

**IMPACT OF RESEARCH AND TECHNOLOGY
ON THE EFFICIENCY OF PRIMARY HEALTH CARE
IN TROPICAL REGIONS**

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EXECUTIVE SUMMARY

Poor health is a common attribute of the majority of the people in developing countries. As a result of poverty, hundred of millions of the world population are suffering from malnutrition and a variety of diseases, with high infant mortality, low life expectancy, and conditions of life which defy description. Poor health is a result of as well as a factor for low development.

Over the last decade, following the Alma-Ata declaration (1978), the approach to health has been revolutionarized. It has shifted from narrow medical perspectives and disease-centered activities to a more comprehensive intersectorial vision of health promotion as part of overall development. The strategy of Primary Health Care is now viewed as the only way to ensure all the peoples of the world with decent health conditions. This approach, formulated by the World Health Organization in the context of the so-called Strategy of Health for All by the Year 2000, strives to reconcile the double aim of efficacy and equity in the allocation of health resources. It essentially represents an ecologically sound approach, strongly focusing on the full participation of the communities involved, and advocating the use of methods and techniques acceptable in the local context.

Many problems remain however to be solved in order to actually implement primary health care in the developing countries. Although a number of limited projects are reported as successful, their replication or extension on a wide-scale are faced with difficulties of many orders, political, cultural, organizational, and financial, among others.

The new discipline of health systems research provides a tool to identify the problems encountered, determine the conditions for success, and design and test possible solutions.

In the meantime, recent advances in research are opening new opportunities for technological developments for health in the developing countries. Information for health management is offering great prospects, in particular the use of microcomputers for planning, monitoring, and evaluation. New health technologies have many promises for screening,

diagnosis, treatment, control and rehabilitation, among which biotechnology, microelectronics, expert systems, diagnostic imaging, and material science. Operation research brings new possibilities to tackle the dilemma between efficacy and equity in primary health care, through the so-called "risk approach". It provides also ways to rationalize the services, particularly referral systems, public health laboratories and radiological services.

These methods and techniques could be termed advanced appropriate technology. Although they might be sophisticated, they can be made appropriate providing conditions are defined for their acquisition and transfer, acceptability, adaptation to the local context, needs in manpower and expertise, and cost. This is the field of the new discipline known as assessment of health technology.

Other special problems require consideration, among which primary health care in large urban conglomerates disasters (natural as well as man-made, including displacement of populations) and mental health, all of which will likely raise major concern in the years to come.

This report review these various problems, indicate specific needs and point opportunities for research and development.

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I. INTRODUCTION

1. DESCRIPTION OF THE PROBLEM: HEALTH IN THE DEVELOPING WORLD

In most developing countries, the health of the majority is appalling. While the World Health Organization has defined health as "a state of complete physical, mental and social well-being, and not only the absence of disease or infirmity", hundred of millions of people are barely surviving at the state of mere being.

The major causes of death in industrialized countries, i.e. cardiovascular diseases, cancer, and accidents, do also exist and are expanding in developing countries. In addition, the tropical countries suffer from a number of widespread communicable diseases, such as malaria, schistosomiasis, filariasis, trypanosomiasis (the African form, sleeping sickness, and the American one, Chagas' disease), leishmaniasis and leprosy (1). With the exception of smallpox, which was eradicated after a major worldwide effort, there appears to have been little progress in recent years in reducing either the incidence or the prevalence of those diseases.

Some 2.6 billion people are living in areas where malaria is still endemic, out of which 365 million, nearly one twelfth of the world's population, live in areas where no control measures are applied.

While world-wide malaria eradication campaigns launched in the 1950ies have initially been largely successful (2), there has been a violent setback in the last 15 years. Transmission has been reinstated in wide areas, incidence has increased manyfolds in a number of countries, and large outbreaks have occurred, a recent example being Turkey.

Schistosomiasis, a parasitic invalidating disease associated with water and agricultural development projects, is reported from 74 countries, with a total of 600 million people exposed to the risk of infection. Some 200 million are estimated to be actually infected.

Onchocerciasis, a filariasis which is transmitted by blackflies, affects some 40 million in tropical Africa, Central and South

America, and Yemen. Blindness is the main complication, which may affect up to 25 per cent of the adult population in some villages of the Sahel. Onchocerciasis has made vast strips of arable lands improper to human habitat.

