this may be realistic. He also computes costs for population censuses, research and educational motivational costs. His total bill for 1980 is computed at $1200 million and for 1985 at $2000 million.

Important unknowns in the Draper programme include variations in the estimate of couples currently using contraceptives, and different guesses about the monies which could be raised by local subsidized marketing, as opposed to totally free distribution. A role for sterilization and abortion would also greatly alter the achievements of the programme.

There can be little doubt that the programme can be and should be attainable and it is to be hoped that sums of money of the order of an annual cost of $1000 million to $2000 million in the latter part of this century will be aimed for. Sweden and Norway now allocate 10% of their total development aid to population activities and if this proportion was accepted by the countries with really large Gross National Products, such as Japan, the USA or the Common Market countries, these figures could be generously exceeded. The Gross National Product of the USA, Canada, Germany, France, the UK, Sweden and Australia exceeded a million million dollars in 1969: one-tenth of 1% of that GNP would suffice, and such a calculation assumes no contribution from the wealth of the USSR, the smaller countries of Europe or the nations of Eastern Europe.

Unfortunately, aid targets are not always met: national governments will often (as in India at the present moment) economize on long-term family planning programmes in order to release short-term resources for what appear to be more immediate aims; crises in balance of payments and sudden changes in political attitudes can all affect the available sum of money. Contraceptive costs are presumably those that can least afford to be cut back. The professional supervision of distribution, and the investment in so-called 'motivation', are the areas that must come under closest scrutiny if money runs short.

The 'simple path' not only accepts the role of induced abortion and sterilization in the regulation of fertility but attempts to optimize the relationship between these surgical procedures and the use of reversible methods of contraception. It is indicative of the restraints within which current programmes operate that no direct comparison of costs, in health or economic terms, between contraception alone and a contraception-plus-abortion programme

has been attempted. However, there are indirect observations suggesting that the latter would be cheaper when measured by either parameter.

THE POLITICAL COSTS

The high ethics that underlie the concept of human rights and the base pragmatism that motivates political action are intertwined, even though the practitioners of the first might deny it and of the second might sneer at the suggestion. Family planning legislation and the discussion of political action often turn upon the issue of the human right to control fertility. For a long time 'protecting institutional doctrine was given a higher political priority than protecting the free choice of the individuals'.[5] In the United States, and in other countries that have contributed towards the financing of the international family planning movement, the philosophy which was politically necessary was also that with the greatest ethical content: 'this [that is, family planning] is entirely a matter of freedom of information and freedom of choice, without compulsion, with complete respect for the views of the individual, his religious inhibitions, and it is merely a matter of making knowledge available, it is mainly an exercise in freedom of speech, freedom of thought and freedom of information', said Senator Gruening at the US Congressional Hearings in which he initiated the current generous aid from the US to international family planning. As Piotrow points out, 'the question birth control advocates and policy makers usually had to face was "how can you justify using taxpayers' money for a cause that many taxpayers consider immoral?" ... the Gruening Hearing seized the initiative and asked instead "how can you justify withholding such important and useful information as birth control from the poor and disadvantaged who want to have it?".'

The Congressional Hearings in 1965 were opposed by the National Catholic Welfare Conference who argued that if the government supported birth control it violated a citizen's 'right to privacy'. Eight years later, the United States Supreme Court was to defend the woman's right to an abortion because to deny it would be an invasion of her privacy. Here the same ethical right is being quoted on the one hand to support opposition to making family planning advice available to those who desire it and, on the other, to support the proposition that abortion should be available on request. Rarely can ethical principles have found themselves with such different bedfellows.

Bad judgement on the possible acceptability, or unacceptability, of particular patterns of contraceptive distribution is common. Basically, simple methods of distributing contraceptives probably present fewer challenges than highly

structured programmes. However, the challenges that do occur are in the minds of social élites. When condoms were distributed in Kenya through local stores in a way which appears to meet the community's needs, social leaders complained they were being 'distributed like lollipops'. There was a fear that condoms might get into the hands of the young unmarried, although the possibility that sexual activity might be entirely in the hands and minds of the young unmarried was overlooked.

Simple availability of family planning services extends the choice of individuals. It enables demographic ends to be achieved through democratic means. In the last analysis, a wide, well-advertised availability of contraceptives backed up by elective sterilization and abortion may be a more secure defence of human freedom than a partial availability of methods for regulating fertility backed by strong educational and motivational campaigns. Most people would prefer the participation of the community in the regulation of fertility to the manipulation of individuals' choices.

WHICH PATH WILL SUCCEED?

There is some evidence that the simple path can work. The low birth rates of the economic depression in the Western world in the 1920s and 1930s were achieved by a simple distribution of the reversible methods of contraception, by a widescale use of coitus interruptus (and possibly by some use of alternative patterns of sexual congress), and by illegal abortion. The medical profession made only a minimal public contribution to the control of fertility at this time, although in private they used these same means to limit their own family sizes. Today, some of the lowest birth rates in the world are found in the countries of Eastern Europe. Family planning programmes are poorly developed and governments encourage people to have children, through tax policies, child allowances, advantages in housing, and the availability of nursery schools. Coitus interruptus, rather poor quality condoms and legal abortion combine to produce low or very low birth rates.

There is little or no evidence that the complex channel works and some evidence that it has failed to achieve set goals. Even the apparent success of well-developed clinic-based programmes, such as that in Hong Kong, has been questioned by demographers. The example of the Indian government in political commitment and courage in the field of family planning has been rightly praised. However, the detail of implementation has been poor and mainly limited to medical methods of contraception (until the late but useful addition of condom marketing). A new abortion law was implemented in

April 1971 but has been choked with bureaucratic regulations. When family planning programmes began in India the annual addition to the population was five million a year and now after 20 years of government initiative in this field the rate of population growth is 13 million a year.

Some people recognize the limitations of the complex path, but hopefully plan to escape from it by some quantum leap in contraceptive technology. There is little evidence that this is going to happen and if it involved a medication the necessary programme of animal and human testing could well make for a decade's delay between the demonstration of the possibility of the method in men or women and its widespread implementation.

Others emphasize 'motivation'. The role of motivation in family planning programmes is variously assessed. Some observers see 'backward unenlightened communities' that must be browbeaten into having smaller families. Others believe education, and in particular sex education, alone can stem the tide of human reproduction. Others would plaster the world with posters exhorting women to consider their health and men to shoulder their economic responsibilities in order to escape from the slums in which they live—invariably illustrated with pot-bellied children, empty rice bowls, broken furniture and leaking roofs. Few pause to ask whether fertility regulation services are really available.

In my personal experience I have yet to visit a country where the services are not behind the willingness of individuals to plan their families. Conversely, I have never seen services, tailored to meet the needs of the consumer, that are under-used. I have seen empty clinics, but then I am not sure the community wants many clinics. Recent market research in Thailand suggested that women found going to clinics for oral contraceptives inconvenient and the physical examinations undesirable:

> 'I go to hospital when I am sick. When I don't have anything wrong with me, I don't think about going to hospital'.
>
> 'I feel shy to have somebody examining my body. When I am sick it's all right'.
>
> 'Why should the doctor have to examine me thoroughly in order to prescribe me pills?'

In Brazil, clinics see an average of 0.2 to 2.4 women an hour, although the average doctor in a Brazilian hospital may have the responsibility of making life and death decisions about hundreds of out-patients each day.

The claim that services lag behind motivation is sufficiently radical to need some justification. To start with England: the father of ten children requested

vasectomy. The London National Health Service consultant who delivered his wife refused sterilization (on the grounds that there were no medical indications) and refused to give the Pill or an IUD to the wife. The man had tried using condoms and withdrawal but both methods failed. The couple had no emotional objects to contraception and had been attempting to get a vasectomy for four years, but could not afford the £25-£60 asked.

The human right to family planning is denied in Sweden, where you can buy condoms, have a legal abortion, get sex education in school, but must fly to London if you want a vasectomy. It is denied in Japan, where you can get an abortion, buy the best condoms in the world, but the Pill and IUD are illegal. It is denied in Indonesia, where there is a massive family planning programme, but abortion and male sterilization are not used and the Pill is officially on prescription. It is denied in India, where abortion and sterilization are widely practised but no genuine effort to distribute oral contraceptives has ever been made.

In any sphere of human endeavour other than one related to human sexuality, the simple path would be chosen in preference to the complex one, on economic terms if no other. It is likely that this choice would be considered well-confirmed by the observational data of the past 100 years of fertility control in developed nations and the past 10 to 20 years in developing ones.

I believe it would be possible to extend the ways and means of controlling human fertility to almost the whole of mankind within the next 10 to 15 years at a very modest cost, if the first set of principles is chosen. If the alternative course is adopted, it may be that, even in 50 years' time, these minimum human needs will not have been fulfilled, despite a very considerable investment. I also believe that the simple rapid approach, although apparently challenging some important aspects of ethics, may involve less potential invasion of human freedom than the explicit intended consequences of some of the giant family planning bureaucracies that have been created.

Discussion

Wenche B. Eide: I would like your comments on postpartum programmes, which are seen as one way of reducing costs. This is partly for logistic reasons, in the sense that the woman is already present after her delivery.

Potts: A world plan of action for postpartum programmes has been put forward by Taylor & Berelson[8] of the Population Council. At a modest expense (between 40¢ and $1.60 a head) it would be possible to improve world maternity services and add an integrated family planning programme. I do

not think this is a way of reducing family planning costs; it is a way of reducing what the élites perceive as the political costs.

Nothing would be more pleasing than to think that the world will extend its maternity services, but it is a fact that 70% of the women having babies today are not attended by a trained person. Clearly, it is important to extend maternity services, but it will be a slow and painful process and is unlikely to be given high political priority. Therefore if family planning services are tied to maternity services, we deny family planning to the bulk of the population in the rural areas. The argument made is that we should add family planning to health services rather than to say that family planning by itself has an impact on health. In fact, maternal mortality in England has declined partly as a result of better obstetric services, and partly because few women now have ten children, and older women are not producing children as frequently as before. Therefore, women at greatest risk in pregnancy and delivery are being protected because of fertility regulation. If family planning services were extended ahead of structured health services into a developing community, that would itself have an impact on health. The maternity-related family planning service, which is very much a goal of WHO, could be irrelevant to the major problems. This is not to say, of course, that if one *can* have a maternity service, family planning should not be an integral part of it.

I recently saw a report on a large developing country by an international adviser on family planning. Basically his advice was to build a maternity service. But that is not immediately feasible in the country concerned. Essential problems were being avoided for political reasons. The adviser lacked the courage to say that what would have impact would be (1) changing the national abortion law and (2) taking the Pill off prescription. It is wrong for political reasons to hide behind maternity services, which exist only on paper. There will not be adequate maternity services in that particular country before the population has doubled, and even that is an optimistic guess.

Wenche B. Eide: I react somewhat to the postpartum programmes, because many of them appear to have been designed by men who seem to imply as a fact of life that the first thought of any woman after having given birth to a child must be: 'Never again!' I have seen this seriously stated in family planning literature. If contraceptive advice is to be related to the postpartum period, it should at least be done in a more positive way, by stressing the importance for the newborn child that a long time period should elapse before the next is born, so ensuring good health for the mother and thus good nutrition and health for the child through satisfactory lactation, and adequate care in general. But all this I believe must be easier to carry out through the mother and child health services wherever they exist.

Potts: One should not bring undue pressures to bear on people over family planning. I am worried by the pressure put on women to accept sterilization when they are aborted in England. They are sometimes told that they cannot be aborted unless they are also sterilized. Another limitation of maternity-related family planning services is that they make only female contraceptive methods available. Most family planning is done by men, because men are the decision-makers of the family for the bulk of the world's population. So contraceptive methods must be packaged and marketed for men.

Victoria Garcia: I would like to describe the other side of the coin and to present family planning as a preventive health measure to be used by health personnel when they make plans to improve the health and well-being of the community in their charge. We think that women have the right to have the children they want and can take care of, and they also have the right, when they decide to have a child, to have it with the best medical care available. In Latin America the groups exposed to maternal and child health risks make up 63% of the population. Maternal mortality is to a large extent avoidable, and occurs mainly as a result of toxaemia in pregnancy and related accidents, infection, and especially clandestine abortions. A number of people have reported that high parity—particularly 'grand multiparity', which is variously defined as births following five, six or even more pregnancies or deliveries—carries increased risks of maternal mortality and obstetric complications.

Some health problems, for example malnutrition, are probably directly related to the increased strain on family resources with each additional child; in the case of common infections, larger family size may lead to more frequent exposure of members of the family to infection. Malnutrition is one of the most widespread and important health problems, for the quality of a family's nutrition can determine the quality of each member's health, affecting the children's growth and development, dental health, and resistance to infection.

The aims of the family planning programmes in Latin America are: first, to make it possible to plan family size; that is, to enable each couple to have the number of children that is best in terms of their health, socioeconomic position and life roles. Second, to make it possible to plan birth intervals to safeguard maternal health and infant well-being and development. Third, to make it possible for women to have children at the age at which pregnancy carries the least risk for the mother and the greatest chance of a successful outcome. Also to make it possible for couples to obtain diagnosis and treatment of sterility and to avoid unwanted pregnancies; and, finally, to prevent abortion, especially illegal abortion.

It is easy to understand that with these conditions the educational component of each programme has to be very carefully planned.

Potts: This is a very political presentation, which I am sure is likely to be successful in Latin America, but it must be understood that it is an artificial approach. The reality is that human beings have a basic human right to decide how many children they are going to have and so family planning needs no other justification, although it can also be justified on grounds of health and on demographic grounds. There is no conflict between these arguments, and programmes must often be packaged for political reasons. One cannot go into Latin America and say, 'make contraceptives available'. However, if we *believe* the mythology we put forward for political reasons, that is when we make serious mistakes. In my opinion, the major decision that has to be made in Latin America is for a non-physician distribution of all contraceptives. Without this decision, an enormous and very serious bottleneck will continue there. Perhaps approaching family planning entirely as a health matter is the Latin American way of escaping the mediaevalism of the Catholic Church, just as we in Britain, with our uncertainties about sexuality, involve doctors too much in family planning, not because of their skills, but because, as I said, they are the one group that society allows to look at the genital organs without taking part in coitus.

Victoria Garcia: In many countries in Latin America one finds all kinds of contraceptives available in drug stores even without a medical prescription. But people still have great confidence in doctors and medical services are well accepted, even in rural areas. In Chile the programme has been officially part of the National Health Service since 1964 and the birth rate has decreased from 3.5% to 2.8%. Our programme is not aimed at controlling the population but at controlling illegal abortion. In Latin America, women carried the burden of limiting their families; only recently have men become interested in family planning, and begun to demand information and counselling.

Potts: The use of clinics and hospitals does not account for any significant part of this decline in the birth rate. In no country of Latin America has the recruitment to the family planning programmes equalled or exceeded the annual addition of women at risk of pregnancy, because the age-structure of the population is already biased towards the young. Latin America, like the rest of the world, controls its fertility primarily with illegal abortion, a few sales of condoms and over-the-counter pills, and much reliance on coitus interruptus. My vision would be to take the existing technology that we know the community uses, to improve it mildly, and really to get across to 80% or 90% of the people, rather than do something which makes *us* feel very comfortable but merely helps 1% or 2% of the population.

Victoria Garcia: The programme in Chile now covers 12% of the women of fertile age. The aim is to extend the coverage to 25%.

Potts: In any other programme, such as vaccination for example, we would not be happy with this aim. I think we have the opportunity to reach 75%.

Victoria Garcia: We are happy with this aim, if it is possible to do it at reasonable cost and at the same time to give guidance and comfort families, and to establish a better relationship with the health services.

Pirie: You did not mention prostaglandins, Dr Potts. What is being done there? And secondly, who stops condoms from being sold in supermarkets in Britain, along with soap and toothpaste? Or do some supermarkets stock them?

Potts: There is a changing pattern in the sale of condoms in the UK. Until a few years ago the Pharmaceutical Association would not allow shops to stock condoms as an above-the-counter article. The manufacturers were not regulated by statute, but they did not want to offend certain groups, so they would not risk selling in supermarkets. They are now beginning to experiment in new retail outlets and condoms are frequently put on the counter in pharmacies. We are getting a better advertising system as well.

Pirie: But who says no?

Potts: We do: this is what the élites do! I wanted to run advertisements on certain London underground stations for a birth control clinic. The Greater London Council refused to allow the advertisement. The advertising of contraception is prohibited in the London Transport regulations.

Prostaglandins are, I think, a good alternative for a late abortion, but so far have not been made a practical proposition for early abortion. Until 12 weeks the hand-operated vacuum aspiration pump is effective, and more predictable than prostaglandins.

Tewari: The package idea is certainly fascinating, but it has its limitations. We used this idea in India in the early 1950s for malaria, before the malaria programme came into existence. Quinine was sold by every village teacher and every post-office. The same is being done now as part of the family planning programme, with about 100 million condoms being produced annually. There is a good distribution system through commercial channels. Unfortunately, there are no takers, and that is where the question of motivation comes in, and of whether, having developed a system of distribution for a packaged system, one can leave it at that. The other thing to note in a country like India is the opportunity that this programme is providing for building up an infrastructure for maternal and child care which would probably not otherwise have come into existence for some time. One of the advantages of the investment in the family planning programme is the way it is helping in the provision of a basic health service at the periphery. The situation, with about 70% of deliveries not having any trained attendants, is a very real problem and to the extent that the family planning programme, whatever the methods or tech-

niques adopted, helps in the infrastructure being brought up to a certain level, it should be welcomed and promoted.

Potts: I would prefer to justify maternal and child health services on their own grounds. I am unhappy when people mix them up and want to divert money intended for family planning to maternal and child health services. Either one can say that there is too much family planning money, which is a valid argument; or one can say that one wants more money for maternal and child health services; but other courses involve a political blurring which is misleading.

The condom programme in India has gone better than the other programmes; there *are* takers. And again, when one looks into the details, the problems arise in getting things out of the bureaucracy and out of the health structure. D. R. Gupta, a marketing executive for the condom programme, told me that the two chief bottlenecks were that the government would not allow him to employ outside advertising agencies, or to run market-research programmes. Until the programme is professionalized with a proper marketing technique and until condoms can be sold in the way baby foods are being sold in East Africa, there will be little progress. At the present moment, we have some good ideas, but they are all on paper and are inhibited because people will not take the last step. In England, we do not permit advertising of abortion. Abortions can be done, but nobody must know how to get them quickly. In India, you have the perfect example of a sensible abortion law—a very humane step forward for the largest democracy in the world—and yet the bureaucratic regulations controlling abortion are designed so that every possible mistake is made, and in the whole of India in 1972 there were only 20 000 registered legal abortions. Official estimates of illegal abortions run to 2-3 million annually. It will not prove possible to pick up any more of the potentially illegal abortions and bring those women into the family planning service, making abortion a turning point in their contraceptive practice, without a big advertising campaign. It would not offend the slum dweller, who wants to know what to do.

