A health delivery system in any country requires the presence and acceptance of a series of "tools" which can be used to solve health problems. At present in many countries, although the nature of the health problems is known and methods of prevention and treatment are available, the selection of the appropriate methods may not take place. In other countries such decisions are based upon technical grounds alone rather than upon the complex of variables that includes cost, effectiveness, safety, the health service structure, and the life style of the population.

In this document the problem is presented, health technology is defined, and a proposal is made for national and international action - limited in the first instance to problems at, or peripheral to, the district level of health services, and closely linked to the programme of primary health care and rural development.

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I. INTRODUCTION

Many of the health problems of the developing world are the same from country to country. The complex of poverty, malnutrition, environmental hazards, communicable diseases, a non-existent or inappropriate health service structure for large segments of the population, an inequitable allocation of health resources, and a lack of local organization and acceptance of health responsibilities can be found in many countries and especially in rural areas and periurban slums. While it is true that many, or all, of these factors may be common to all developing countries, it is also true that the ways of dealing with them can be so diverse that each country, or part of a country, may have to evolve a unique series of actions.

The influence of poverty and rural underdevelopment on health and some ways in which they can be attacked are the subject of a separate document. Similarly, the characteristics of the health care system known as primary health care were presented at the Twenty-eighth World Health Assembly as a part of the promotion of national health services, and are the subject of Health Assembly and Executive Board resolutions and of a WHO programme. Such ideas are now finding their expression within countries. They include the participation of the community, and provide a link between a country's past and present solutions and the ideas, techniques, and knowledge of preventive and curative medicine that are practised in other parts of the world.

The present paper examines whether this is enough. Debates on primary health care and the promotion of national health services stress the diversity of possible delivery systems, but little emphasis has been given to the equally crucial choices facing national health services when they consider what tools they will use to attack specific problems. Here the choice also is wide. The variables influencing such decisions clearly relate to cost, health service structure, practicability, and acceptability as well as to effectiveness.

With so many variables to consider there can rarely be an optimum decision, but rather one that is justifiable for a given country at a given time. The choice, if made on the proper grounds, cannot be described as better or worse than a different choice made by another country, and cannot be labelled as of either high or low quality. A decision-making process that ranks health problems in order of importance, considers for each problem where in the chain of disease causation and expression the health intervention or treatment should occur, and then determines which health tools should be used, and upon whom, is inherent in the problem-solving approach. In the present paper this series of choices is called "health technology" and it forms one of the foundations of a country's efforts to solve its health problems. Health technology skills and decisions are obviously meaningless without a health service system to apply them. But the reverse is also true: a health service system based upon primary health care or other methods that has no accepted national health technology to apply will not markedly influence the health of the population or it will be inefficient and ineffective.

The complex called "health technology" should be the technical core of every health service programme; its application within each country is likely to be unique; and its systematic evolution needs to be fostered and actively supported. WHO has an important part to play in this process particularly as regards its relationship with primary health care and the promotion of national health services.

1 Document A29/22.
II. THE PROBLEM

Taking one aspect of childhood mortality as an example: many countries in the developing world report a high proportion of infant and child deaths related to diarrhoeal disease and dehydration. A series of factors relating to the family (poverty, cross-infection among children), nutrition (undernourishment, early weaning, lack of suitable weaning foods), the child and the mother (low birth weight), the environment (contaminated water, improper disposal of faeces), and the disease agent, are compounded so that they not only increase morbidity but transform what might be a minor illness into a health crisis frequently progressing to the dehydration and toxaemia which may be fatal. All these factors are separately changeable in a number of ways, and the resulting illnesses also are treatable at different levels. A child-spacing programme and the improvement of the nutrition of mothers can decrease the proportion of low birth weight children; breast feeding can be encouraged; weaning foods can be made available or prepared locally; safe water supply and proper faeces disposal can be introduced; and many of the sick children can be treated for fluid and electrolyte loss by simple oral replacement therapy at home if the condition is ascertained early enough, or by subcutaneous or intravenous methods by a health team worker at a later stage. There are many different ways of promoting and implementing such health interventions. Singly, all may have some influence; in combination the health risk becomes negligible. It may be said, then, that the technology is known.

But for a majority of the population of the world a total approach cannot be undertaken even though the disease problem is recognized and has high priority, and a limited amount of resources is available. A choice has to be made and translated into action that includes the training of health workers so that they can understand what is to be done and how to do it, and the provision of the proper drugs, vaccines, or other "tools" which may be needed.

It may be difficult to make such a choice because the data on which it can be made is rarely available. Each of the preventive and therapeutic measures cited above, taken separately or in combination, can be costed. An appreciation can be made of their effectiveness. Their practicability at the different levels of the health service system and their acceptance by the population can be assessed. The results of the evaluation will vary markedly from country to country and are rarely studied - and then for only a few health problems.

At the present time, the absence of data, and of a suitable national decision-making mechanism, means that the choice is difficult or even impossible, or is based on pragmatic grounds. It does not take into account nonclinical variables, ignores the health service structure, and does not consider the wishes or life styles of the people. Such a narrowly based process encourages the passive transfer of techniques from one country to another, although they may be inappropriate, unsuitable, or even to the disadvantage of those in need.