African trypanosomiasis, or sleeping sickness, an often fatal disease which is transmitted by the tsé-tsé fly, is restricted to the sub-Saharan region of the African continent. About 50 million people in 34 African countries are at risk of developing the disease, and of these only 5 to 10 millions have access to some form of protection. The number of new cases recorded per year is about 20 000, but many more probably go undetected.

Chagas'disease is almost entirely confined to Latin American tropical and sub-tropical countries. It is transmitted by an widespread and ubiquitous insect living in the houses, the "kissing bug". It has been estimated that up to 20 per cent of blood donors in endemic urban areas are infected with the parasite. About 65 million people are exposed, whose 15 to 20 million are actually infected. Some 10 per cent of them will eventually develop a severe cardiopathy. In some areas, chronic Chagas'disease is possibly responsible for up to 10 per cent of the deaths among the adult population.

There are still some 15 millions leprosy patients in the world and in some countries, some 2 per cent of the population is affected, a large number of them with crippling deformities (3).

The incidence of food-borne diseases, sexually transmitted diseases, and some zoonosis, seems to be increasing (4).

More than two-third of the people in the world's poorest countries have no access to safe water supply. In some areas, the quasi-totality of the population suffers from water-borne diseases and diarrhoea, which are directly associated with lack of basic sanitation. In some countries, such as Egypt, Iran and Venezuela, in any given month, some 40 to 50 percent of children of preschool age are found suffering from one or several episodes of diarrhoea (5). It

is the leading cause of deaths in children between 0-5 years in a large majority of developing countries. To quote Dr H. Mahler, Director-General of WHO : "Each year, some 5 millions children defecate to death" (6).

Intestinal parasites cause chronic debilitating illnesses rather than death. Their prevalence in developing countries is high, close to 100 per cent of the population surveyed being affected with one or several helminthiasis (verminosis). According to WHO estimates, there were in 1971 650 million people in the world affected with ascariasis, and 450 million with ancylostomiasis (hookworms) (7).

To the effects of these diseases should be added the ravages of widespread nutritional deficiencies or plain malnutrition. It is estimated that some 100 million children under 5 years of age are suffering from protein-energy malnutrition. According to WHO, in some areas of Africa, 23 per cent of children aged under 5 years present signs of severe, and up to 65 per cent, of moderate protein-energy malnutrition (4). The mortality of infants aged 0-1 year reaches or exceeds 200 per thousand in a number countries, which means that one child out of five die before his first birthday. This is fifteen to twenty times the risk observed in industrialized countries. The mortality continues to be high during the subsequent years, when infectious diseases of childhood such as measles, pertussis and pneumonia, takes a heavy toll. Combined with malnutrition, these diseases have a high lethality. In Sahelian countries, measles represents one of the major cause of mortality in children. During periods of famine, up to 50 per cent of children developing measles may die.

The number of children who are blind from vitamine A deficiency in the diet, an easily preventable condition, exceeds probably half a million. Each year, in Bangladesh, India, Indonesia and the Philippines, some 500,000 preschool children are said to develop severe xerophthalmia, a stage of the disease eventually leading to blindness if not treated (8).

Large numbers of children die from infectious diseases such as in the first place measles, which makes death by the millions, and also whooping cough and (especially in newborn children) tetanos. These diseases could and should be prevented by immunization. Fewer than 10 per cent of the 80 million children born each year in the developing countries are immunized against the common infectious diseases of children (9). Maternal mortality at birth is still high, 2 to 6 deaths per 1000 live births, that is 100 to 500 times the Western European rates (10). In some areas, it may account for about half the deaths of women in reproductive age. Illegal abortion plays an important role, with one fifth to one half of all maternal deaths caused by induced abortion in Latin America.

Nonetheless, disease-centered epidemiological indicators are not the best way to express the dramatic health situation in the poorest countries of the world (Table 1). It provides only bare figures in terms of deaths and episodes of sickness, and does not convey the amount of suffering, bad life and frustration associated with poverty. In those populations, the life expectancy at birth is on the average 55 years (48 years in the low income countries south of the Sahara) or even 36 years in some countries, as compared to 72 years in the industrialized world (11). Death and disease in these countries are caused by poverty as much as by microorganisms. "Ill health adds to hopelessness, but its removal does not mean that there is hope." (12)

The perspective remain somber, especially in the African Continent where the population is likely to grow by 300 per cent in the next 40 years. According to Robert S. McNamara : "Some 600 million individuals at the end of the century will remain trapped in absolute poverty, a condition of life so characterized by malnutrition, illiteracy, disease, high infant mortality, and low life expectancy as to be beneath any reasonable definition of human decency" (11).