Evang: I think you are over-simplifying the problem, Dr Potts. You cannot base yourself on the idea that the customer is always right in a situation where very complex attitudes are involved. We have seen what has happened with breast-feeding when advertising has been allowed to take over, and that is a relatively simple thing. We have plenty of evidence to the effect that without the availability of contraceptives in a country being changed in any way, the birth rate has been fluctuating violently. How do you explain that, since the motivation is the same? How have the Chinese succeeded? Not by selling contraception. They went about it in exactly the opposite way to what you recommend. They produced the motivation and then came to the customer.

Another point: I think you confuse commercialized medical services in rich countries, and the way in which doctors monopolize these (in this I agree with you), with the fact that in all poor countries health services are free public services. This is the only way of serving the people. And these countries are in the painful process of developing health services which might provide not only service, but also attitudes: to breast-feeding, to muscular exercise, to nutrition. These are *parts* of life; so is family planning. And the fragmentation of this into an anti-tobacco service and a breast-feeding service and a family planning service is a hopeless way and is tremendously costly. It would be tragic if your view represents the trend in the International Planned Parenthood Federation, because it goes completely against the present development towards producing an all-embracing health service. Motivation is still the important thing. You cannot get rid of the health service, because as yet there is only one contraceptive method that can be sold directly to customers, namely the condom; the birth pill has not yet reached the stage where it can be let loose on the population. There are risks. The other methods all require health services—not necessarily a doctor, but the new type of widened health service using auxiliary health workers.

Potts: The views I presented are my own; I have polarized things in my paper as a shorthand approach to a complicated subject. However, the IPPF now recommends all its member associations to look carefully at new methods of distributing contraceptive pills, and does not think that the doctor is an essential element in this. Many people would now hold that you should sell pills like condoms, and that to withhold them is damaging to the population. I made the calculation that in India, if pills were available in shops like condoms and the uptake was only about 3 or 5% of fertile couples, roughly 2000 maternal deaths would be saved each year. I think we kill those people through our attitudes. I am not saying that family planning should *not* be a part of the health service; but health services are very limited and do not reach rural areas. It would benefit those people to offer them family planning services not based on health services as soon as possible, if it is technically feasible to do that—and I think it is feasible. My second point is that within the limited budgets available for health services, too much is being absorbed by this very expensive process of family planning, in the way we now do it.

D. B. Jelliffe: To some extent this is a false polarization, and I want to make a bridge between the two approaches. Why should health services and the family planning *and* other types of health activity not be marketed? Take soap: it is the best preventive of skin disease, but we do not give soap out through health centres. I am in favour of anything which can be marketed or where modern advertising techniques can be used. The health profession has

to get out of its rigid stance in this regard. But from the other point of view, there are misconceptions about the types of health services that we should be talking about. These are not health services that will be dominated by doctors. In my field, child health and nutrition, the trend now is towards simpler services which really reach the rural areas, and are based on medical auxiliaries. My feeling is that the marketing approach to family planning is needed—provided there is a market; provided there is the motivation; and provided there is a money economy, which there may not be in many parts of the world. But equally, there is need for a low-cost, rural mother and child health service of which family planning and the distribution of contraceptives would be a part. The proportions of each approach would vary with the circumstances. The commercial techniques successful in Japan would not be very successful in rural Uganda. Dr Evang mentioned China. One of the ingredients of their success in family planning has been the distribution of contraceptives through the barefoot doctors. The barefoot doctor is an example of the type of rural health activity I am describing. My plea would be to avoid polarization and to have an amalgam of the two approaches, the percentage of each depending upon the local type of economy and type of ecology.

Potts: I agree very much with that. I would only add that one should avoid prejudging the situation. There have been too many experts saying that Indian women will not use pills; in Kenya there is now a condom-marketing scheme in an area of half a million people in which half the outlets of the village shops are taking up and selling condoms in dispensers. This is a subsidized scheme, but it appears to be acceptable to the community and a useful addition. People for years said that Latin American men would not be vasectomized. Services have been made available in Colombia and quite a lot of men have been vasectomized.

Bradley: I see a similarity between this discussion and those concerned with water supplies, in that when the medical professionals are involved, they become more concerned about making one person more sick because it is on their consciences as professionals, than about the ninety-nine whom they are not treating because they do not see them. The argument for dissociating the contraceptive pill from the doctor is surely very similar to that of dissociating small water supplies from the engineer. If you can show statistically that the community is much better off with one thing than another, you must separate the doctors from the 'patients', or they will have too much on their consciences when one person dies after taking the pill or after a slightly substandard water scheme has been built. I suspect that part of this discussion is really about institutions and professions.

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Human Rights in Health
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Personal health care: the quest for a human right

MAURICE KING

Nowhere do we fail more dismally to apply what we already know for the good of our fellows than in the provision of personal health care. It has been estimated that more than half the world's people have no access to the modern means of health care at all,[2] and this is in the Second Development Decade of the UN, in which health is being seen, not only as a means of development, but as one of its ends. Such is the human condition against which we search for a human right, our entire purpose for doing so being to see that no one shall be denied that right.

Personal health care is the help in sickness that one man can give to another by virtue of his special skill and knowledge. If a sick man lacks access to it, he is denied the possibility of being helped by any of a large number of medical interventions of varying complexity, cost, and benefit. *If we are to do anything useful to promote human rights in this field, we have eventually to specify in detail which of these interventions constitute this right.*

An intervention is merely a convenient name for one of the acts necessary to provide personal health care, be it injecting penicillin, administering polio vaccine, testing the urine, or even transplanting a kidney. Health care, and the interventions of which it is made up, can be simple or complex, expensive or cheap, and it is our task to try to determine what is the minimum quantity of it which all men everywhere have a right to enjoy. If this right could be defined in detail and generally agreed upon, we could observe it, handle it, cost it, and above all measure it, both in quantity and quality, and see who gets it and who does not. Perhaps, when we have done so, more people might enjoy it.

By adding 'rights' to 'wants' and 'needs' we make a difficult pair into an even more difficult trio. The right to personal health care can be considered as a group of interventions that an individual will only sometimes need, may not

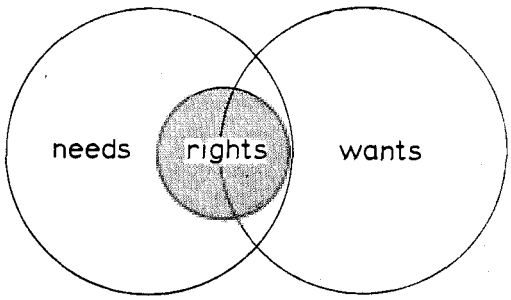

FIG. 1. The relationship between rights, wants and needs.

always want, which are not to be imposed on him, but which must be available. In view of the present circumstances of the developing countries, the interventions constituting this right can only be a part of the objectively assessed medical needs of a community. They are certainly not the same as its total wants, the relationship between the trio being conveniently expressed in the form of the diagram in Fig. 1.

Although we cannot, at this symposium, specify in detail exactly what human rights in personal health care shall be, we can, I think, go a useful distance towards deciding what they should look like, which will be at least something towards promoting their fulfilment.

THE ORDERING OF INTERVENTIONS

At its simplest, our human right in personal health care is but a group of the appropriate interventions taken from the totality of medicine. The question is: which group? In making our selection we need to consider both medical and economic criteria. In establishing the medical criteria we are assisted by the possibility of ranking interventions into some sort of order or technological scale.

That there is an order among interventions is well seen in clinical pathology, for example. Thus the simplest, cheapest, and almost the oldest test of all, and still one of the most useful, is to test the urine for protein. A little more demanding in equipment and skill is the measurement of haemoglobin. Slightly more expensive and difficult is the measurement of the blood sugar. Considerably more complex and costly again is the estimation of the protein-bound iodine in the blood. Towards the extreme in sophistication and expense come such procedures as radioimmunoassay. Such differences enable interventions

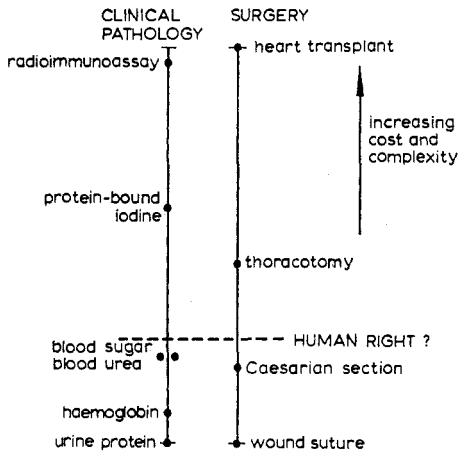

FIG. 2. An outline of the technological scales for clinical pathology and surgery.

to be placed on a scale of increasing cost and complexity, in terms of both the equipment needed for them and the demands upon the operator who does them. The detailed relationships of such a scale are inevitably somewhat arbitrary and in practice the scale can only be partial. For example, it is difficult to know exactly where two closely similar tests, such as determinations of the blood urea and of the blood sugar, come in respect of one another. Nevertheless, a scale such as that shown on the left of Fig. 2 can be made out.

This scale has at least two significant features. The first is that if a particular hospital laboratory can do a certain test, it can usually do all the tests below it in the scale. If, for example, it can measure the haemoglobin, it can surely test the urine for protein. If it can measure the protein-bound iodine, it can certainly measure the blood sugar. Closely associated with this is the fact that, if a patient has access to a test at a particular point in the scale, he probably has access to all those below it. The second significant feature is that the position of a particular test on the scale has little relation to its diagnostic usefulness. Those higher up the scale are not necessarily any more use to the patient or to his doctor than those lower down.

A similar hierarchical scale of interventions exists in surgery, from the simplest suturing of a wound at one end to the transplantation of a heart at the other, with such procedures as Caesarean section and thoracotomy coming somewhere in between. Here again, if a hospital can do a thoracotomy, it can certainly provide a Caesarean section. If a patient is in a position to get an operation higher up in the scale, he can probably also get all those lower down.

Here too the benefit of a procedure may bear little relationship to its position in the scale.

Similar scales can be constructed in other specialties, such as radiology, or even internal medicine, and to some extent there is a correlation between them. For example, if a hospital is just able to provide a Caesarean section, it will certainly be able to measure the haemoglobin, but perhaps not the blood urea.

It is significant that these technological scales can be constructed in terms of what health units in developing countries are capable of doing, and that they are susceptible to exact measurement. They are also some measure of the way in which these health units appear to grow, in that they are apt to add on more complex procedures and so move up the scale. Even in units showing a very great imbalance, between, say, excessive surgery and no child welfare, their development within specialties is likely to follow such a scale.

If such an approach is valid it may help us to define human rights in health care. Perhaps there is a 'threshold' somewhere on these scales below which everything might be included as a human right?

But, before going further, more must be said about benefit. Needless to say, a scale on which benefit was ranked would look completely different. But, alas, it is, economically speaking, quite impractical to define human rights either entirely or even largely in terms of benefit. However, benefit is an important aspect to consider at the 'threshold' point on the technological scale. Here it would be useful to consider some 'trade-off' between cost and benefit which would allow some particularly beneficial procedures just above the human rights threshold to be included, while some of those of lesser benefit just below it were excluded. In practice, however, such a re-ordering of the scale might be overshadowed by two further peculiarities of the various interventions—their clustering, and the disjunctions between them.

THE CLUSTERING OF INTERVENTIONS

Many medical interventions are closely clustered or associated in the sense that if one is available, another can be provided at little or no extra cost. Thus, if a laboratory can examine a thick blood film for malaria, it can examine the stools for amoebae at no further expense. If children are already being weighed, it is hardly more expensive to chart their weights. The provision of a health centre makes it possible to supply a large cluster of interventions, and a district hospital another cluster.

The definition of a human right in personal health care must take into account this way in which interventions naturally associate together. As shown in

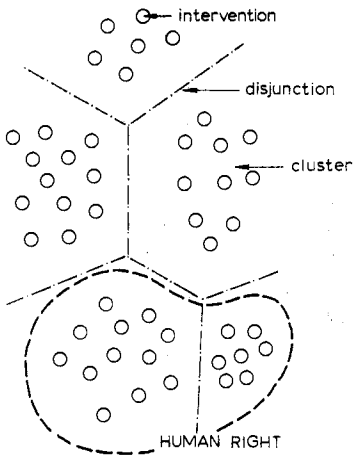

FIG. 3. The clustering of interventions and the disjunctions between them.

Fig. 3, the 'right' should try to include a cluster rather than cut across it. Such clustering means that there is not much point in deciding whether, for example, BCG vaccine should be a human right independently of the means to chart children's weights, with which it is so closely associated. If these are already charted, the marginal cost of providing BCG vaccine is not great. One of the most significant associations is that between the interventions for child care and those for family planning, the former providing a most useful vehicle for the latter.

THE DISJUNCTIONS BETWEEN GROUPS OF INTERVENTIONS

As a natural corollary of clustering there are wide gaps or disjunctions between some groups of interventions. Take, for example, the treatment of dehydrated children. It is possible to provide in a mere 20 pages of basic English a complete account of how to treat dehydrated children, including some elementary physiology and rules of thumb treatment, such that 95% of them can be cured at little cost. To improve on these figures requires a level of knowledge and an expenditure of at least an order of magnitude greater. For example, an understanding of milli-equivalents is required, together with an Astrup machine. There is thus a clear disjunction or gap between a group of simple interventions that are adequate for the vast majority of children, and a much more costly and sophisticated group which are required if a higher cure rate is to be achieved.

There is a similar disjunction in the field of clinical pathology. US $500 will provide a microscope and all the equipment and materials needed for a wide range of simple but very useful investigations, appropriate to a health centre or district hospital.[4] But a sum of money of an order of magnitude greater is required to provide the equipment for the next methods up the technological scale, including such items as an autoclave and a flame photometer.

It is through disjunctions, or natural planes of cleavage between groups of interventions, that we must define human rights in personal health care. Thus the simpler group of procedures described here for the treatment of dehydration and the simpler set of laboratory methods have good grounds for being considered as a universal human right.

'GOOD MEDICINE' IS MORE THAN A LIST OF INTERVENTIONS

A list of interventions, however carefully chosen, can only provide the barest framework for medicine. It might specify, for example, that a health worker should be able to examine the ear and recognize certain abnormalities in it, or that he should be able to teach a mother how to express her breast milk. But many small details are also important, such as when during the examination of a child is the best time to examine his ear, and how he should be held while this is being done, or whether a mother is *shown* how to express her breast milk, or merely told how to do so. These small details, even kindness, are no less a human right than the intervention itself. Something else has thus to fill in the detail round the skeleton provided by a bare list of interventions. Although a detailed pattern of practice stems from the whole tradition and ethos under which health workers are trained, it is most easily handled if it is carefully defined in manuals that are written round the interventions and so serve to fill them out in detail. Ideally such manuals should embody a pattern or system of practice that should be widely accepted as 'good medicine' under the particular circumstances for which they are written—a problem to which I shall return.

PACKAGING THE INTERVENTIONS WHICH FORM THE RIGHT

Having proceeded so far we find ourselves with a wide assortment of simple and comparatively cheap interventions in the various fields of medicine which confer great benefit at little cost, and at least deserve consideration as human

rights. But lists of interventions by themselves are of comparatively little use to a health service, even if they are filled out in manuals. If human rights are to be realized by the provision of services, they have to be developed in a form which encourages health services to implement them. Some wider concept and more effective health service 'tool' is needed, and it is useful to think in terms of 'health care packages'.[5]

From the point of view of the health services a 'package' is much more than merely a careful collection of interventions. It also contains everything technically necessary to promote their application. Critically important is a detailed set of behaviourally defined educational objectives for the staff applying a package. These objectives embody the interventions for training purposes, and are in practice the most convenient way of listing them. Other necessary items, besides manuals, are teaching aids, curricula, equipment lists, and ways of recording and reporting, together with methods of evaluating both the knowledge of trainees and the quality of the services they provide. A package should also contain methods of supervising the workers applying it, and of introducing it on a service scale. Norms are needed for costs and output per worker. Some measure of its epidemiological impact is also required, where this is observable. The items in this heterogeneous list are conveniently called 'components', and all relate in some way to the particular group of interventions forming a package. A health care package can thus be defined as an *integrated set of components assisting the application of a particular group of interventions for the improvement of health care under specific socioeconomic conditions.*

'Health care packages' are becoming fashionable and mean different things to different people. Very often they are taken to mean merely a particular mix of services, such as a certain combination of child care and family planning, and the idea of several integrated components serving a selected set of interventions is lacking.

The real purpose of a package stems from the postulate that, although individual components are useful by themselves, their combined effect is likely to be more than merely additive. Thus a kit of laboratory equipment or a manual is little use alone, but integrated with one another and used together they may be very valuable. Great emphasis is placed on the components being complete and integrated. Thus, if a particular item of equipment is described in a manual, it has got to be in a government's medical stores list. The components have also to be complete, in the sense that a child care manual has to specify all the knowledge that a worker requires in this field.

This is not the place to go much further into packages from the point of view of the health services, except to say that their boundaries are largely a

matter of administrative convenience and that it is at the bottom of the scale that they promise to be so useful, because it is here that such a vast quantity of services are required. This is also where well-designed packages can in some measure augment scarce technical, administrative and educational skills, and help to make up for limited opportunities for communication. Higher up the technological scale these constraints are so much less severe that packages lose their point. One of the great opportunities of a package is that it enables great attention to be concentrated on the many small details upon which successful health care ultimately depends—an attention which they seldom get. Packages promise to be useful administrative and educational tools that can save hard-pressed administrators and teachers much trouble. They also throw into sharp relief the technical deficiencies which now so greatly hinder services. For example, one such deficiency that has come to light in the attempt to put together a child care package is that there is still no account in English of how a medical auxiliary should examine a child.

Thus 'packages' have the unique advantage that they are at the same time both an exact way of defining rights in personal health care, and a valuable administrative tool for implementing them.