In different situations the decisions are likely to vary. In one area the options may be limited because poverty makes it difficult to improve the feeding of mothers and children or to counter the environmental hazards. The geography of the area may make the movement of desperately ill children to a health centre difficult or impossible. Decisions can nevertheless be made on the remaining options that will result either in a successful intervention for that particular stage, or in the conclusion that no reasonable action can properly be proposed. Either of these outcomes is useful. The decision might be that the encouragement of breast feeding, oral rehydration of vomiting and diarrhoea in children by the mother, and emergency care by the village health worker would reduce child mortality significantly. Such action might need to be supported by the packaging and distribution of oral rehydration salts, the retraining of village health workers in rehydration methods, and a health education campaign on child feeding, faecal/oral transmission of disease, and dehydration. This could be considered an appropriate decision.
Such a decision requires responses at all levels of the health system and may be unique. It cannot be described as better or worse, or of higher or lower "quality", than the decision of a different area which opts for an improved food supply, a water supply programme, and supporting treatment services. Judgements upon the appropriateness of the solution rest upon its efficacy, its cost, its safety, and its acceptability - not upon its complexity.

The considerations which should influence health technology decisions are well known but only rarely acted upon. Sometimes this may be because no multiple-level decision process exists for such questions or because such decisions are considered to be the personal prerogative of individual health workers. In other cases, decisions at the centre and in the field are based on clinical or clinical trial data as to safety and effectiveness which are the result of observations on controlled volunteer groups and do not take into account the variables and difficulties of applying a method to that part of a population at special risk, or to the whole population. A type of health intervention may be effective in a controlled trial but is unacceptable to the ideas and life style of a population; may only be obtainable at an unrealistic price; or may be quite ineffective because it does not reach the true population at risk. Errors may be compounded by the influence of industry and of professions (e.g. medical, pharmaceutical) which sometimes appear to equate complexity with quality and often encourage decisions which push both prevention and cure to higher and higher levels of the referral system. They may also encourage "mimicking" or the "importation" of apparent solutions from one country to another without adaptation, even though such solutions are neither needed nor appropriate.

An awareness that the problem has been solved in one area does not mean that the health technology problems are solvable in another. Moreover there are large gaps in existing knowledge. A satisfactory solution is one which is safe, effective, of wide applicability, capable of being used at the earliest possible point in the disease process, acceptable to the population; cheap, and usable at the peripheral level of the health service or by household members themselves. A health technology solution which has all these qualities could be described as acceptable or appropriate. Such solutions have sometimes been described as "simple", but this is clearly a misnomer since the steps in research and development leading up to it may be highly sophisticated and complex. The development of a standard freeze-dried smallpox vaccine, or of BCG vaccine, was difficult and expensive - but the result was an acceptable "simple" product.

For every effective strategy already in an appropriate form, there are many others that need to be made cheaper, less complex under conditions of delivery and more acceptable to the people served or altered to cover a wider spectrum of health needs. For this to happen innovative demonstrations will be needed; field trials on total populations are required; and basic and applied research must be carried out. One must face the apparent contradiction that to arrive at an appropriate technology that can be used at village level in developing countries may require a very complex analytical approach: extensive and even sophisticated research, as well as field studies carried out by highly qualified people, will be required to obtain an appropriate technique that will meet specific needs under the prevailing conditions.

The problem is a real one and is closely related to primary health care. Without an acceptable health technology, primary health care is meaningless and will inevitably fail. Without primary health care and a health service system, the range of technologies which can be applied to improve health is so limited that the majority of health problems are unsolvable.

III. DEFINITION OF HEALTH TECHNOLOGY

While the term "health technology" can be applied to specific needs such as education and training or to any aspect of the biomedical and health services, it is used in the present context to mean health-directed action:
(i) which is selected on the basis of the scientific and technical knowledge available, and in the light of the social, economic and cultural characteristics of the population and the area to be served;

(ii) which is designed and implemented in conjunction with related action at different levels of the health structure and related sectors;

(iii) which can be self-applied or applied by a health service worker; of which the effect on health or disease can be clearly stated; and of which components can be described in objective terms in order that persons can be trained to use them; and

(iv) whose introduction and use can be costed, and which during the national decision-making process can be compared with other alternatives for influencing health status.

Health technology must be subject to review, improvement, change and adaptation when applied in the field.

In addition there are certain criteria which reflect the needs of primary health care and of the overall national health services and can serve for comparison of one technology with another. The better health technologies are those which:

(i) foster actions that promote health or prevent ill-health at the earliest possible stage (in preference to those which deal with it after the event);

(ii) can be safely and effectively used at the most peripheral level of the health service system or within the home;

(iii) are cheap to produce and administer;

(iv) are based upon locally produced materials and production capacity, do not require sophisticated equipment, and can be used without major servicing or technical repair costs;

(v) can form part of a health delivery system consistent with the life style of the people, and have links with locally accepted views of health and of disease and treatment methods;

(vi) have shown themselves to be effective;

(vii) have a "wide spectrum", i.e. can be used less selectively, with simple criteria, and whose effect may influence positively other health goals;

(viii) can be costed, and the outcome (in health terms) compared with other methods; and

(ix) can be easily taught to people without presupposing a high level of previous education.