2. HEALTH CARE IN DEVELOPING COUNTRIES

2.1. Types of approaches to health care

Health may be classically approached along two directions, that is (1) prevention, and (2) cure. Vaccination for poliomyelitis is prevention; prothesis for paralysis is cure at its worst, that is care for sequellae. Chemoprophylaxis for malaria is prevention; treatment of malaria is cure, even if transient.

Preventive and curative measures may be directed at the individual, or at populations. Prevention of blindness through addition of vitamine A to milkpowder is population based; buying vitamine A at the pharmacy is strictly a personal measure.

Interventions may be disease-specific, or comprehensive. A leprosy control programme is specific since it is restricted to one disease; provision of safe water in sufficient quantity is comprehensive since it will reduce the incidence of a large array of water-borne diseases together with having indirect beneficial effects on health by improving the hygiene.

In low developing countries (LDC's), the attainment of large-scale long-term effects require a combination of measures heavily weighted toward the population-based preventive side.

2.2. Patterns of health care

From an historical point of view, and for the sake of simplicity, patterns of health care in LDC's can be grouped in three categories:

- i. hospital-based medical care
- ii. disease-oriented programmes
- iii. basic health services

These patterns often overlap to a considerable extent.

i. Hospital based medical care

For the large majority of the population, including most of the medical profession, health care has long been equated with treating

the sick. Hence the need for hospitals : large hospitals with specialized services and sophisticated equipment in the major cities, small hospitals and dispensaries in rural areas. This approach has been reinforced by two factors, i.e. the existence of a private medical sector, concentrated in the towns, and the presence of non-governmental organizations, mainly churches, which operate mostly in rural areas. Hospital-based care focuses on curative medicine, with generally little concern for preventive activities.

ii. Disease-oriented programmes

Millions of people in LDC's are affected by some specific diseases, which cause a large amount of suffering, reduce work capacity, and curb economic development. Malaria, schistosomiasis, onchocerciasis, African trypanosomiasis, Chagas disease, yaws, leprosy, avitaminosis A and goiter, are, among others, such widespread diseases. Control of these diseases may transform the economy of the regions affected, at the same time saving millions of lives.

The successful implementation of specific control programmes depends on the advance of epidemiological knowledge together with the development of technology. An historical example of such a programme was the control of yellow fever, following identification of the virus and the discovery of its transmission by the insect *Aedes aegypti*. It made possible the achievement of the Panama Canal (13). African trypanosomiasis was also efficiently contained, if not controlled, in equatorial Africa through a coordination of measures directed at reducing the contact between the tse-tse fly and the human host. Entire regions which were formerly unsuitable for human settlement were cleaned up from the disease. The discovery of penicilline made possible the eradication of yaws or at least its control in a number of countries where previously up to 30 percent of the population were affected.

Following the discovery of efficient residual insecticides, namely DDT, great expectations were placed on the world-wide malaria eradication campaign initiated by WHO in 1956. After a decade of efforts, by 1968, malaria had been eradicated (maintenance phase) in areas where 651 million people were living; an additional 702 million were being protected by eradication programs (14). Consequently, in a number of countries, infant mortality drastically declined. Due to unsuspected or overlooked factors, such as the emergence of resistance to insecticides and the lack of supporting services and infrastructures to consolidate the results, these early successes were not maintained (15). On a world-wide scale eradication or even control proved in the long run to be a failure.

Goiter was largely controlled through addition of iodine to salt or the injection of iodinated oil. Avitaminosis A, a major cause of blindness in children, can be controlled by the administration of vitamin A or the fortification of food with the vitamin.

The global eradication of smallpox was achieved in 1977, following a world-wide campaign based on a carefully studied strategy of focal vaccination using the bifurcated needle.

Vertical programmes of that kind constitute preventive care at its best. Their implementation did not imply that curative care had to be or was neglected.