WHICH PACKAGES MIGHT BE CONSIDERED A HUMAN RIGHT?

We are now in a position to consider which group of packages might be practically attainable as a human right. In view of the extreme economic constraints of so many countries, packages for the delivery of out-patient rather than in-patient care deserve priority, some of the cheapest and most effective interventions being those for the prevention or treatment of infectious disease. Human rights in maternal and child health should come high on the list. A very strong case can also be made out for the provision of simple operating facilities, and such surgical interventions as should be within the capacity of a general duty medical officer, especially those required for trauma and operative obstetrics. Much progress towards the development of such a surgical package has indeed already been made. The technical quality of medicine at this level is greatly increased by the provision of simple laboratory methods, and of surgery by the availability of blood transfusion.

WHO IS GETTING HIS RIGHT AND WHO IS NOT?

Fig. 4 is a graph in which the ordinate is a composite scale derived from the

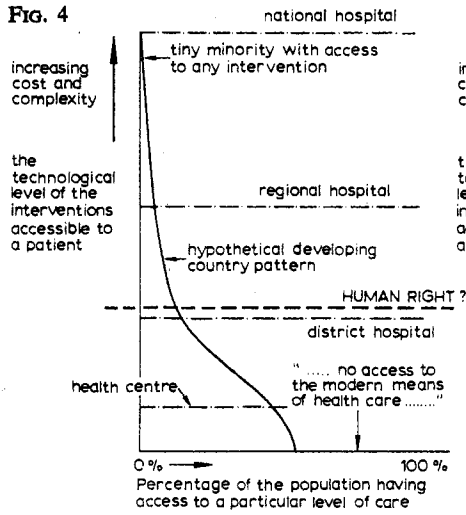

FIG. 4

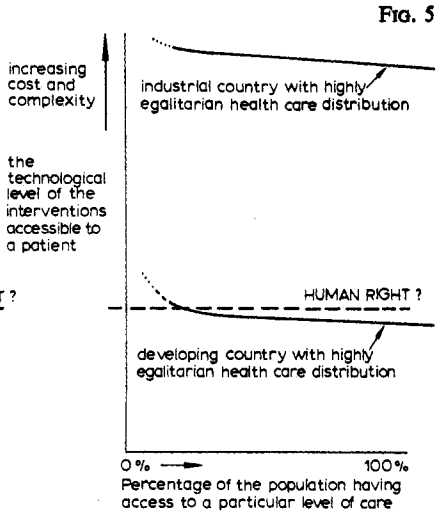

FIG. 5

FIG. 4. The access of the population in a developing country to different technological levels of health care.

FIG. 5. Two egalitarian patterns of distribution of health care.

scales in Fig. 2, and represents the cost and complexity of the interventions available to a patient. The abscissa is the percentage of the population enjoying care at a particular level. If we assume that a patient having access to a certain intervention also has access to the interventions below it in the scale, then it is possible to show the care provided by different types of health unit, and that enjoyed by societies with different health care patterns. Fig. 4 shows the technological levels of care ideally provided by health centres and by district, regional and national hospitals. It also shows the hypothetical pattern for a developing country where a small élite have access to almost any intervention, if necessary by going abroad for it, while more than half the population have no access to the modern means of health care at all.

Fig. 5 shows what the graph would look like for two hypothetical countries with highly egalitarian health care patterns, one industrial and the other developing, and also where the human right might come on such a graph.

If a graph of this kind is to be useful it has to be obtainable by observation, and for this indices or markers are required at the varying technological levels, as shown in Fig. 6—the lower levels being of particular interest for a definition of human rights. One of the advantages of defining these rights in terms of

FIG. 6

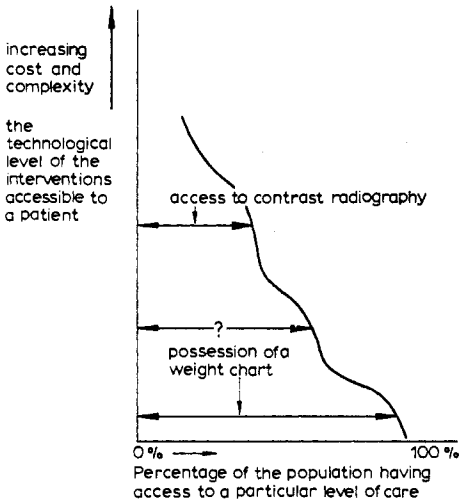

FIG. 7

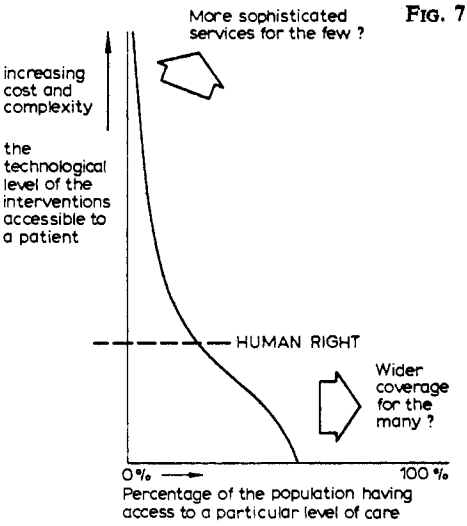

FIG. 6. The use of indices to measure the profile of access to health care.

FIG. 7. The tensions over priorities for the development of health services.

packages is that, if they contain suitable tracers or markers, it should be comparatively easy to know who is enjoying them and who is not. In child care, for example, the possession of a weight chart is an ideal marker, and all the less-privileged children in developing countries need one. If the issue of a weight chart forms part of a mother and child health package, then its possession by a child is good evidence that he has access to the rest of the package, should he need it. Data on who possesses a weight card could readily be obtained during a census.

Other markers will be required for packages defining ambulatory adult care, and for in-patient services at the level of the district hospital. It would also be useful to have markers at other points on the technological scale beyond those which it is realistic at present to consider as possible human rights. For example, access to contrast radiography promises to provide a useful marker for comparatively sophisticated services. Patients are referred for it from a wide range of specialist departments, and if the distribution of income among the people getting this investigation matched that of the population as a whole, it could be assumed that all sections of the population had equal access to a wide variety of sophisticated interventions. The necessary data would not seem unduly difficult to obtain.

Fig. 7 shows the directions in which politicians and the major political factions within medicine would like to see money spent, the tension between them being particularly acute in the developing countries. In many countries the large, conservative, hospital-based, technologically preoccupied group seek to spend the money on raising the peak level of care for the privileged. The smaller, socially committed and more community-oriented minority would like to see it spent to enable more people to attain a minimum level of care, and thus obtain their human rights.

RIGHTS IN RESPECT OF QUALITY

In personal health care 'quality' is at least as important as 'quantity'. Few things are more difficult to measure, but it is probably easiest to measure with the comparatively simple services with which we are concerned. If the way things should be done is completely specified, and a pattern of 'good medicine' defined as part of a package, the care provided is much more susceptible to observation in the interests of quality control. If, for example, a package requires that dehydrated children be rehydrated in a clinic with an oral rehydration set, then the presence or absence of such a set is a measure of the quality of this particular intervention. If the package requires an auriscope which works, its presence in a working condition is another measure of quality. Other and more important indicators of the quality of care are how many days a week a clinic is open, and whether the growth of all children is monitored on a chart. The use of an objective, weighted quality score promises to make it possible to arrive at a very useful indication of the quality of care given by a particular clinic. It must, however, be closely related to what is practicable, be decided on with the participation of the health workers, and be used more as a 'team game' than a threat of sanctions. The level of a worker's knowledge also provides another oblique indication of the quality of his services. Thus, if the objective examinations forming part of a package show a health worker to have little understanding of what he is about, then the quality of the care he provides is likely to be low. If his understanding is better, his performance is likely to be better also. Even though none of these indicators are absolute measures of the quality of care, they are all in some degree an estimate of it. In aggregate they promise to be useful, but only where 'good medicine' has been carefully specified and packaged.

FROM PACKAGES TO RIGHTS

One of the first steps is the national recognition by the medical profession of the technical quality of the packages that might constitute a human right. Every sentence in their manuals and every procedure and drug will have to be scrutinized. Will it be agreed, for example, that a combination of penicillin and streptomycin is to be advised for newborn children with septicaemia when every paediatrician thinks that ampicillin and cloxacillin are better—and more expensive? The national adoption of a package requires agreement by the leaders of the profession and the government that the package epitomizes 'good medicine' under their particular socioeconomic circumstances. But a national consensus is a different thing from an international one, and this is what will have to be achieved if a useful definition of human rights is ever to be widely accepted. Here we are up against the great cultural variations between different national patterns of medicine, and any agreed system of even elementary medicine will be difficult to reach. As a result, sponsorship and promotion by the appropriate international organizations will not be achieved lightly. Perhaps the continued experience of a number of countries with closely related packages will pave the way for the subsequent international recognition of those representing human rights in personal health care. It seems likely that we shall have to proceed from packages to rights, and not *vice versa*, because it is only as packages that rights can be manipulated. In ten years' time it will be good to hear a director of medical services say that his clinics employ the 'Human Rights Child Care Package, Mark VII' and that 97% of the children in his country have access to it.

Discussion

White: Have you considered the possibility of defining these activities not in terms of 'interventions' but in terms of the human organism?

King: In Indonesia our point of departure is what could be done under the prevailing circumstances, rather than what we should like to do. We are considering not only the common diseases but also the rarer diseases for which something can be done. We have looked at the socioeconomic conditions of Indonesia and at the present state of the art of medicine in our attempt to select what is potentially practical, rather than what is needed totally. Our approach is pragmatic rather than holistic.

White: Would this include, say, fertility control as part of personal health care?

King: Theoretically one could certainly apply the package approach to fertility control, and we may later do so. However, we have deliberately chosen to start with child care, because this is so neglected in Indonesia at present, compared with maternity care and particularly with family planning, that it offers the greatest return for the effort invested. Needless to say, our child care package is being integrated with family planning.

The size of a package is largely a matter of administrative convenience. Conceivably, we might have begun on child care, maternity care, and family planning simultaneously. This would have been too big a task, so in the hope of doing a thorough job in a reasonably short time, we have limited ourselves initially to child care. It would also be possible to work on a number of smaller packages, such as ones for 'diarrhoea', or a child's weight chart, but a multiplicity of smaller packages would be much less easy to handle.

Evang: I would like to extend the implication of Dr White's comment and ask whether you have considered starting with the whole human being in the local setting. Your approach is an extremely useful one but it is a method where one thing has to be added to another. What you must avoid is the risk of underestimating the whole human being in a so-called primitive society, where the same anxieties, the same reactions, the same disappointments, and the same type of basic human values exist as in our own society. You must not establish a local health service where someone could be in a position to refuse to help a person because this was not 'his desk'. On the other hand it is extremely useful to discover, as you say, what can be done. To my mind, the practical approach would be that personnel should be trained for particular 'interventions' but at the same time would have to act as amateurs in other fields in order not to refuse treatment. People are not willing to be regarded as a liver, a urine, or an eye, but want to be seen as a person—a member of a family or a social situation. That is your difficulty.

Potts: Dr Evang has raised the very human problem that if you set up a simple service to take simple forms of treatment to the whole population, what do you do when a person with a more complicated condition comes to the service? That is a worldwide problem in medicine and one which in the West we have gone further away from than we should. How does the doctor comfort when he can't cure? How do we tell someone that we can't cure him? This is not emphasized in Western medicine; we have been carried away with our own technology, so that when faced with a disease with a disappointing cure rate, like cancer of the breast, we sometimes use a *wrong* technology because we have to deceive ourselves as doctors that we can cure everything. The traditional healer, who is probably an expert in staying with the person whose disease is not curable, may be able to teach us something, and possibly contribute

something to the solution of problems in developing countries. He may know, when the service is inadequate, how to say 'no' without losing human dignity or respect for the person.

King: I see no conflict between not being able to do everything for a patient, and looking at him as a whole person. The decision to work on what one might call a 'technological area', such as child care in health centres, rather than on what various kinds of staff might do, has proved to be a very useful approach. The better-educated midwives can probably be taught how to undertake most of the interventions in the package in a comparatively short time. The less-educated auxiliaries will take much longer, and it may only be practicable for them to master part of the package.

Packages could be used to train either single-purpose or multi-purpose workers, and the training of the latter might incorporate a variety of different packages, of which that for child care might only be one. Potentially, a package of the kind we are devising might also suit voluntary health workers. It is to be hoped that in due course there will be a wide variety of well worked-out packages to choose from. The sheer grind of putting them together is one good reason why we have not had them before now.

White: I may not have made my initial point clear, and perhaps it isn't clear enough in my own mind. Could we think of beginning with a package of what specified people need for achieving their rights to health? We should ask how these needs can be met, rather than how well a health worker can exercise trained skills. The initial emphasis is on finding what people need, and not on what the worker has been trained to do. I am reminded of the story of three men sentenced to the guillotine, who were given their choice of position by the executioner. The first said he would like to die with his face to the ground, returning to mother earth; the blade came down and stuck on the way; and on a legal technicality he was freed. The second man said he would like to die with his face to the embracing heavens, and again the blade stuck on the way down, and on a technicality he was freed. The third was asked which position he would prefer and he said: 'I don't want to get in that machine at all until you fix it up and get it in working order!' We may become so involved in whether the machine works that we forget life and death.

King: We are indeed intimately involved with the machine, but we are only too well aware that in present circumstances there are many things it cannot do. This is inescapable, and one has to start from the premise that it is better to have something that *can* be done in an imperfect world, rather than something that might be done in a perfect one. We accept the fact that the package can only help, say, 90% of sick children, and that there will be perhaps 10% for which it can do nothing. We are aware that there will be some deaths

we can do nothing about, but I hope that we have not forgotten them!

Bradley: I think Professor White has made a valid point, namely that you haven't taken your ideas far enough back. If one starts by defining rights in terms of interventions, these are technical matters, and this therefore removes the discussion of human rights from the field of common discourse. I think this is dangerous. One has to start from a step further back and put it in terms of reducing, say, the chance of a child dying to below one in 20, or something like that. Clearly that is still too technical a formulation, but one has to start by expressing the problem in terms which can be generally discussed, not in technical terms. Later one can proceed to design an appropriate package.

King: I like to think that the problem has been formulated in terms we can discuss. Where we have fallen short, I think, is in our consideration of what one might call the biological and ethical background to human rights.

Biologically, and at the cellular level, the survival of the myriad cells which together make up *Homo sapiens* as an individual depends on their collectively providing for themselves certain 'rights' in the internal environment by way of access to food, water, mechanisms for restricting their own multiplication, and the means of fighting disease. In a similar way, on a world scale, the survival of the nearly 4000 million individuals who make up *Homo sapiens* as a species now also depends on their collectively providing for themselves parallel rights in the external environment by way of access to food, water, fertility control and health care.

Ethically, our concern with human rights is at once an attempt to give practical meaning to the brotherhood and equality of man, and a recognition that the biosphere has become so cramped that unless we all join hands for the good of all, we shall all perish. It is also the realization that we have now reached a point where the welfare of mankind as a whole is at stake, and that we must do something about it.

Our well-being as a species now depends almost entirely on the relationships between people. A human right is but a human relationship of a special kind. It relates those who have the means of granting it to those who would like to accept it. Unlike most other human relationships, it is a relationship not merely between some men, but between all men. From this it follows that the acceptance of something as a human right implies a further personal relationship among the whole human family. On a more intimate scale, among the people we know, we understand our rights and obligations well enough. On a global scale, our welfare, and now even our existence as a species, depends upon our extending our sense of obligation to the whole human group. Putting it another way, a human right is but the corollary of a species-wide obligation.

Burton: We are talking about trying to meet some standard of human rights with respect to different kinds of health care, and it has been said that rights have to be claimed and that there has to be some feeling on the part of the people who have those rights that they can exercise some demand or some insistence: rights don't arrive automatically. I wonder how you see people claiming the 'rights' that you have suggested they should expect? This recalls the problem of protecting people from the radiation hazards associated with nuclear power stations. It has been pointed out that when money is spent to make these establishments safer, one can describe the increased safety in different ways. For example, one could say that the likelihood of a malfunction that would lead to a major radiation disaster is such and such; one could also express the same gain in safety in the sort of terms Dr Bradley used, by saying that the chances of dying prematurely or losing so many weeks or years of life as a result of getting a larger dose of radiation are being thereby so much reduced. If you apply that sort of thinking to your scale of health benefits, how will the recipients or those exercising these rights understand the particular kind of benefits? And how, in the educational part of the package, is your description of those benefits likely to affect the choice that people would want to exercise in health, and hence the definition of some threshold or level of rights?

King: Distance is one important factor determining access to health care, and everything possible must be done to make sure that health care is brought as close to people's homes as possible. But, distance apart, I don't see any great difficulty in people claiming their right to personal health care—provided it is there for them to claim.

Choice does not pose difficulties either. If a disease can be treated as part of a simple health care package, there is unlikely to be much option as to how this is best done, so patients are not going to get much choice.

C. Elliott: I would like to congratulate Professor King on focusing so sharply on the key issues of who is getting what. This is surely the issue to which we should all be trying to move. But the point is that we do not yet know enough about the distribution of health care to be able to plan a better strategy as carefully as the exigencies demand. I am not saying that we cannot improve on the present situation. Of course we can. But the 'package' approach does assume, I think, that we know much more about the structural and social constraints on the use of health facilities and the reactions to preventive programmes than is, for most countries, actually the case. I am pleading for more studies of the 'consumption' end of health care, in order that Professor King's ideas can be put the more effectively into practice.

D. B. Jelliffe: It is important to stress that what Dr King is doing is the

spearhead of what is almost a world movement at present. To a technological hobo like myself, who tries to bridge gaps between one discipline and another, it is clear that the same type of thrust is occurring in the nutritional field, in the maternal and child health field, and in the public health field. One of the most difficult things is to select the main compartments or ingredients in the package, and here there are different possibilities: there is maternal health, child health, nutrition, and family planning, and two other areas—food production at the village level, and village improvement, including water supplies and so on. The International Union of Nutrition Sciences has recently produced the Zagreb Guidelines[3] which suggest the same type of thing. The American Public Health Association[1] has eight programmes which it is going to start in different parts of the world, together with universities and colleagues in different countries overseas, for what they call the 'development and evaluation of integrated delivery systems', which means contriving something like Dr King has described and seeing if it works. So this is a world trend and we should emphasize this important conceptual development. Where Dr King has particularly contributed is with his analytical skill in dissecting out the components, because this is where the difficulties really are.