Measured against the above criteria, there are few examples where it can be said that an adequate or appropriate health technology exists for any health or disease problem. Knowledge of the epidemiology of a disease may exist and may lead to intervention methods and the production of tools for action, but these in turn require change, development, and adaptation on a continuing basis. We frequently know what needs to be done, and why; but we have not taken the final step in producing a mechanism by which a course of action can be decided upon and implemented.
IV. POSSIBLE HEALTH TECHNOLOGY ACTION

While there are clearly gaps in the understanding of the etiology, epidemiology, prevention, and treatment of many of the common diseases, a large body of knowledge already exists, is increasing at almost geometrical rate of progression and is for the most part available throughout the world.

However, there are wide gaps in the application of health technology in a way which could directly influence health status even within existing health services, and for the following reasons:

(i) Information on different choices of health intervention is rarely available in conjunction with the key variables that influence national decisions, e.g. quantitative statements as to cost of implementation, expected outcome, linkage of selected action, population acceptance, safety, or methods of training. Where such information is available it may not be applicable to real conditions; and where it is not, no widely available and tested methodology exists for obtaining it quickly and cheaply.

(ii) There are few examples to indicate the way in which such information can be presented to national decision-makers in order to assist them in making an appropriate decision. As long as such decisions are considered to be "technical", the data provided may be restricted solely to the technical aspects. Clearly national policy decisions are based on social, political and economic considerations as well as on technical ones, and the data provided must reflect this reality.

(iii) Few mechanisms are available within the institutional frameworks and ministries of health of most countries for adopting known technologies to local conditions, producing relevant data, discarding useless or ineffective methods, and reaching appropriate decisions. Moreover there are few links between the technical and the planning and executive branches of health structures.

(iv) Important technical links are missing between known strategies for influencing health and their application in the field. For example, innovations such as the use of the bifurcated needle for smallpox vaccination have been given insufficient emphasis.

(v) Research and development efforts, and investment, have an inherent tendency towards an increase in the effectiveness of individual (rather than population) health interventions, towards sophisticated methods, movement up the referral system, and increased cost. These are the reverse of the qualities needed and listed in the previous section.

(vi) Most of the research and development resources in money, people and institutions are in the industrial rather than the developing world, and are directed to different priorities.

(vii) There is an imbalance in the allocation of research and study resources in favour of fundamental rather than applied research.

None of these impediments is likely to be overcome without a deliberate and planned change in direction at many different levels. This requires a clear statement of principle on the part of WHO, followed by a series of actions which should find their expression within individual countries. It is a matter of great urgency to take the initial steps in such a process at once.
V. WHO'S POSSIBLE ROLE IN HEALTH TECHNOLOGY

Health technology must find its expression in health-related programmes in countries; all other action can be described as supportive. WHO's role in assistance could be multiple both as regards the problems it selects as priorities and in its levels of action.

The first task is to present the wider issues for debate, so that the missing elements can be determined and described, and a consensus can be reached on the needs and on the manner of action. To do so is WHO's responsibility as the international health agency and as the world's health conscience.

The total task is immense. It is therefore suggested that initially WHO should put the main emphasis upon those health conditions and intervention methods which are in line with existing WHO priorities in primary health care and rural development for the under-served populations. This will mean concentrating upon health conditions in the developing world which are common and alterable, and on levels of intervention which are applicable at, or peripheral to, the district level of health services. It follows that the method adopted would be to assist countries to develop a national health technology component within their organizational structure for primary health care and rural development. This will require the forging of links between the groups carrying out primary health care programmes, the population, the planners, the national technical experts, and the research groups. It may well require both short- and long-term action to increase national capabilities in cases where such groups are weak or are only starting to function.

In the preceding section it was stated that there is insufficient information available in suitable form to allow a proper choice of options by most, if not all, countries. Where such information exists, it should be collected and presented to those facing decision choices so that an appropriate national decision can be made or a national solution evolved. This may require the promotion, support or conducting of applied research and studies to provide useful products as well as a distribution mechanism between countries.

If the above steps are taken, it is probable that many missing health technology components which could have wide applicability will be identified. WHO would attempt to describe the unsolved questions in terms understandable to research workers and would promote or support their solution by universities, research institutions or industry in both the industrial and the developing world.

While any one of these actions would assist the development of the appropriate tools and their proper application to the right problem in the right place, WHO will clearly have insufficient resources to cover the whole field and give such a programme the intensified attention it deserves. Therefore some part of WHO's effort must be spent on a planned and structured effort to guide world opinion as to what health technology is needed for what purposes. Such an effort must focus upon the health professions themselves, to overcome their preoccupation with "quality" technology, and upon the general public, who in their individual fear of ill-health and death equate massive expenditure, sophisticated methods, and "high" technology with personal survival.

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