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Human Rights in Health
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Bottlenecks in implementation: some aspects of the Scandinavian experience

WENCHE B. EIDE, MOGENS JUL and OLOF MELLANDER

Guaranteeing human rights in health is more than a technical problem. Basically, it depends on the political will of the leaders of a society, and the extent to which health is regarded as a development goal in itself. Even with a maximum of good will, however, good health depends very much on the efficiency with which appropriate technical resources, facilities and institutions can be built up within a country and, of course, on the extent of those resources.

For a number of years to come, the less developed countries will probably continue to need some outside assistance in this process. It is important that the assistance provided should be as effective as possible, so that dependence on it can be gradually reduced.

Effective technical assistance within the field of health must be based on good ideas about how certain problems may best be solved. Many such ideas have been proposed and discussed at this symposium. What will happen to them? Which decision-maker will pick them up—and how will he interpret them? To whom will he transfer them—and in what fashion? The question is, in fact: what impact may this symposium and other similar meetings have on the planning and performance of development programmes?

In this paper we shall analyse some major requirements for obtaining the most effective technical assistance in the health field, and the likely consequences of what we consider are serious bottlenecks in efficient planning and performance. We shall then test our hypotheses by reviewing some past experience from Scandinavian technical assistance, taking three case studies from the nutrition sector as specific examples.

Finally, we shall present some proposals for possible alternative ways of administering technical assistance, taking into account the requirements suggested.

THE PROVISION OF EFFECTIVE TECHNICAL ASSISTANCE

Effective technical assistance calls for:

(1) Relevant technical insight among planners and among those who transfer 'know-how' within the specific fields of assistance that they are supposed to handle, and

(2) The maximum diffusion and replication of that know-how in recipient countries, in order that a rapid transition to self-reliance can be achieved.

Under these two headings a series of subsidiary requirements can be listed, many of which have been touched on in this symposium. To be relevant, technical insight should, for instance, be:

(a) Up-to-date, in terms of new findings, concepts, and trends in the international debate;

(b) Appropriate for the circumstances in which it is to be applied;

(c) Adjustable to new conditions; and

(d) Adjustable in the light of experience.

The requirements for the maximum diffusion and replication of knowledge in the recipient country would be:

(a) The systematic collection and utilization of earlier experiences, in donor and recipient countries ('administrative memory');

(b) The maximum involvement of local research and professional groups in identifying problems and choosing methods and resources; and

(c) An emphasis on training at all levels in the recipient countries.

HYPOTHESES ON BOTTLENECKS IN THE ADMINISTRATION OF TECHNICAL ASSISTANCE IN THE HEALTH/NUTRITION FIELD

Relevant insight

How much 'relevant insight' is needed by planners and administrators, and by those responsible for the transfer of resources and know-how? Planning obviously requires some technical insight, and without this element planning must show weaknesses in the long run. It is encouraging to see that economists are now taking a greater interest in planning for social goals than formerly, and the tendency in recent years for more systematic methods to be included in planning in the field of health, including nutrition, is much to be welcomed.

However, governments should never accept the results of any planning that has been undertaken without the cooperation of adequate technical staff. For example, although planning in the very complex area of nutrition should

certainly not be left to specialists in single disciplines alone, there are unfortunate examples where the 'planning concept' has been cultivated to the extent that long-term specialist experience and insight in technical matters has been neglected. We would warn against general acceptance of the philosophy expressed by one aid representative at the Nutrition Congress in Mexico in 1972, which could be interpreted as implying that external experts are usually a burden to practical programmes! The remark undoubtedly stemmed from the difficulty administrators often have in obtaining precise advice quickly from scientists. However, this attitude can only narrow further the bottlenecks in cooperation between planners/administrators and expert advisers in the future—except, of course, when the planning unit itself includes the necessary expertise.

At the administrative level, efficiency very much depends on a fruitful dialogue between experts and administrators. A basic premise for such a dialogue is the existence of an adequate framework for it. Practice varies in the three Scandinavian countries as to the systematic communication between administrators and expert advisers. We consider the situation to be far from satisfactory in any of the three. Even where a set-up for the use of advisers is provided on paper it becomes meaningful only when it is fully used in practice, and this is not always the case.

Even when advisers are used, it is useful for the administrator to have some basic technical understanding of his field, although we do not believe that efficiency depends on profound insight into all aspects. On the contrary, someone who originally may have been an expert in his field will soon cease to be one when he has to occupy himself with routine administrative tasks. It would also be very expensive to maintain, within the administration, specialists in all sectors of what now goes into technical assistance.

We do believe, however, that the often complete lack of biological training, and thus of biological thinking, among administrators—probably not only in Scandinavia, but in all countries where administrators have traditionally been recruited from the humanities, law or social sciences—may represent a serious bottleneck preventing an adequate dialogue between experts and administrators in many aspects of health.

Nutrition has proved to be a particularly vulnerable area. In spite of the necessity of multidisciplinary approaches when it comes to *solving* problems, we are convinced that people with a basic understanding of and experience in human nutrition are indispensable, not the least for the appropriate identification of the problems. Hence, the 'nutrition programmer', as suggested by Berg & Levinson,[1] should never become a substitute for but rather a complement to the specialist, or 'nutrition craftsman'. However, it is essential that the

latter supplements his basic and specialized expertise with a serious awareness of his role in society, and sees himself as one part of an expertise *team*.

If the planning of technical assistance is left to the traditional bureaucrat-administrators alone, we are afraid that a long period will elapse between the production of an idea and its implementation—if it ever is implemented. How can a non-technical planner immediately evaluate a new idea, assess it against earlier experience, foresee the consequences, and so on? We regret the artificial division between 'planners' and 'technical experts' and regard planning as an important operation and a *tool*, where all who know something about what is to be planned are drawn upon in a joint venture.

If problems are identified and operational procedures selected by people who are neither chosen for the job because of special skills (contrary to most other sections of society), nor supposed to use advisers in their work, or willing to use them, we foresee the following consequences:

Inadequate identification of problems (with too much emphasis laid on 'reasons' that may seem plausible on the surface, while the true reasons are hidden and can only be discovered by more specific and refined methods).
Inadequate choice of resources and methods.
Inability to select the most relevant personnel for specific jobs.
Inability to interpret and evaluate results for use in possible modifications of the original plans.

At the level of implementation, the question of relevant insight relates to field advisers, field experts, and volunteers. It perhaps sounds trivial to say that the value of expatriates lies in their greater knowledge compared to local personnel; but this often seems to have been forgotten in technical assistance.

For a long time recipient countries seemed to acknowledge that technical assistants coming from abroad mostly brought in something good. Advice was needed, and advice was given. Then the recipient countries—and some people in the donor countries—began to question whether expatriates might perhaps also be contributing something less desirable. In their style of living, their behaviour, and their tendency to use resources on the same level as in their home countries, many of them were found to contribute to the social gap between those parts of the population that had the means to copy them and those who had only the aspirations. Still, the knowledge brought into the country by expatriates was seldom questioned, and the other aspects were therefore tolerated. Only now do we notice that some developing countries are beginning to doubt the value of much of the content of technical assistance. A thought-provoking analysis of this has recently been published by the Dag Hammarskjöld Foundation.[9]

For instance, Oyugi[7] gives a telling example of a great number of expatriate

experts (including Scandinavians) brought in for a district development planning programme under the Special Rural Development Scheme in Kenya, and questions what these people really accomplished that local staff could not have done. He describes the experts in this case as 'all unfamiliar with the country, but even more so with the local conditions'. These strictures can probably be applied to most categories of technical assistance personnel, and it is difficult to understand why so little is done by donor countries to prepare such people for their tasks. At present, Scandinavian technical assistance personnel going to Africa are offered only a two to three weeks 'sandwich' course of some African history and politics, mixed with information about personal health in the tropics, and spiced with technical tit-bits relating to development assistance.

Framework for the diffusion and replication of technical knowledge

The value and effectiveness of technical assistance to a large extent lies in the speed with which the recipient countries can become self-sufficient in skilled manpower. Therefore, a most important part of technical assistance should be the training aspect. It then becomes of crucial importance *what* is being taught in the various training courses and programmes. Training *must* be geared to local needs and conditions, and therefore is again closely related to the question of problem identification. Who should identify the problems? Who should be responsible for procuring data and for initiating research? Who should be responsible for developing curricula? And so on.

The answers are not immediately clear. We want to stress the absolute necessity of involving local professionals, research groups and so on from the very beginning of the planning process of a project or programme that has been agreed upon between two countries. This sounds obvious, but is surprisingly often not achieved. One reason is the often much higher prestige attached to an outside expert, or the skill with which the donors make the recipient believe that their experts are better. Sometimes we think they are, in fact, better. But this is no reason to avoid involving local colleagues as much as possible, and from the start. How will they otherwise ever be able to take over full responsibility? However, the framework for communication with—and even the identification of—local professionals, research groups and technicians is often weak in developing countries. There are examples where sectors of the local administration have been virtually unaware of research going on in their own country—research which could have been useful in many contexts where expatriates have been automatically called upon.

Admittedly, the standard of local research and technology may not be the same as that which can be provided by technical assistance from abroad. But then 'standard' is a relative concept in the first place. Moreover, a 'low' standard often has to do with a lack of stimulation, difficult access to contemporary literature in the field, few opportunities to attend international symposia and conferences, and a lack of resources and equipment in general. How can the standards of local research ever be improved unless such research is recognized, stimulated and mobilized in relevant ways?

On the other hand, one should not romanticize the local experts and professionals. Many of them have been trained in industrialized countries, which may have led them far astray from local problems. The design of relevant training programmes for scholars and fellows from developing countries is still an underdeveloped art in most academic institutions, and there are many examples of PhD studies undertaken abroad which may have little more than prestige value for the scholar in his work in his home country[8]—a prestige which may be misinterpreted later to imply particular expertise relevant to local problems.

Furthermore, the demands for a more appropriate technology in development programmes do not always originate among the planners in the developing countries themselves, but rather derive from people in 'developed' economies who are aware that the quest for economic growth has already taken dangerous directions.

One could therefore now wish for really close cooperation between technicians in developed and less developed countries, where those in developed countries make their colleagues in less developed countries aware of the dangers ahead. This should not be done in an atmosphere of 'we know better', but rather of 'do try to avoid our mistakes', and where both parties have something to learn. In this way 'experts need not clash'[6] but can bring together the best of the experience of both worlds.

If the framework for this contact between professionals and research people in developed and less developed countries is lacking or inadequate, the opportunities for this important dialogue are lost. Likewise, contact between experts and the administration on both sides must be systematic and institutionalized, or the dialogue will bring few results in practice. The alternatives will then be:

(1) Continued emphasis on action and methods selected by people from outside, often inappropriate for the country, with the subsequent dangers of the exhaustion of resources, and of perpetuating the 'Tarzan' element;[10] that is, the feeling that if any serious job is to be done, it must be done by 'experts' from the outside, with a resulting failure to develop dedicated self-reliance; or

(2) Complete cessation of technical assistance simply because the develop-

ing countries begin to discover these dangers and would rather be without them. In this case, even the positive impulses will not be available and there may be self-reliance at perhaps too early a stage.

In his Tanzanian analysis, Green[4] points out that what is most critical is 'not an early decline in the volume of technical assistance, but a steady rise in the absolute and relative share of posts filled, institutions run and research carried out by Tanzanians'. If one agrees with this, the question becomes one of how to make this a smooth transition, as rapidly as possible.

SOME ASPECTS OF THE SCANDINAVIAN EXPERIENCE

We should now like to review some examples of technical assistance programmes or proposals that have emanated from Scandinavia and test some of our hypotheses on these. Our descriptions and comments are highly subjective, but will at any rate serve to bring to the surface some questions that we feel must be asked in the future.

Sweden

The Ethio-Swedish Nutrition Project started in 1962 after being planned by a few Swedish scientists—paediatricians and biochemists—who had been working on problems related to nutrition for many years. A proposal put forward to the government was immediately accepted, and the first team of experts—six in all—arrived in Addis Ababa in September 1962. The project was in operation from the beginning of 1963. The first years were mainly a period of fact-finding and of collecting baseline data. A great many people were involved, and the close personal connection with Swedish university departments in these fields proved extremely valuable.

In addition to useful data, a multidisciplinary research programme arose from this collaboration, as a side-effect of the project. The programme was highly 'development-related' and thus of general value beyond the specific project, although it was to some extent based on project-related funds.

A multidisciplinary advisory group (the Nutrition Advisory Group of the Swedish International Development Authority—SIDA) played an important role during this period in the recruitment of directors and other technical expatriate staff, especially doctors, nurses and biochemists. A series of conferences and seminars were arranged, starting in 1963, in order to keep higher administrators in the ministries of health, education, agriculture, and industry in Ethiopia informed about the progress of the project. To a considerable extent

these activities were planned, organized, and executed by members of the advisory group in collaboration with the local project staff.

One important result came out of the research projects, which in addition to its general value should have been given much more recognition in Ethiopia: that the best results of giving information on nutrition—and possibly of giving supplementary foods also—would be achieved by making them part of a health package. The advisory group increasingly emphasized the importance of building up the basic health services. However, instead of suggesting and providing facilities for implementing these conclusions, by extending the pilot study on to a broader basis, SIDA underwent a sudden shift in policy around 1968, to the effect that:

(1) The influence of the advisory group on the project was reduced to insignificance;

(2) Research in Sweden related to the project had to be terminated, since funds were suddenly withdrawn by SIDA; and

(3) The integrated pattern of implementation worked out on the basis of the fact-finding phase and the pilot study was ignored.

The alternative chosen was an attempted short-cut, and preference was given to:

(1) Modern marketing and distribution of the infant food Faffa as an isolated activity; and

(2) Giving information about nutrition by means of mass communication methods with a very loose, if any, connection with existing health services.

It may be argued that in a country where only 10 to 15% of the population are within the reach of any form of health service, efforts to improve nutrition should not be confined to such a limited administrative apparatus, and we agree. On the other hand, we still know very little about the effects of a new food in terms, for example, of its possible displacement of other food items in the family diet, resulting from an overemphasis on the wholesomeness of the new food.

Should more efforts have been made to invent unorthodox, simple, and inexpensive forms of health services for more people, where direct person-to-person contact between auxiliaries and the people could have gone a long way towards ensuring a correct use of the Faffa? This is not the place to discuss these details; however, we cannot accept the rather negative concept of 'medical people' and 'specialists' that some administrators seem to have, which implies *a priori* that technical experts can never have a broader outlook on their professions and tasks. The alternatives chosen by administrators are often primarily based on 'common sense' (which is very fashionable nowadays). This may of course easily result only in other, much more narrow-minded solutions

being considered the most appropriate. One can ask whether the much-talked-of 'integration' is too difficult for a generalist administrator to grasp and put into practice, simply because he does not understand the individual components sufficiently and cannot easily coordinate them?

In the Ethio-Swedish Nutrition Project the original advisers were more or less completely left out of the planning process at the time when planning for implementation should have started. It can therefore be said that a recent evaluation of the project may have overlooked the impact the original advisers could have had on the development progress in the later years.

Denmark

A Danish example is chosen from the field of nutrition related to agriculture: the Thai-Danish Dairy Farm. This $2 million bilateral project was started in 1961 at Muag Lek, about 100 miles from Bangkok. The project does not appear to have been designed as a nutrition project, but like most agricultural projects it has nutritional implications.

The project was conceived in 1961 by a three-man team from Denmark. The objectives were of a general nature: to operate a dairy demonstration farm and a training centre. Neither the subsidiary objectives nor the activities of the farm were spelt out in the agreement between the two governments. Presumably, it was simply assumed that the introduction of dairy farming in Thailand was desirable in its own right. No pre-investment study was made, nor any attempt to analyse the demand for fresh milk. Only in 1971 was it realized that the Thai population had a preference for condensed milk and that it would be difficult to change this. No plan of operation appears to have guided the activities of the project, which simply developed from day to day. It was not originally envisaged that the farm would be involved in processing and marketing milk, but as other outlets failed the farm had to take up this activity.

The farm is on 370 hectares of land. In 1971 the size of the herd reached 1500 cattle. Of the total area, 280 hectares are sprinkler-irrigated and used for forage crops, for example grass, and legumes such as cow peas, Muag Lek beans and perennial soybeans. Some farmers in neighbouring areas have begun delivering milk to the project. In 1971, the production of pasteurized milk from the project made up more than half the fresh milk produced in the country.

An evaluation team from FAO visited the project in 1971 and pointed out that the demand for fresh milk in Thailand would soon reach saturation point unless an intensive advertising campaign were launched to stimulate consumption. In addition, it was pointed out that production would soon surpass the

processing capacity. It was not possible for the FAO team to make a cost-effectiveness analysis of the project because the system of accounts failed to specify separately expenditures for investment and operations—for example crop production, milk production, milk processing, training, and extension.

The feasibility of dairy farming is much debated by the Thai government. Doubts stem from uncertainties about market prospects and the high cost of local production by comparison with import prices for condensed milk. On the other hand there is an increasing pressure for local production because of balance of payments considerations.

A project such as this may have merits as an employment-generating activity or as a nutritional improvement, or both. It is likely that this project, now, will be of value as self-financing economic development, by having created more opportunities for employment. But since the milk is sold by the project at a price equivalent to US $0.25 per litre, retailing somewhat above US $0.70, it could hardly be classified as nutritional improvement in a country with an average income per head (GDP per person) equivalent to US $130 annually. Actually, the 370 hectares of irrigated land could have produced many more calories and much more protein, for example in the form of soybeans, which would have involved less effort measured in terms of labour and agricultural inputs, and yielded a kind of food more readily incorporated into the Thai diet. The project serves as a centre for training in dairy farming and milk processing, but it can be questioned whether these are desirable industries in a country where milk consumption is not a habit and where nutritional needs can be met with foods that are cheaper to produce.

Norway

The example from Norway is chosen from the field of training of technical assistance personnel, again in relation to nutrition. Scandinavian nutritionists had long felt the need for people going out to work as experts or volunteers in nutrition and home economics to be better prepared for their work. In 1970, Swedish nutrition experts organized a training course in 'tropical nutrition' for academically trained nutritionists. Part of the course was held in a developing country and was very successful, according to the participants and the organizers. SIDA supported the course financially, but made few efforts to take initiatives in order to provide jobs for the participants afterwards. Later, the course was deemed unnecessary, as there seemed to be no need for such people. Repeated demands for support for new courses were turned down, although it was specifically stated that only applicants with a job in view would be accepted at these new courses.

In 1972 the Norwegian Agency for International Development (NORAD) was approached by Norwegian nutritionists and asked whether the agency would propose a course in nutrition and home economics as a possible joint venture between the Scandinavian bilateral agencies. The outline of the proposed course was based on the earlier Swedish model, but also included elements of disaster relief.

It was specifically suggested that a discussion should be held between the proposers and the administrators before any decision was taken, in order to clarify the desirability of holding such courses. After five months, NORAD finally answered that such a course was not considered necessary for the purpose of recruitment, as no requests had been made for such personnel.

In a world where malnutrition is becoming a key health problem in developing countries, this attitude may give cause for concern. In itself, the validity of the reason given may be questioned, as several requests for associate experts, volunteers and advisers in nutrition and home economics had in fact been received during later years. In any case, someone should surely feel responsible for making recipient countries, or international or humanitarian organizations, aware of the need for relevant knowledge in the field of nutrition for groups giving technical assistance in health, education, agriculture and disaster relief work. Moreover, if the facilities exist for running tailor-made courses for specialist personnel—in this case nutritionists and home economists—administrators ought to make potential employers aware of this, so as to break the vicious circle of lack of awareness—lack of requests for relevant personnel—lack of relevant training facilities—lack of relevant personnel in the field—lack of awareness.

Even if one does not become an 'expert' in a few months, courses designed for and geared to development aspects of specific fields will give a reasonable basis for sound practice in these fields, so reducing the number of faults and mistakes which everyone has to go through in a completely new setting. (The idea is not unfamiliar to the bilateral agencies: SIDA has for several years supported special training programmes in tropical agriculture.)

The main points that can be criticized here are:

(1) The decision in NORAD was taken by people unfamiliar with nutritional problems in developing countries.

(2) The suggestion from the proposers that the question should be discussed with them, before any decisions were taken, was ignored.

(3) Administrators showed reluctance to take initiatives which would promote the implementation of new ideas that might not fit into the familiar concepts of what is needed for relevant technical assistance in a particular field.

This is an example of the gap between the apparently much easier task of supporting a resolution in the United Nations on problems of malnutrition (Norway has been particularly active here) and the obviously much more difficult one of understanding why people who are to work with malnutrition in developing countries ought to receive some information about what malnutrition is like in those countries.

PROCEDURES IN TECHNICAL ASSISTANCE: A COMPARISON WITH INDUSTRIAL DEVELOPMENT

It is interesting to compare a development effort in multilateral or bilateral assistance with the procedures used to develop a new product in industry. Here, new ideas and projects are evaluated jointly by groups composed of people from, say, Research & Development, Construction, Production, and Marketing divisions. This evaluation group, and a succession of similar groups (project, or new venture, groups), will, over the lifetime of a product, follow each idea from fruition until the project is given up, or sale of the successful product is eventually discontinued. The first, pre-project evaluation consists of the following:

(1) Definition of the product (objective) and the markets (needs) it fulfils.

(2) Identification of alternative means of meeting the needs (the competitor's position).

(3) Estimation of the chances for success, and regular revision of this estimate.

(4) Estimation of development, production, and marketing costs (by means of proper accounts these estimates are followed from the beginning and regularly revised).

(5) Consideration of the necessary skills, if they are available or could be available, for development, production, and marketing.

A review of the Danish case described above suggests that much could have been gained by applying the basic principles of such a procedure. The Swedish project had probably reached a stage where further development could have been achieved by means of such procedures, even if they had not been used systematically from the start.

The Norwegian case exemplifies point (5). Very little thought is being given to the existence of the necessary—meaning relevant—skill in key sectors of technical assistance, such as health and nutrition; yet lack of such skill—or unwillingness to procure it—may have much more serious consequences than in industry, in that the capital invested is the lives of human beings, and not purely a matter of finance.

Another lesson may be learned from industrial experience. As mentioned above, each transfer of an idea—such as a development project—between different functional groups is viewed as a bottleneck; unless properly handled each may jeopardize the project because of delays, misunderstandings, lack of commitment, and so on. In a bilateral aid project, problems of this nature become formidable because two national governments, political considerations, and a long chain of transfers are involved. Experience from industry suggests that in such cases groups such as those mentioned, now often organized as 'new venture groups', are the appropriate organizational structures. Such a group might be made up of:

Technical specialists in the recipient country (with organized channels to integrated specialist groups).

A government representative in the recipient country (with organized channels of communication to policy-making, finance, and foreign relations in the country).

Aid agency representatives (with organized communication links to aid policy and aid finance within the agency).

Technical specialists in the donor country (with organized channels of communication to integrated specialist groups).

A group such as this would first develop a definition of the given project and an evaluation of it; it would subsequently develop, follow, and be responsible and accountable for the project from its pre-project stage to its final evaluation after it had been in operation for some time. Cost–benefit analyses, at regular intervals, would be a standard component of the procedure.

Many would find the procedure here suggested too complicated for use in technical assistance. However, it has been adopted in industry because previous experience proved this to be necessary, and effective. It is suggested that the same may well apply in development projects which are by their very nature more complicated and difficult. Experience with foreign aid has suggested that a serious need for improved definition and management of projects exists if the public—in both recipient and donor countries—is not to become disenchanted with the whole concept of technical aid, and if this aid is to bring about permanent improvement. The above is offered as a possible approach which has already proved its value in extensive tests in industry.

It must be stressed that full integration of all aspects is needed *from the start* of any development planning process. A step-wise procedure where one specialist builds upon the work of another may have serious consequences for the end result, because decisions may be taken in an early phase which cannot be altered, even if this is found desirable by specialists in a later phase. In particular, the special skills of social scientists—especially development

sociologists and social anthropologists—have been much too little utilized in technical assistance planning, at least in Scandinavia. We seriously believe that considerable effort and funds have been wasted in the past because of this, probably with undesirable effects for the people in developing countries. The use of these specialist groups should, therefore, be encouraged.

A NEW ROLE FOR RESEARCH?

Technical-administrative groups such as those described would at any rate come into operation only after certain problems and goals had been identified. We believe that for problems to be identified appropriately, local research has to be stimulated in the recipient country, partly through the provision of opportunities for contact with research groups in industrialized countries. The latter, on the other hand, can best be of help if they are given opportunities for *continued* contact with colleagues in developing countries and with their problems. Only then will they become familiar with the actual premises for development, and increase their knowledge about local conditions, without which any advice may be irrelevant.

Today such contact is sporadic and temporary, often the result of the presence of an expatriate on a time-limited contract in a developing country, or a fellowship offered by an academic institution in an industrialized country. Such fellowships may, of course, lead to an undesirable brain drain, which is understandable, because the individual may be tempted—not primarily to enjoy the 'sweet life', as is often suggested—but to remain in intellectual contact with research colleagues. The alternative facing the fellow or scholar is often an academic vacuum, because no one follows up what happens to him after his return home, or stimulates him further.

Only in a few cases has it been possible to maintain contact over many years between research groups and institutions in developed and less developed countries that can lead to more than personal relationships. The main reasons why this is so rarely achieved seem to be:

(1) Lack of a systematic approach to development-related research in the developed countries, and hence the allocation of only limited funds to it. The general scepticism about 'research' among both the public and many administrators, who see it as something having little to contribute to 'practical life' and 'action', becomes particularly critical in connection with technical assistance, which is in itself already a sensitive political issue.

(2) The orthodox and built-in inertia of academic life in most universities, where academic rewards are often more important than the kind of

research undertaken (perhaps partly justifying some of the above-mentioned scepticism!). Even people who would like to continue the contact and work they once started during periods as technical assistants in a developing country are often forced to forget about it, to hurry home in order not to lose their jobs, and—above all—to return to 'scientific' work.

Fortunately, something seems to be on the move now in Scandinavia. In Sweden a Royal Commission will shortly present proposals for increased support for research related to development. This will be the first time in Scandinavia that someone has tried to define what is meant by such research. It is hoped that it may also contribute to a clarification in Norway, where the situation at the moment is confusing. No one knows whose responsibility it is to formulate a policy for development research. Denmark has for many years supported a special institute for development studies (the Institute for Development Research in Copenhagen), but this has a general orientation and is not specifically related to assistance, and does not involve itself in technical questions.

It is to be hoped that forthcoming discussions on this matter in Scandinavia will increase the funds available for the relevant research that should be considered as a component of development assistance.

A well-formulated policy might also solve some of the problems related to status, academic mobility, and so on. Instead of requiring a completely new kind of research worker, who overnight decides that he is no longer interested in academic rewards, we should accept people as they are—and probably will continue to be—and design research policies in such a way that the unavoidable academic characteristics may be maintained, but built into a system with partly new goals.

In practice, in the future we imagine that fewer people will be employed on long-term contracts, and thus fewer will be on long leave from the home job *(with all the difficulties this may imply), and more of the research or technical* specialist 'commuters' will make shorter but frequent visits, in *both directions*, with exchange of views, experiences and advice. Recruitment and training could be taken care of more easily in this way, by people who know more about the kind of expertise needed, and who can also look after training.

We propose that the aim should be to set up a number of more or less 'self-managing' groups, with members in both developed and developing countries, much like the new venture groups referred to above and so frequently used in industrial development. These groups should be made responsible for much of the technical work now performed by administrative bodies, which have limited opportunities for keeping abreast of development in basic professional thinking and in knowledge in key areas, and which by the very

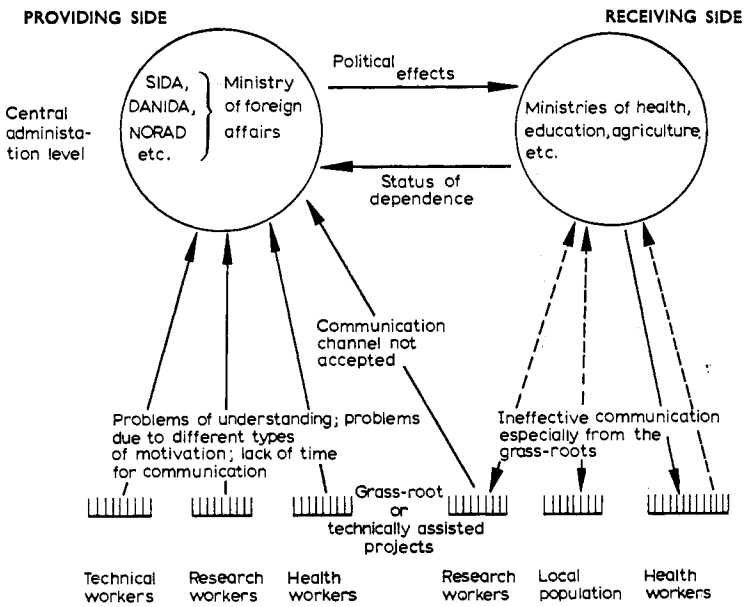

FIG. 1. Problems of communication in health services dependent on technical assistance. SIDA, Swedish International Development Authority; NORAD, Norwegian Agency for International Development; DANIDA, Danish International Development Agency.

nature of their organizations are prevented from acting with the necessary flexibility. In development work, improvization and adjustment must be allowed to take place when needed, even if they interfere with the original terms of reference.

Such self-managing groups can of course only be viable with appropriate financial support. Substantial savings in salaries could certainly be made, because the idea is to make use of people already active in the professions and research, even if a certain amount of overstaffing at their institutions would be needed. In any case, resources would have to be allocated. On the other hand, the present administrative apparatus should be relieved of many of the tasks now associated with identifying problems, with selecting methods and approaches, and to a great extent also with recruitment.

Fig. 1 outlines the system of administration of technical assistance in health as it often functions today. Quite large administrative bodies on both sides are responsible for almost every aspect of the cooperation between donor and recipient countries. Political considerations govern communications between the two administrations: at least, most donor countries manage their aid activities on this basis. The recipient countries are still in a position of de-

pendence, although one must foresee a stronger tendency for developing countries to select their donor countries in the future.

At present, in spite of what is said officially about donor countries undertaking only what is requested by recipient countries, a majority of these requests are still worked out by, or with the assistance of, expatriate advisers within the recipient country's administration, who will, of course, to a large extent influence the type of request made.

Huge problems of communication hinder the attempt to see that technical aid is used appropriately. This can be partly explained by the often different backgrounds of those who are to communicate. To take an example from nutrition: endless hours have been spent in many countries by nutrition advisers (that is, where they exist) in efforts to explain the most basic facts of their discipline to administrators. Attempts to discuss 'nutritional philosophy' in a broader sense have proved even more unsuccessful. Such an understanding can only be developed over years of experience and thinking in this sector; it cannot be learned overnight by people trained in completely different fields. Nevertheless the generalist administrator will make decisions, negotiate programmes and projects, and be present at international meetings on food and nutritional problems. Obviously, we are simply using the wrong type of organization, forcing the administrator, often even the diplomat, to make decisions and negotiate in areas in which he has no training. In theory, he relies on the expertise of the recipient country; in reality, he does not. This is unavoidable, although contrary to the present basic thinking behind development assistance.

In the developing countries factors such as those mentioned are exacerbated by the lower prestige usually held by local professionals and research workers and their institutions, by comparison with people from international or bilateral organizations. Communication between the Ministries and the 'grass-root' workers in many developing countries mostly takes place in one direction—through orders from the centre to the periphery. Many local research and professional people feel that they are seldom listened to.

A particularly intriguing aspect of the unsatisfactory communication is that direct contact between the grass-root workers actually involved in the projects in the developing countries and the donor administration is apparently not accepted. Admittedly, this channel is not likely to be frequently used, but examples are known where local professionals have visited donor countries and tried to discuss matters directly with representatives of the donor agency, who were, however, not willing to do this. A change of attitude here might create administrative difficulties; yet an important source of information is being excluded at present.

In spite of the positive efforts made in the early 1970s to open a dialogue between nutrition experts and planners through a number of international conferences and symposia[2,11] it is doubtful whether the situation will be resolved solely by developing a clearer understanding of the high priorities of health and nutrition among non-specialist planners. Things have to be done in practice, and we doubt whether the present kind of decision-making within the administrative agencies is satisfactory.

In general, aid is so organized that a donor agency acts mainly in response to a request from a developing country's government. The recipient country frequently makes requests on political rather than technical grounds. The donor agency in principle makes little evaluation of the technical merits of a project. In practice, a considerable amount of selection and judgement is exercised, but since this is not openly recognized, no machinery has been created for involving technically or scientifically competent people in the identification of problems, in planning procedures, in the selection of approaches for implementation, and in the recruitment of personnel. Development work thus becomes mainly a matter between the diplomats of two countries, with no means of involving the technical insight in either. This has the result that no true transfer of knowledge takes place and no commitment is felt on the part of those people in the recipient country who constitute the follow-up potential there.

Administrators are frequently aware of the need for considerable technical and scientific insight in their work; they attend conferences and technical meetings, and normally show a genuine interest in acquiring knowledge themselves. This, however, is not a workable substitute for involving technical or scientific specialists. But with the present system it often becomes so time-consuming and cumbersome to use such specialists to the desired degree that this is simply not done.

Technical specialists are, at best, mainly relied upon once a problem is thought to be identified and an approach, good or bad, has been agreed upon—that is, when the important decisions have already been made. Specialists are then used mainly as 'technical experts', the over-riding criterion for their selection being that they are available for short-term employment. *When they return, they mostly go to permanent positions in their home country* and their experience, often hard-earned but valuable, *is lost completely.*

It should be clear from this discussion that the organization of aid, or development assistance, needs to be re-examined. One might think of several alternatives. For instance, we would like to draw attention to an interesting proposal from the Technical University of Copenhagen[3] which suggests that this institution would like to find its place in global development within the

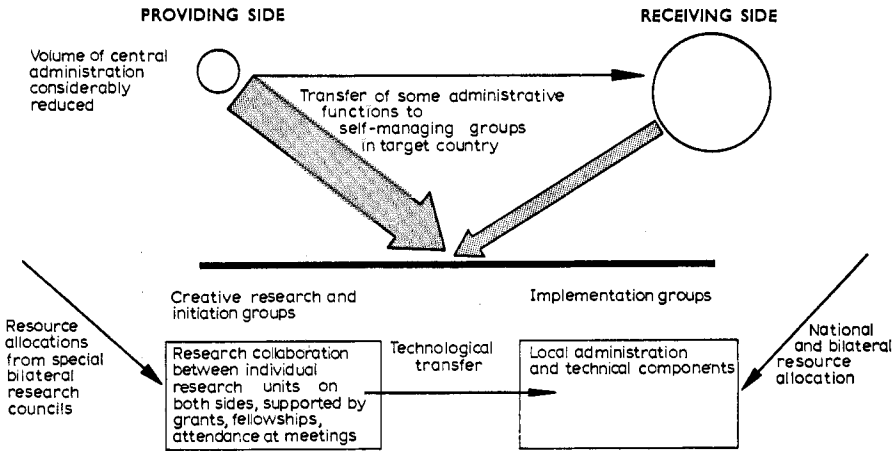

FIG. 2. Decentralization and the use of self-managing groups as an alternative to the centralized administration of technical assistance.

framework of collaboration with a so-called 'friendship university' in a developing country. It is not known how the proposal has been received by the authorities. One can also point to the very useful discussions on 'link schemes' sponsored by UNESCO.

Positive experience has been gained by an effort in Norwegian technical assistance, where a Norwegian building research institution was given the responsibility for assisting Tanzania to establish a similar institution there. This, in our opinion, is a much better method than for the requesting country simply to ask for advice, possibly to hire a few experts, and for the rest to leave to the non-technical administrators what a technical group could do better.

We believe that if more or less self-managing groups were established, much more dynamic, flexible, open-minded and effective cooperation in development would be possible. Furthermore, cooperation would become more of a reality, and not merely a term that is more acceptable politically than 'aid' or 'assistance'. Fig. 2 shows how the volume of administrative work in the donor countries might be reduced if many of the functional tasks were transferred to self-managing groups in the target country. Ways of financing these groups, as well as the desired collaboration between research groups in developed and developing countries, are indicated.

Many crucial questions about this model have not been answered, or even raised, in this paper. Our purpose has been to encourage some new thinking about a problem of increasing importance. Whatever kind of administrative

organization is chosen for cooperation in development in the future, we are convinced that a greater understanding in the developed countries of the value of continuous contact between parallel groups, institutions and universities in developed and developing countries would benefit both sides. If, for example, universities are to be able to play a role of some importance in the global perspective, such contacts are, in fact, nothing less than a basic requirement.

Discussions along the same lines as these are now going on in several other places, and efforts are being made to establish more or less autonomous groups, for example in nutrition planning, training and research. We feel the time has come to discuss these problems more systematically and on a broader basis. In the Appendix some suggestions are put forward for how this could be done.

CONCLUSIONS

The model suggested for administering technical assistance so that many of the present bottlenecks in the application of knowledge and experience can be avoided may be provocative and unorthodox, and may seem unrealistic to many people. However, the increasing criticisms from many developing countries and the impatience and frustrations among a number of professional and research groups in the developed countries indicate that a discussion of alternatives to the present situation is required. The increasing commitment among young people to global aims should also be taken care of. It must, however, be done within an organized, though flexible, framework.

The question therefore is: are the present administrative systems and communication channels locked forever, or will a constructive debate be capable of bringing about improvements?

Appendix

In order to investigate the point of view of people actively engaged in administering technical assistance in the health field, one of us (W.B.E.) undertook a series of interviews with selected staff members of SIDA, NORAD and DANIDA (the Danish International Development Agency). The focus of these interviews—or, rather, informal discussions—was the following:

> To what extent should staff members of aid agencies themselves be responsible for all aspects of the planning and administration of 'technical' development programmes within the health field, and what should be the basis of recruitment for such tasks?

To what extent should the utilization of specialist, non-administrative advisers be preferred to full responsibility by the administrator for technical matters for which he has not been previously trained?

How, in the latter case, should the channels of communication between outside specialists and administrators be designed to ensure the best results?

The interviews turned out to be of great value for the present paper, although it was not considered feasible to systematize the answers in an objective report. Not only was the sample of people interviewed small and heterogeneous, but the conditions and types of administrative organizations, and the systems by which specialist advisers were utilized, appeared to differ so much among the three agencies that any superficial comparison between what would seem to be, for example, 'the SIDA viewpoint' and that of the others would be unjustified. Also, not all the people contacted were able to allocate the time necessary for an exhaustive interview, so there were differences both in the administrative levels reached in the three countries and in the items covered in the individual interviews.

We feel that a more detailed analysis of the present situation is needed, as well as a thorough discussion of what would be the ideal organization of development cooperation. Earlier analyses of the problem[5] have focused on the most effective collaboration between existing bodies and to a lesser extent on the way in which these bodies and agencies ideally ought to work. In our opinion it is not only the framework that is of importance, but equally the people who are to function within the framework, and their background, concepts and aims.

It is suggested that a systematic appraisal be undertaken of the present handling of technical assistance cooperation in health in various donor and recipient countries. Among the points to be studied are the following:

(1) The recruitment policy followed for administrators of specific technical areas within the field of health in its broadest sense. This point might include a mapping of the background of present administrators in key positions at various levels.

(2) The use of expert advisers—internally or externally—and the communication procedures followed. Of particular interest is the degree of responsibility given to advisers and consultants outside the administration in decision-making, both at the planning level and in respect to implementation and to recruitment policies. Further, the use of outside advisers and consultants in negotiations between donor and recipient countries, and in delegations to specialized international meetings, should be examined.

(3) The system adopted in order to ensure continuity, and in particular the way in which previously gained experience is systematically collected and kept ('administrative memory') and—above all—used.
(4) The degree to which interested specialists or specialized groups in developed countries are allowed to remain in contact with development problems over a substantial period, long enough for them to acquire the skill, experience and insight which are a necessary basis for their function as advisers to planners and administrators of technical assistance projects. This would include a study of the means for such people to make a career in areas related to development assistance.
(5) The degree to which local specialists within the developing countries themselves are stimulated, assisted, and made use of by their own administrations (as well as by the donor administrations by some appropriate arrangement).
(6) The degree to which specialist groups (possibly of the self-managing type) may be established within specific sectors but may also be designed in a way that ensures cross-disciplinary approaches to the planning and performance of development programmes and projects, rather than narrow, sectional approaches with no consideration of harmful side-effects. In particular, it is important to review the extent to which social scientists are being made use of in the planning, design, performance and evaluation of technical programmes and projects.
(7) The type of information and communication channels established between specialists within research and professional fields, on the one hand, and the planners, negotiators and administrators of technical assistance, on the other; and an evaluation of the way in which these channels function in practice.

Discussion

Bradley: One theme running through Dr Eide's paper is the element of *time*. Over the past years there has been a change in pattern. Formerly people went to developing countries and, because of the colonial systems, stayed there for many years. They were often insulated from local conditions but nevertheless were in the environment for a long time. We now have a system where there are incentives to go from the UK to a developing country for a short time—of the order of months, or up to two years. It has, however, become peculiarly difficult to stay for a long time, because of difficulties in organizing the ad-

ministrative back-up. If someone works in, say, Central Africa until he is 50 and then returns to the UK there has to be some way of providing for him for the rest of his working life. Although spending time in a developing country does not *necessarily* mean one learns anything from it or can help more, without sufficient time it is practically impossible to learn about a country. The short-term consultant is a peculiarly dangerous animal!

Wenche B. Eide: We are aware of this element of time, but we still feel that, as you said, a substantial number of years in a developing country is not necessarily and by itself any guarantee that one has learnt something. It all depends upon the way in which one has worked and lived. And in any case, whatever the custom has been so far, it is not necessarily the correct road to follow in the future. The developing countries themselves increasingly wish to be more independent of 'aid', but at the same time they may still want to keep up a certain amount of professional contact. However, this contact should serve to broaden the spectrum of possibilities among which they themselves may choose, rather than forcing upon the developing countries our particular ways of doing things. We therefore believe that keeping up an organized contact, with some means for exchange between the countries in *both directions*—in the sense that research and professional people would come from the recipient countries to our part of the world just as much as we go there—could contribute very much to the identification of relevant problems and of ways of solving them. And as much as we feel the necessity of raising the prestige of, for example, local research—research all the time being taken in its widest sense—certain types of influence probably ought to reach the research groups in the developing countries. No doubt the standard of research has much to do with lack of access to contemporary literature, lack of invitations and these kinds of things, as we have pointed out in our paper, and this ought to be much better organized.

Moreover, if people from the developed world have the possibility of more frequent visits, but not necessarily of very long duration (which often means great difficulties in their home situation), this may lead to the building up of certain types of people who could really contribute something, through active collaboration with local colleagues.

Last, but not least, we should not forget the positive and desirable influence this might have upon the level of information about 'development' and 'global problems' in our own, industrialized countries (of relevance to our own situation as well). One colleague in Norway recently went so far as to suggest, in a newspaper article, that it might be a good idea to invite people from, say, Tanzania to fill positions in certain areas of our own government administration. For the time being, such a proposal will be met with an ironic

smile, but there is no reason why it should not be considered seriously, although the opposite is taken for granted.

Querido: You have embarked on an extremely difficult problem and it would be worth going into it as thoroughly as possible. I think we should confine ourselves here to technical systems in health. You referred to the analogy with research and development in industry, but there are fundamental differences. R & D in industry requires in general capital investment, with a small amount of skilled labour and a large amount of unskilled labour, to put it simply. In any health care system, 60–80% of the expenditure is for personnel, with a low capital investment. The system is based on skills of delivery, personal contact and fitting into the social structure. This does not mean that one should not apply the same general principles of R & D as industry does, such as defining the needs and objectives, the means of implementation, and the required skills; evaluating the system; and so on. But the health care system differs essentially from an industrial system. It is relatively easy to transfer a standardized industrial process to a developing country. One can define exactly how much raw material has to be handled and how many skilled people are needed. The system will work if it fits in with the local technical structure (the power supply, roads, etc.). The development of a health care system meets different problems. The academic people working in the health system of a developing country may be just as good as their equivalents in a developed country; they read the same international literature, and if they work abroad they will fit into that system. What these doctors frequently do not realize is that anything they can do in a developed country depends on the presence of supporting services that are not yet developed in their own country.

Therefore the discussion between the research groups of the receiving country and the donor country requires on both sides a thorough understanding of the differences between the two countries, first on the technical levels with regard to the presence of supporting services, such as administration, budgeting, technical maintenance, and supply mechanisms. But equally important for the donor country is the knowledge of local values, attitudes, and the prevailing social system. This knowledge can only really be acquired through personal experience in the project. Because 'people' are involved in health care, a project can only be successful if it is indeed the project of the local group.

The essential point is that, in the sector of health care, we should realize that we are dealing with people who define their aims and needs but do not realize that these often can only be realized with an infrastructure far more complicated than is available. I do, however, agree that short-cuts from the donor group to the recipient group are necessary for the adequate improvement of results.

D. B. Jelliffe: The difference between R & D in industry and research in health needs emphasizing, because industrial research is essentially geared towards implementation. Dr Eide discussed research in relation to implementation in the health field, including in developing countries, and how to make the link between fundamental research work and its application. It is more than a question of communication, because people in medical research are often doing work that has no obvious practical application, but the communication of research results between health experts is an additional difficulty. I discovered this in the course of six years spent trying to carry the results of applied research to the implementation stage, in the Caribbean. I came to the conclusion that the decisions ultimately made on implementation are political decisions, made largely by people who are not trained in the biological sciences, who are very hard-pressed, and who are continually changing. But one of the biggest blocks to implementation is the lack of appreciation by the research workers that—without becoming politicians—they have to develop some homespun wisdom as advocates and presenters of their results. The idea that communication by means of a research report is sufficient to get something done is wrong. Advocacy is needed as well. There are many factors on our side now in relation to this, because for the first time I see an increasing overlap of interests between people from the administrative and economic side and technical people, in relation to the Second Development Decade, towards the need for simple, practical, rural health systems, adapted to the local culture. The time is ripe to try to implement this type of technology, now that at least in some parts of the world the political, administrative and economic thinking is going in the same direction. The question becomes one of how we can come together and work out how to do this.

Mellander: May I exemplify what Dr Jelliffe is saying. We recently made an attempt to analyse the actual situation in Sweden with regard to the support of biomedical research related to development. We have two sources of funds for such research: the Swedish International Development Authority, and the Medical Research Council and other research councils. These bodies are responsible for distributing the funds. Now, how are the funds really distributed? If the allocations for 1972 are analysed, the different types of research projects can be divided into two groups—one which I would like to refer to as being above the surface of reality, and one group below the surface of reality! (See Fig. 1.) Above the surface of reality I include the design of efficient but inexpensive delivery systems of health care; I also include the development of domestic foods for children and design of vaccination programmes, as well as methods for the local production of protein concentrates for infant feeding and methods of testing such foods. All these I consider to be of very high

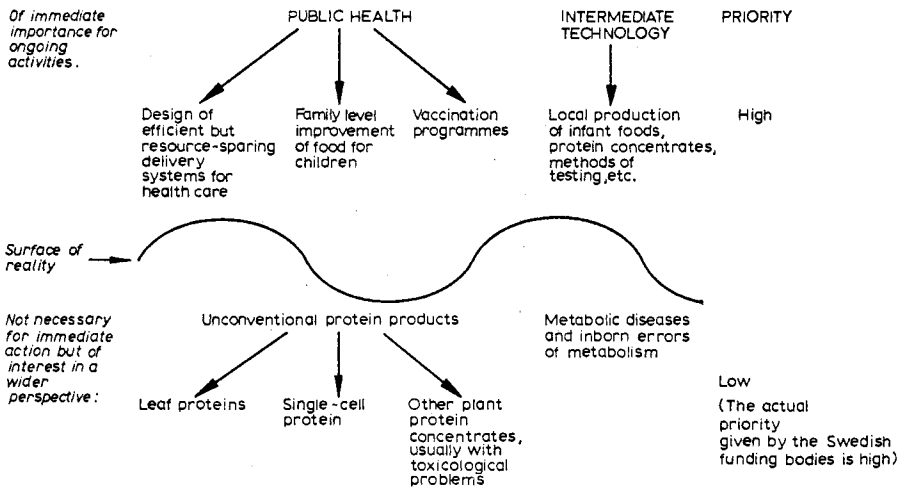

FIG. 1. (Mellander). Examples of biomedical research projects and their priorities.

priority. As examples of the type of research I consider to be below the surface of reality, I include studies of leaf protein, also single-cell proteins, and other unconventional plant proteins, usually with toxicological problems. I do not say that these are unimportant questions: but I do claim that they are not needed for the immediate action we can take on the basis of present knowledge. What priority is given to these two categories of projects? One finds almost no allocation to anything above the 'surface of reality' but large sums are allocated to research projects below that surface. This is surely the result of a communication problem, partly induced by the lack of technical knowledge and technical competence in the administrative bodies responsible for allocating funds. The problem really is that we still have mandarins in our administration! I think it is vital that the recruitment principles and competence levels in such administrative bodies should be reconsidered.

Tewari: What is the composition of the Medical Research Council in Sweden?

Mellander: It includes representatives of the medical faculties and of the government, so it is a technical body which should understand the issues, but often the highly theoretical medical people tend to predominate (the molecular biologists, for example).

Bradley: I agree very much with the results you are describing but I don't agree that this situation is due only to the mandarins; it is also the fault of the professionals. The same thing happens in the UK and it is because, for those of us working in medicine and science in developed countries, the way to ad-

vance ourselves in our own community is to study the problems below the line. Also our education is such that these problems are more intellectually satisfying. This is a fact of life, and there is no way round it except by altering our value systems.

Burton: As a footnote to this, given such an orientation among professionals in the developed countries, this tends then to be imitated by professionals in the developing countries.

C. Elliott: I want to support warmly what Professor Mellander and Dr Eide have said about the importance of communication between research workers in the developing countries and aid administrators in the developed countries. One of the encouraging things that has happened in this field is the courage of the Canadian International Development Agency in calling together the recipients of its aid, and letting them talk among themselves, and to it, in an entirely unstructured, free way. We don't know yet the effect on the aid programme, but it was a courageous attempt to establish that link, and one wishes that other aid agencies would have the same courage.

Wenche B. Eide: It is extremely encouraging to hear that such things are happening. If a study of some of the points suggested in the Appendix of our paper (p. 265) could be undertaken, probably more positive examples could be brought out, and not only negative criticisms. These would then serve as an inspiration to other agencies.

I am persuaded that the time has come when aid or technical assistance in its 'traditional' form must be re-evaluated. Whether the richer countries like it or not, people in the developing countries are beginning to want to do things their way. Unfortunately this is not always so clearly spelt out by the authorities and the final decision-makers in these countries, sometimes because of the fact that the necessary political will simply is not present. That is why it is all the more important to design systems whereby research and professional people—the grass-root workers—are also guaranteed a say in the development plans of their country. And even when the political will is there, they will be needed for the most relevant formulation of needs on the 'technical' level. One way of doing this might be to encourage and support self-managing groups such as we have proposed.

I would add a final reason for worry with regard to the administration of technical assistance as it functions today: the larger the administrative bodies become, the more they acquire their own life, so to speak, and it therefore becomes a matter of increasing importance to keep them alive and functioning for their own sake. This easily creates a defensive attitude towards other opinions than those reached within the administration itself. Instead of openly taking part in a sound public debate, the administration often regards opinions

put forward by outside commentators as personal criticism, and arguments against certain policies or practices are rejected on the basis of 'lack of information' or similar grounds.

It is hard to understand why it is so difficult to admit that development activities simply *are* very difficult to deal with. One reason may be the fear of a decline in public support for aid, which is already rather low in Scandinavia. But many people believe the public would in fact become *more* interested, if they were presented with the true nature of the problems. The information to the public, however, at least in Norway, about our participation in development cooperation, seldom goes to the bottom of the problems. Mostly, the aim seems to be to draw as nice a picture as possible. The result is that many people—especially among the young—increasingly mistrust the present administration and activities, and turn against the idea of development assistance in general. Paradoxically, and sadly enough, this cannot but assist the extreme reactionaries in their arguments against governmental aid—although on completely different grounds!

Should public interest perhaps be allowed to decline to a minimum, if necessary, while some new thinking is done about revitalizing the whole area of development assistance with new concepts and aims, with regard to the administrative systems as well?

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General discussion

INTEGRATION OF WESTERN ATTITUDES AND THE RESPONSES OF RECIPIENT COUNTRIES

Querido: I would like to make four brief points. The first is that anything we try to do requires more time than expected; and this time element should be thought of in decades. The second point is that in the past, in other countries, nothing has happened immediately and according to plan; I think, therefore, that the things needing to be done in developing countries should be divided into two stages: one which I call 'seeding'—small experimental projects; and a second stage—the long-term development of ideas. With this second stage I come to my third point: as plans for the long-term develop, they have to be adjusted, as any long-term plans do at the intermediate stage. For this, one needs the willingness of the receptor country for continuous discussion and evaluation, so that work can go on for many years.

My fourth comment concerns the problem of how to translate, for example, Dr King's analytical ('Western') approach into a proposition which fits local values and the existing social system. How is this to be done? Obviously I do not know, but one thing is certain, that the existing aid agencies and governments will not be decisive in this because most of them operate too far away from the level of implementation. Dr Wenche Eide's point comes in here, that at the working level (the research, or grass-roots level in her Fig. 1, p. 260) in both donor and recipient countries one would like neutral meetings to develop a philosophy, which might manifest itself in 'seedings', or might get through to governments for long-term thinking and for readjustment of the middle-term plans. The problem with developing Dr King's ideas, for example, is that people in the 'research' sector in the recipient country are working on the basis of what they know from the literature, and on this level they will not usually be able to bring in the amount of experience that Dr King has behind

him. This is quite apart from the fact that the administrative people in the recipient country are of the same type as the people in the field and might consider it a devaluation of their aims (based on Western systems) to embark on an unorthodox system like Dr King's. So the problem is how to get the 'Western' approach over to decision-makers in the recipient country, and how to get it interacting with the existing systems there, and I suggest that Dr Eide's ideas about direct interchange at the research level could be fruitful here.

C. Elliott: You seem to be assuming that time is a commodity in infinite supply, but the immensely important implication of Dr Pawley's paper is that this simply is not true and that very little time is left. Dr Pawley himself said that some of the fixities are probably not as fixed as we have to take them. But nonetheless, as I understood him, by the end of the century there ought to be established a norm throughout the world of, for instance, a two-child family. If that is right, we can no longer assume that we have 10, 15 or 20 years before *major* structural changes (not only in family planning but also in food supply, water, and primary medical care, which are all interrelated) begin to be made. So I would challenge the assumption that one can afford to think that time is infinite.

Pawley: You are correct about the time factor, for the following reasons. I don't think we can assume that there will be more land resources than we know about now. There may be unexpected large-scale developments, like universal irrigation through desalination of seawater, but we cannot assume that such things will become realities, and in fact there might be serious objections, such as the energy costs. We calculated the maximum potential land for crop production in the Indicative World Plan and arrived at the figure that about 26% of the land surface could be arable in developing countries (excluding China); whereas it was 12% in 1962, and is now 13 or 14%. We also cannot assume that yields can be increased beyond the maximum achieved for the best countries at the moment, although an increase may be possible. On these two assumptions, I calculated that land and biological possibilities in crop-growing would both be exhausted by about the same date, 2040; but we shall run out of time in *Asia* long before that.

However, even when the two-child family is achieved, with the present age-structure in developing countries it will be 50 or 60 years before the stable population is reached. During that time the population can treble, *after* the two-child family is reached. I see no way—short of disaster, which brings in Malthusian controls—that the world can stop short of having something like 12 000–15 000 million people. This much is inevitable, in my judgement. But it will be more than that unless we get somewhere near to the two-child family by about the year 2000.

C. Elliott: If we accept that major changes must be made by 2000, how does this affect Professor Querido's argument?

Querido: I assume you agree that one cannot just impose on developing countries what one wants them to do. That is why there are two stages: you have to begin with smaller projects which generate experience, and from there develop long-term plans. Any ten-year plan has a five-year middle-term and a one-year short-term budget. Maybe one will move ahead more rapidly in one area: say, in Asia one country will go ahead faster than another; then the other countries will suddenly realize that they also can go ahead. The problem to me seems to be how to have a continuous discussion on an equal level between donor and recipient countries. It is not so much the problem of how much time we have, but how to get the discussion going, in such a way that conclusions are *accepted and implemented*, and do not end up in reports that are put away.

Wiener: Taking up Dr Pawley's point, I think it would be dangerous to equate the availability of natural resources with the desirability of developing them. Availability of natural resources is a necessary but not a sufficient condition for developing them. The desirability of developing natural resources depends on their possible contribution to the achievement of the basic objectives that we have been discussing in this symposium—sufficient and adequate food, safe water, clean air, population control, basic health services. In the Third World it is not a question of fixing objectives, but rather of how to use our limited means to reach our direct objectives, and (a factor that we have largely neglected) a structural transformation at all levels of government and the nation. We have discussed only how to achieve direct objectives through what I would call the 'project loop': the planner, having defined his direct objectives, concentrates completely on achieving them. But this is only half the job. The other half is what I would call the 'upward loop'. Underdevelopment is equivalent to an inadequate decision process and an inadequate bureaucracy. The political and bureaucratic processes have therefore to be upgraded by indirect action (contained in the upward loop) in order for their operational quality to be improved. An upgraded decision process will make better decisions in the next project, or even in the one in hand. To achieve such a change we need a more comprehensive planning approach. We ought to cease thinking of one kind of goal only; we must include structural upgrading of the political and bureaucratic processes among our planning objectives. The only other alternative is revolution, and this is not a very effective way of upgrading structure.

White: Is the question about time relevant, in the sense that regardless of the reliability of the estimates described, the heavy responsibility on us is to move ahead as rapidly as we can? We need not spend effort on deciding whether

basic change is going to come earlier in Asia or later. We ought to be thinking about how we can move ahead as rapidly as the forces can be released and mobilized.

C. Elliott: I take the point, but I don't think it is adequate. The speed at which resources can be mobilized is determined by the set of conditions that Dr Wiener is talking about. The urgency of *knowing* that if we continue at the leisurely pace at which we have been moving over the last 15 years, Malthusian checks of one sort or another—whether they are crudely Malthusian or less so—will operate, can shift the order of possibility. So the aim of going ahead 'as rapidly as we can' needs interpreting in the light of the sort of parameters that Dr Pawley has tried to sketch out.

White: One striking thing about our discussions in 1972 with the Chinese working at the communal and provincial level was that they never spoke about pressure of population on resources, or shortage of resources, or any target with respect to population growth. Perhaps others have encountered this; we never did. What was said by them to be a more persuasive motivation was the change they were going to effect in the welfare of the ordinary person within the immediately foreseeable future. I wonder whether we are not representing, both in our view of the future with our long-term planning and projections, and perhaps also, as Dr Querido suggested, in our sense of 'packages', a very distinct Western orientation, which may have little relevance for a large part of the world's population.

Pawley: Very likely you are right; and it is also correct that the Chinese don't pose the problem this way. Nevertheless, when I asked the Chinese Cultural Attaché here how many children a young Chinese couple now thinks of having—what do they regard as normal?—he said *two*; which is a little below the net reproduction rate of unity. I don't know the birth rate or the fertility rate in China, but if this is the point of view that young married people now have, then the Chinese may have no need to worry about limiting population and the resources, because it would mean that they would probably slow down to a halt in population growth by about the year 2000. So the problem is under control.

Wolstenholme: In 1965 the Chinese told us that they felt the whole of their revolution—the whole of their experiment—would fail if they did not get population down to a maintenance level, if not lower, by the year 2000.

Katherine Elliott: Two official observers from the International Planned Parenthood Federation who visited China in April 1972 described[2] what they called 'the best family planning programme in the world', with enormous advances since an IPPF visit in 1965. All methods of contraception were freely available with much stress on education but no question of compulsion. In some urban

areas the birth rate was known to have been reduced from 46 per thousand in 1963 to 13.6 per thousand in 1971. In these areas 90% of couples use some form of birth control. If these figures are even partially reflected in rural areas (and with 1.3 million barefoot doctors providing health education among the peasants there seems no reason to think that the means of fertility control are not reaching all areas), the Chinese probably do have grounds for optimism.

A. Eide: I am sceptical about this way of thinking in terms of approaching catastrophes in 2000, not because this is not important but because there is *already* a disastrous situation in various parts of the world. Preoccupation with predictions may make us overlook the fact that there are at present processes which are called economic development but at the same time have tremendous negative consequences for large numbers of people. The Green Revolution is one example, with its increased grain yields and at the same time an increase in the number of slum dwellers leading a very miserable life. The industrialization of Southern Africa is another, where there is growth of industrialization at the same time as a decrease in the standard of living in the Bantustans. We may, by using a macro-approach to the problem, not be willing to look at the underlying social conflicts, which have very much to do with the question of human rights. There is also a tendency to look at problems from a paternalistic point of view. There have been examples of a major power intervening in a localized war and both providing more sophisticated ways of killing people and at the same time introducing relief activities. In certain industrialization processes, emanating from the industrialized world, victims are created, and then relief activities are initiated to take care of some of the victims, in marginal ways.

I can see at least three different approaches to the implementation of human rights: the paternalistic approach, the market- or consumer-based approach, and the approach of self-reliance. These approaches can be located on a dimension extending from a centralized, one-dimensional pattern of development to a decentralized, pluralistic model. The paternalistic approach assumes that 'we' have to take care of 'them'. For this purpose 'we' have to accumulate resources which 'we' can distribute to 'them' after having reserved our share. 'We' know better than 'they' what they need, according to this approach. It provides us with both a justification for accumulating resources, and a pleasant feeling of being humanitarian when we distribute part of these.

The market (consumer) approach professes not to assume that 'we' know better than 'they', but puts an array of goods at their disposal (provided they can afford them). Through a variety of more or less subtle means, 'we' do, however, influence 'their' opinions about what they need. The self-reliance approach, finally, is one in which 'they' find out themselves— and are encourag-

ed to find out themselves—what they need and how they can utilize their own resources to satisfy their needs. The paternalistic approach tends to see 'them' as ignorant objects that have to be taken care of; the market (consumer) approach tends to encourage an individualistic, competitive, self-centred spirit where every person is for himself or herself in pursuit of the satisfaction of demands. The self-reliance approach encourages joint, collective action to utilize the resources of the community in the best way for that community. It is possible to identify in various cultures greater or lesser acceptance of, say, self-reliance; and the degree of self-reliance also depends upon the way in which some societies are being penetrated by others. I am thinking here in terms of processes of industrialization and of investment which have much to do with the way in which the development of the society unfolds.

There are ways of promoting self-reliance and ways of breaking it down. My bias is towards promoting it. This means promoting the efforts of local people to identify their own needs and to do something about those needs themselves. It seems to me that the way China has gone about solving its two-child problem is that in the total process of a social restructuring, security has been developed for the old people, who are no longer dependent upon having children surviving to take care of them in old age, because the collectivity takes care of them. (For example, in China people retire on a 70% pension, men at 60 and women at 55 years.) In other words, the solution of this particular problem depends on an integrated process within which many other problems have to be solved as well. That is where we should not simply say that some cultures are able to do this and other cultures are not. We should also try to think of how we influence these various cultures to be more or less able to do it.

Potts: I do not disagree with your judgement. My more radical suggestions for the distribution of family planning are the ones that are not going to be accepted. The tragedy is that that is the one approach which could achieve results within a short-term timetable. We may be in a situation where only mild to moderate degrees of revolution can solve the problem. If we assume that we have to accept the *status quo* and simply manipulate it, we may find that certain problems are insoluble.

One of the major problems about integrating indigenous thinking lies not in the Western approach, but in the local political situation. The biggest resistance to using indigenous health workers in a family planning programme usually comes from medically trained people within the country concerned. The real gap often comes between the villager and the élites in the country. These élites are basically Western in their approach and they are making the same mistakes as the Western experts. The point of optimism is that the only viable

way of extending health programmes, and to some extent family planning programmes, is to build on the indigenous resources of the community and particularly to use the traditional personnel and skills; the traditional midwives, for example, make excellent distributors of contraceptives. So we have to use that group of people, and in using them we may learn how to integrate them. But we should not enter this problem as a group of experts saying 'We know how to use traditional midwives in a family planning programme'. All we can do is to put as many options as possible before the village community in the rural areas, or in the shanty towns, and see which options they pick up. This relates to the problem of how to measure results. My philosophy would be to present as many options as can be thought of, *not* to exclude those which one thinks are improbable, because it is the improbable ones that may be most significant, and may help solve the problems.

Katherine Elliott: Something like this was the basis of plans for some rural areas in South America, I believe—to let the village choose a bright young woman to receive a brief course in health education, including family planning, and to get her to feel responsible for the success of contraceptive measures within a community she knows well.

Victoria Garcia: Sometimes we are so anxious to change habits, practices or behaviour that we become impatient and fail to spend enough time trying to find out why people act in a particular way, what their feelings are, and why they have particular practices or habits. Nor do we try to discover what the real structure of the community is, and who are the leaders, the decision-makers, the key people. We press for the changes instead of convincing people by discussing with them the benefits of some of the changes suggested.

Wenche B. Eide: I could not agree with you more, but this all depends on who sits down and designs the programme in the first place and whether people are included at this stage who can help us to learn about the community. The social sciences can contribute so much here, and I have been surprised that they have been barely mentioned in this symposium. Yet knowledge of its will, hopes and aims is crucial to what can be achieved in the local community. The medical profession or any other technical profession cannot solve this problem; it does not have the techniques. And as much as we want other people to respect our kind of techniques, I think we should insist that the social scientists are the ones who can and should assist in this. For instance, any team that is to design a 'health package' ought to include a social anthropologist.

Tewari: One certainly wonders whether there is usually the right mix of the technical component with the sociological approach, and whether the aid-givers, with the advantages they have of technical development, and their

capacity for achieving results, have overlooked the need to prepare the ground for the utilization of technological advances. I was very pleased to hear what Dr Eide had to say on this in her paper. Professor Mellander discussed the composition of the research councils that allocate research funds (p. 269), and it became clear that they did not represent the needs where the research is to be applied. This means that once the basic components of a programme have been laid down, it is capable of only marginal adaptation when it is put into operation. One needs to keep all options open longer so that there can be continuous feedback that can be effectively used.

It is good to see what is happening now in aid as against 10 or 15 years ago: the difficulties experienced have had a sobering influence and there is less of the 'good Samaritan' approach. There are several aspects here. The aid-givers have certain objectives and targets which may form part of a global strategy, and those administering that aid are answerable to their superiors and have to fulfil these targets; and they are in a hurry to report success. But they find that the receivers, firstly, are not in a receptive frame of mind and, secondly, lack the capacity or the organization to assimilate to that extent, and this results in a lot of communication problems. Communication does not take place in the depth and over the wide spectrum necessary and it is probably second- or third-hand communication. But the problem essentially comes down to the differences in values which we assume and take in our stride as acceptable.

Bradley: During the symposium we have referred a great deal to élites. It seems that in one sense they are the élites because of their power, but another aspect of élites is their knowledge; in other words, we now have professional élites. Under the systems that we have been discussing, excluding China, the professional causes the community to do something, and his power to get things done rests in his being an expert; it rests in his private knowledge. He knows about techniques whereas other people do not. The moment he shares them with the community, in a sense he ceases to be an expert and so loses his privileged position. Within that system, therefore, he tends to keep his expertise to himself, which also means that the community tends to lack the information. In China the great advantage that has been contrived is a system whereby the professional derives no power from his private knowledge. It is only when it becomes public knowledge—when he has to convince the commune that it is a good thing to do whatever he thinks is a good idea, or they ask him about something, so that he has to discuss with them—that he receives status in the community. This has the effect of removing the professional from an élitist position, and of informing the community, and thereby I suspect it helps to generate the infrastructure. How one passes from one sort of system to the other, short of revolution, I do not know; nor do I know whether it is possible

to achieve this partially. It does seem that the problems of professionalism and of élites are closely tied up, and more so than they used to be.

Evang: We are discussing how to integrate Western approaches and indigenous thinking and, even more, traditions. One condition besides the technical knowledge of a person is his human qualities. This is difficult to judge beforehand, and you cannot develop it by formal education. You need people who are willing, in a tolerant and human way, to treat others at the same level, and that ability is given to some people; others do not have it. The experts who are successful in their own countries are unfortunate in that they have always had success at home and cannot take a defeat when they go out to developing countries. The other point is, what *is* the Western approach? We in our Western civilization are in a situation where we now know that the so-called Western approaches have included strong destructive elements in regard to the quality of life in our consumer society. We are in the process of discussing the further values that we have to add to the industrialized mass production of material goods. For example, in a document presented by the UN secretariat to the conference of Ministers of Social Welfare and Health at The Hague in 1972 it was clearly stated that we have reached the point for revision. So the other condition for integration would be an awareness that we do not know whether our approach is the right one, or whether the industrial market-research period has come to an end, and is now producing destructive results—pollution, urbanization and so on—with highly undesirable changes in the general picture of disease.

Bradley: I do not agree that education cannot affect the sort of people produced and their relations to others. I believe it can. I think a lot of our problems are tied up with patterns of education and can only be solved by changes in them.

D. B. Jelliffe: One can and must select very carefully the type of person to work on aid projects in developing countries. Certain kinds of people are not suitable—those who are aggressive, egocentric and full of drive are quite wrong for this type of work, because the essence of success is what remains behind afterwards, and this depends on working with and through national colleagues. It *is* difficult to learn this, because we have been brought up to prize an aggressive behaviour pattern. To work as an adviser, where one's role is not to push forward and do things first, but to work with people and in fact to hold back and not try to claim credit, but to let others have it, is not easy.

On the implementation of programmes, with the possible exception of family planning most of the components we have been discussing would be acceptable and regarded as important by politicians, by local élites, by economists, by technicians, and by villagers. So there are grounds for optimism.

I think the 'packages' that we have been outlining would appeal to these various groups in different ways.

The point is, how can one implement such programmes? Where shall we obtain the funds and staff? While we do not know how to do this in detail, there are often many people who are being under-used, and there is even some 'hidden money' not being spent. I would emphasize three hidden resources: (1) *Self-help:* in some parts of the world this is part of the natural culture. In Haiti, for example, there is a traditional system called coumbite, where everyone works together on some central project. This type of self-help is a hidden resource. It may not always be there, but when it is it should be used. (2) *Volunteers* have not been discussed. There are three main types—international volunteers, with all their advantages and disadvantages; national volunteers, who can work in a volunteer service rather like military service; and the village-level volunteer. These all need to be considered as resources.[1] (3) *Traditional health workers*, who we must try to incorporate into our plans. The Chinese example is a relatively easy one, because here is something which is partly codified (e.g. in the form of acupuncture), has a long history, and is woven into the cultural fabric. It would be more difficult in a part of Africa, where there might be a local system for one village or tribe. Such cross-cultural integration is also difficult when it comes to questions of aetiology. If you work with a traditional health worker and teach him modern techniques (such as vaccination) you are in a sense endorsing his concepts of supra-human aetiology. This may cause problems, because these aetiologies are usually very different from the scientific concepts of causation. Nevertheless, for reasons of economy and use of resources, it is important to bear these three different groups in mind.

Mellander: On this vital question of hidden resources, in South Korea where I was sent as a WHO expert in medical and nutritional education, I found that in the 14 medical faculties there were four or five applied public health and nutrition projects that were not known or were insufficiently known to the Ministry of Health. They were run by outstanding scientists in collaboration with scientists from abroad, the USA especially. Not only scientists, however, existed as a hidden resource; in the countryside I met a so-called 'limited' doctor who had started by himself to use home-made powdered fish-meal prepared from dried small fish to add to infant food, and he had made a system of this in his mother and child care work. This leads me to the suggestion that we should try to make use of existing personnel resources and to extend them and back them up by giving international status to groups already existing in a country, instead of sending in foreign experts who are unfamiliar with the situation. My recommendation to the Manila office of WHO was to try to

create such groups and give them our backing. We have proposed that this sort of nucleus be used to create what we call self-managing groups (see pp. 245–264). This term and concept is taken from the Swedish car industry where they have tried to get people away from the assembly line and to create self-managing groups with a certain duty to be performed in a certain time. Would it not be possible to start out from some of these hidden resources in developing countries and create self-managing groups which are internationally backed up in their own context, and supported by personnel from outside only when needed, and by international funds, to act as a task force to achieve something in a given time, in a given economic framework? This could be used as a model and one could try different approaches in order to give people increased responsibility. The viability may be much better than when projects come entirely from outside.

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Conclusion

G. E. W. WOLSTENHOLME

In this symposium we set out to discuss some basic essentials for health: safer water, sufficient food, the prevention of avoidable disease, and access to the means of controlling fertility, all of which, we maintained, should be seen as human rights. We hoped to encourage a practical approach towards bridging the obvious and widening gaps between those for whom these fundamental health needs have been fulfilled and the many for whom they have not.

Since medicine remains an art as well as a science, I think that three lines written by William Blake at a time when conditions in the industrial slums of Britain were no better than conditions now are among the poor of Asia, Africa and Latin America, sum up the trend of what has been said during the symposium. Blake wrote:

> 'He who would do good to another must do it in minute particulars.
> General good is the plea of the scoundrel, hypocrite and flatterer,
> For art and science cannot exist but in minutely organized particulars.'

None of us apparently being scoundrels, we have not found any easy solutions offering instant general good. Much of the symposium has been devoted to 'minute particulars', but always with the hope in mind that, as Professor Edsall put it, if we can establish 'useful signposts pointing to some realistic goals, the other necessary steps are more likely to be taken.'

Although the world food–population equation may, if every resource is used, balance until the year 2000, time will run out much sooner in Asia, where 84% of potential arable land is already under cultivation. We discussed ways of increasing food production, including the more economic use of land on a world scale, better pay for farm workers, the wider dissemination of agricultural 'know-how', and greater attention to the breeding of useful plants that people ate before fashions in food added to world malnutrition.

Thinking of population in relation to food supplies, we agreed about the

human right to choose how many children to have; and many of us felt birth control measures should be marketed and made as freely available as, for example, soap and matches.

We emphasized repeatedly the need to make better use of what exists. Appropriate technology could improve and safeguard water sources already in use and, within limits, the quantity of water may be of more significant benefit for health than its quality. Similarly, traditional 'healers' can make a valuable addition to the numbers of health care personnel needed to form an essential infrastructure, especially in rural areas; and professional élites could be much readier than at present to share their special knowledge with ordinary people. As Ian Burton emphasized, 'A measure of the success of a people in harnessing science and technology to their ends is not to be found in the degree of complexity or sophistication or newness of what is employed, but in the degree to which it preserves and enhances those values and qualities of life that are considered important. By this criterion the so-called advanced industrial nations cannot claim to be any further advanced. They are in need of appropriate technology as much as if not more than the developing countries'.

Certain themes came up repeatedly as we moved through the four chosen topics, and some points deserve high-lighting. We began with financial resources. Charles Elliott suggested that people spend quite a lot of money privately on health—on self-medication, for instance—and that this might form an additional resource which could be trapped to help those who lack even minimal health care. This idea recurred in relation to water supplies where it was suggested that providing the élite with plenty of water but at inflated cost could be a way of getting a limited quantity of safe water to the poor at low cost in surrounding areas. Continuing on costs, we regretted the economic limitations on supplies of drugs and vaccines. Even where a pharmaceutical industry succeeds in finding an effective drug for a widespread disease such as schistosomiasis and is then willing to make the drug available at cost price, this basic cost is still beyond the reach of most of the people most in need of treatment. There is a great need for easier, more effective, longer-lasting vaccines and for cheaper drugs. The vast resources of skill in the pharmaceutical industry and in government or privately run research institutes ought to be made more generally available. There is every reason to implement and extend ways of financing the purchase of drugs and vaccines with local currencies.

Both Dr Cvjetanović and Dr King suggested that perhaps the only 'real' right in health is that the available money should be properly spent, and Professor Querido stressed the need to get a continuous dialogue going at an equal level between donor and recipient countries. This can be linked to the

plea from Scandinavia for much greater diversity and up-to-date competence among the decision-makers in both donor and recipient countries. Who identifies the problems; who consults with whom about the problems; who does the research that is required and who pays for this; who decides which solution should be implemented; who chooses who is to be taught and what to teach? All these questions and many other related ones show the need for a much wider interpretation of the responsibilities of the health department of any country and for the encouragement of 'self-managing' groups, better consultation arrangements and a much more effective system of feedback from the areas where the work is being done. Perhaps governments need to think again about what constitutes a ministry of health and about what should be covered by the health budget and therefore about the size of that budget.

Another recurrent theme was the value of human milk. Unsafe water adds to the dangers of bottle-feeding. Breast milk allows the infant to share some of the mother's natural protection against communicable diseases. Lactation has at least a partial value as a contraceptive. Breast milk deserves to be mentioned among FAO's figures for world protein supplies: the quantity may be small but the quality is undeniable. Professor Jelliffe introduced us to the doula, who is responsible for supporting the new mother and encouraging her to lactate successfully. The doula is experienced but not necessarily specially trained, and the La Leche League is her equivalent among the élite. We hope this trend will reverse what is becoming the fashion among the urban poor in developing countries, where bottle-feeding is seen as progress but instead is so often disastrous.

The value of such non-professional health workers emphasizes the need for much more, and much more effective, health education, and brings us to a further recurring theme of the symposium. We returned repeatedly to the achievements of China in the field of human rights to health. It seems that the Chinese approach is endlessly flexible. The best in traditional Chinese medicine has been successfully integrated with modern medicine. Protection against communicable disease is universally provided and eagerly sought. China is perhaps the only country which gives encouragement to all known contraceptive methods. Much of China's success seems to stem from her vast network of health workers who are so much a part of their communities and who provide the means of getting health education and health care to even the remotest villages. It seems we could learn quite a lot from the Chinese example.

Wenche Eide mentioned the positive contribution that symposia might make. Let us hope that this one may have helped towards a better understanding of what is involved in some of the inequalities. I think we have to remember, if we are going to select a level of 'rights', that this level must then be the same

for everyone, throughout both prosperous and poor countries. We would, all of us, only be entitled to anything as a 'right' up to this universal minimum. Obviously we would hope gradually to raise this level in the future.

Since we have been thinking about China, I might perhaps finish with another quotation—a Chinese proverb. It is: 'Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime'.

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Biographies of contributors

DAVID J. BRADLEY Born in 1937 in Leicester, England. Is now First Assistant in Pathology at the Oxford University Clinical Medical School and Staines Medical Fellow of Exeter College, Oxford; in October 1974 he becomes Director of the Ross Institute at the London School of Hygiene and Tropical Medicine. Until recently he was Tropical Research Fellow of the Royal Society and he has worked for eight years in East Africa on parasitological and public health problems. With G. F. and A. U. White he is the author of *Drawers of Water* (University of Chicago Press 1972).

IAN BURTON Born in 1935 in Derby, England. Is Professor of Geography and Associate of the Institute of Environmental Science and Engineering at the University of Toronto. In 1972/73 he was Visiting Professor, School of Environmental Sciences, University of East Anglia, and recently served as Chairman of the Expert Panel on Perception of Environmental Quality for the UNESCO Man and the Biosphere Programme. He is now serving as consultant to the International Development Research Centre, Ottawa, on water supply and sanitation in developing countries. Author of *The Hazardousness of a Place* (with Kenneth Hewitt; University of Toronto Press 1971) and editor of *Perceptions and Attitudes in Resource Management* (with Derrick Sewell; Queen's Printer, Ottawa 1972).

CHARLES COCKBURN Born in 1914, formerly Director of the Epidemiological Research Laboratory, Colindale, London. Is now Chief Medical Officer, Virus Diseases, at the World Health Organization in Geneva.

B. CVJETANOVIĆ Born in 1918 in Pijavicino, Yugoslavia. Is Chief Medical Officer, Bacterial Diseases, at the World Health Organization in Geneva. Previously Professor of Epidemiology at the University of Zagreb. In 1973 he was Hitchcock Professor in Public Health at the University of California. He has published papers mainly on enteric vaccines, epidemiology, and mathematical models of bacterial diseases.

B. H. DIETERICH Born in 1925 in Stuttgart, Germany. Is Director of the Division of Environmental Health of the World Health Organization in Geneva. He previously served as sanitary engineer in WHO's community water supply programme, as sanitary engineer and later as chief of water pollution control in the Federal Government, Federal Republic of Germany, and as a consulting engineer. He has also worked in several academic institutions.

GEOFFREY EDSALL Was born in Philadelphia in 1908. He held research fellowships at the Harvard Medical School until 1939 and was Assistant Director and later Director of the Division of Biologic Laboratories, Massachusetts Department of Public Health from 1939 to 1949. He was in turn Instructor in Bacteriology and Immunology at the Harvard Medical School and Assistant Professor of Public Health Bacteriology at the Harvard School of Public Health. From 1949 to 1951 he was Professor of Bacteriology at the Boston University School of Medicine. In 1951 he became Director of the Immunology Division of the Walter Reed Army Medical Center and later Director of the Division of Communicable Diseases at the Walter Reed Army Institute of Research and Director of the Commission on Immunisation, Armed Forces Epidemiological Board. From 1960 to 1972 he was Professor of Applied Microbiology at the Harvard School of Public Health, and Superintendent of the Institute of Laboratories, Commonwealth of Massachusetts. In 1972 he became Professor of Microbiology at the London School of Hygiene and Tropical Medicine. He has published about 120 papers, chapters in books, etc., chiefly on immunization and other aspects of infectious disease control.

ASBJØRN EIDE Born in 1933. Is Secretary-General of the International Peace Research Association and Senior Research Fellow of the International Peace Research Institute, Oslo, of which he was the Executive Director in 1970. He was formerly a lecturer in law at the University of Oslo. Author of books and articles on the international protection of human rights, on peacekeeping, and other subjects.

WENCHE B. EIDE Born in 1935 in Sarpsborg, Norway. Is Assistant Professor in Nutrition at the University of Oslo, in the Institute for Nutrition Research. She is particularly interested in problems of nutrition in developing countries and has made study visits in Africa, Asia and Central America. She is nutrition adviser to Norwegian-sponsored voluntary development activities in Sri Lanka (Ceylon).

CHARLES M. ELLIOTT Born 1939 in Yorkshire, England. Is a Senior Research Associate of the Overseas Development Group at the University of East Anglia, where he is directing a programme of research on the distribution of social consumption. Formerly he worked at the UN Research Institute for Social Development in Geneva and at the University of Zambia in Lusaka.

KATHERINE ELLIOTT Born 1919 in Lincoln, England. Is Assistant Director of the Ciba Foundation. She worked in paediatrics and obstetrics at Cambridge and afterwards in India, and later did part-time infant welfare work in London. Organizer of several previous Ciba Foundation symposia, including *The Family and its Future*, *Teamwork for World Health*, and *Lipids, Malnutrition and the Developing Brain*. She is a member of the OXFAM London Medical Group and contributed to *Health Manpower and the Medical Auxiliary*, published by the Intermediate Technology Development Group. Her article on 'Meeting world health needs: the doctor and the medical auxiliary' was published in *World Hospitals* in July 1973.

KARL EVANG Born in Oslo in 1902. He was Director-General of Health Services for Norway, 1939–1972. President of the 2nd World Health Assembly in 1949. He was awarded the Léon Bernhard Foundation Prize in 1966 and the Bronfman Prize in 1970. Author of *Health Services, Society and Medicine*, several other books and numerous articles (mostly in Norwegian). In 1973 he was visiting Professor of Social Medicine at Tromsoe University, Norway.

VICTORIA GARCIA Born in 1913 in Copiapo, Chile. Is Professor of Health Education in charge of training of professional health educators for Latin America at the School of Public Health, University of Chile. She is a member of the WHO Expert Committee on Health Education.

RUDOLF GEIGY Born 1902 in Basle, Switzerland. Is Professor of Zoology at Basle University. He is the founder and former Director of the Swiss Tropical Institute in Basle, and editor of *Acta Tropica*. Was for 25 years President of the Zoological Garden in Basle and is now its Honorary President. Has done research on insect development and physiology, on the transmission of pathogenic protozoa through arthropods, and on the epidemiology of relapsing fever and sleeping sickness. Author of a text book on tropical disease, over 150 scientific papers, and research films. He is involved in a number of projects in Africa: the bilharzia project in Madagascar, the Central Pathology Laboratory in the Dar es Salaam *Rural Aid Centre*, and the Medical Assistant Training Centre at Ifakara in Tanzania.

DERRICK B. JELLIFFE Born in 1921 in Chatham, England. Is Professor of Public Health and of Pediatrics and Head of the Division of Population, Family and International Health at the School of Public Health, University of California, Los Angeles. In 1968 he received the Rosen von Rosenstein Medal of the Swedish Pediatric Society. He is the author of numerous books on tropical paediatrics and nutrition, and is editor of the *Journal of Tropical Pediatrics*.

E. F. PATRICE JELLIFFE Born and educated in France. Has worked mainly on paediatric parasitology, the methodology of nutritional surveys, and the assessment of nutritional status by means of anthropometry in developing countries. Her publications include anthropometric data and studies of hair root morphology, quartan malaria, the significance of placental malaria, and patterns of breast-feeding. She was formerly research fellow/nutritionist at the Caribbean Food and Nutrition Institute, Jamaica; is now working in the Division of Behavioral Science at the University of California, Los Angeles.

MOGENS JUL Is the Director of the Danish Meat Products Laboratory, Lecturer in Food Preservation at the Royal Veterinary and Agricultural University, Copenhagen, and Director of the Danish Research Institute for Poultry Processing at Hillerød. He was formerly Director of the Technological Laboratory of the Danish Ministry of Fisheries, Lecturer in Fisheries Industry and Dean of Chemical Engineering at the Technical University of Copenhagen. From 1946 to 1953 he was Chief Fisheries Technologist of the Food and Agriculture Organization in Washington and Rome. From 1953 to 1968 he was Director of the Danish Meat Research Institute, and from 1965 to 1968 research consultant to United Breweries Ltd, Tuborg. He was secretary of the Protein Advisory Group to the United Nations from 1968 to 1971.

MAURICE KING Born in 1927 in Ceylon to British parents. Is working for the World Health Organization in Surabaya on the development of a mother and child health care 'package'. Author of *Medical Care for Developing Countries*, *Nutrition for Developing Countries*, and more recently *A Medical Laboratory for Developing Countries*.

PER LINDBLOM Born 1921. Is Deputy Executive Secretary of the International Federation of Institutes for Advanced Study in Stockholm. He previously served in the International Philips Concern for the design and management of international projects.

RICHARD LLEWELYN-DAVIES Born 1912 in London, England. Is Head of the School of Environmental Studies, University College London and Professor of Urban Planning. He is also Chairman of the Centre for Environmental Studies, and senior partner of the firm of architects, town planners and health services consultants of Llewelyn-Davies Weeks Forestier-Walker & Bor.

O. MELLANDER Born in 1911 in Malmö, Sweden. He has been Professor of Medical Biochemistry at the University of Göteborg since 1951 and was Director of the Medical Biochemistry Department from 1951 to 1967. He was formerly Associate Professor of Pediatrics at the University of Uppsala. He has been a WHO consultant in medical nutrition on several occasions in the Middle East, Far East and Europe and has been a member of the Swedish International Development Authority's Advisory Group for Nutrition since 1963. Has published studies of the biochemistry of human milk, enzyme-resistant peptides, and infant nutrition.

WALTER H. PAWLEY Born in 1911 in Stockton, California (but an Australian since 1913). Is Director of the Policy Analysis Division of the Food and Agriculture Organization in Rome. Formerly Director of the Indicative world Plan for Agricultural Development, 1965-1985. Before joining FAO he was Economist to the New South Wales Department of Agriculture and Lecturer in Agricultural Economics at Sydney University. Author of *Possibilities of Increasing World Food Production* (1963) and *How can there be Secured Food for All – in this and the next century*? (1971).

N. W. PIRIE Born 1907. Worked in Cambridge on the separation and metabolism of glutathione, methionine and other sulphur compounds, on *Brucella* antigens, and on plant viruses. He has worked at the Rothamsted Experimental Station from 1940 on the physiology of virus infections, and on the extraction of leaf protein and its use as human food. Publications on food include *Food Resources: conventional and novel* (Penguin 1969).

D. M. POTTS Born in 1935 in Sunderland, England. Is Medical Director of the International Planned Parenthood Federation. In 1973 he was awarded the Hugh Moore prize for his work in international family planning. Author of *Textbook of Contraceptive Practice* and numerous papers on abortion, contraception and on the early embryology of animals.

A. QUERIDO Born in 1912 in Amsterdam, Holland. Since 1948 he has been Professor of Medicine at Leiden University. He was Dean of the new Faculty of Medicine at Rotterdam from 1965 to 1969. Since 1964 he has been interested in the development of care systems for developing countries; he spent six months in India, did field work in Ecuador and Indonesia, and acted as temporary consultant for the Pan American Health Organization and for WHO. Author of many papers on experimental nutrition, and experimental and clinical endocrinology. He is an honorary member of the Association of American Physicians and an honorary Doctor of Science of the Albert Einstein College of Medicine, New York.

T. R. TEWARI Born 1909 in Simla, India. He served in State and Central Government Health Ministries in various capacities and retired recently as Director of the National Institute of Health Administration and Education, which he helped to develop as a Staff College for senior health administrators and a research centre for health practice. He planned and implemented the first major contributory medical care scheme in India, and played a

key role in health planning in India as Secretary of the Central Council of Health and the Health Planning and Review Committee.

GILBERT F. WHITE Born in 1911 in Chicago. Is Director of the Institute of Behavioral Science and Professor of Geography at the University of Colorado. Author of *Science and the Future of Arid Lands* (1957), *Choice of Adjustment to Floods* (1964), *Strategies of American Water Management* (1969) and *Drawers of Water* (with Anne U. White and David J. Bradley, 1972).

ARON WIENER Born in 1912 in Poland. Since 1945 he has been responsible for planning the development of water resources in Israel, and since 1958 has been active in the development of water resources and agriculture in developing countries. Publications include *The Role of Water in Development* (1971).

G. E. W. WOLSTENHOLME Born in 1913 in Sheffield, England. Has been Director of the Ciba Foundation since its opening in 1949. Earlier, in the Army Medical Service, he was in charge of blood transfusion and ancillary services in the central Mediterranean. Formerly an Honorary Secretary of the Royal Society of Medicine, he is a Fellow of the Royal College of Physicians, Chairman of the Institute for Research into Mental and Multiple Handicap and a Trustee of the Developmental Sciences Trust. He recently became a member of the General Medical Council and is that Council's representative in the European Economic Community. In Ethiopia in 1963 he set up the Haile Selassie I Prize Trust, to which he remains adviser, and he is consultant to La Trinidad Medical Center, Caracas, Venezuela.

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Index of contributors

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