The whole concept of mass-campaigns for the control of specific diseases has been remarkably expounded by C.L. Gonzalez in 1966, who stated the conditions for their success and also emphasized the need for developing in parallel or for strengthening basic health services in order to consolidate the achievements (16).

When these programmes failed to achieve and/or maintain control, it was due either to (1) lack of organization or collapse of existing structures, or (2) incomplete knowledge of the many factors which may interfere with the dynamics of the disease, such as the emergence of drug or insecticide resistance strains of the pathogenic agent or the vector. Overenthusiasm about eradication, which is

more a slogan than a scientific concept, may explain the subsequent disappointment with these vertical programmes, more than a real failure to achieve control of these diseases.

iii. Basic Health Services

The declining success of the malaria eradication campaign in the late 1960'ies uncovered the weakness of the rural health structure in many developing countries (14). The results achieved in the attack-phase of the campaigns could not be maintained in the consolidation phase for a total lack of services. The World Health Organization Expert Committees on Malaria then spelled out a number of prerequisites for launching malaria eradication campaigns, one of them being that the stage of development and the future prospects of basic health services be assessed.

Basic Health Services are defined as: "A network of coordinated peripheral, intermediate and central health units, staffed by competent professional and auxiliary personnel, and capable of performing effectively a selected group of functions essential to the health of the people living in the area. It is administered by central, intermediate and local organs, as appropriate to the general administrative pattern of the country"(18). Basic health services are supposed to encompass the following activities: basic medical care, detection and prevention of disease, maternal and child health, sanitation, health education, and the reporting and collection of statistics. In addition, in order to assist mass campaigns, they should cover school hygiene through simple surveillance and protection measures, geographical reconnaissance, determining the location of people and dwellings, and the collection of vital statistics.

Basic health services are inseparable from "horizontalization" and "integration". According to Gonzalez (16), "the horizontal approach seeks to tackle the over-all health problems on a wide front and on a long term basis through the creation of a system of permanent institutions commonly known as general health services". A considerable literature was published on the conditions for

integration of vertical disease-oriented campaigns into the basic health services.

Demonstration areas for basic health services were established in a large number of countries (201,207,208,209,210). Extension at the national level proved difficult. In some instances, it was found that the basic health services were underutilized (19). It was often attributed to the lack of involvement in the communities concerned.

The Basic Health Services strategy was soon to be replaced by the Primary Health Care Approach.

3. THE PRIMARY HEALTH CARE APPROACH

3.1. Primary Health Care

Primary Health Care (PHC) as promulgated at the International Conference of Alma-Ata, 1978, constitutes a truly revolutionary approach to health. It is defined as:

"...essential care based on practical, scientifically sound, and socially acceptable methods and technology made universally accessible to individuals and families through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination.

It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family, and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health process"(20).

The primary health care approach as enunciated in Alma-Ata was prompted by a series of observations made in a number of countries of the world (75), which can be summarized as follows (21):

- the continuing low health status of the majority of people;
- the lack of coherence between health services and other services which could influence the main precursors of ill health;

- the concentration of resources upon centralized high technology institutions concerned with highly selected and unusual conditions;
- the inability of health services to function as a system;
- the selection and training practices of health professionals which put them apart from the population they serve;
- the failure to arrange public accountability for resource allocation at the local level.

From an operational point of view, PHC consists at least of the eight following elements (22):

1. education concerning prevailing health problems;
2. promotion of food supply and proper nutrition;
3. adequate supply of safe water and basic sanitation;
4. maternal and child health, including family planning;
5. immunisation against the major infectious diseases;
6. prevention and control of locally endemic diseases;
7. appropriate treatment of common diseases and injuries;
8. provision of essential drugs.

The Primary Health Care Approach was adopted by the governments of the World as their official health policy at the Thirty-Second World Health Assembly in 1979.

This approach to health care is quite broad in scope. It is underlined by five principles that distinguish it from earlier narrower perceptions of care. These are : equitable distribution, community involvement, focus on prevention, appropriate technology, and a multi-sectoral approach (23). Health thus extends beyond health services, encompassing other elements such as nutrition, education, water supplies and housing. The concept is not new. As far as several decades ago, community development programmes centered on basic health services were started in many developing countries (24). One of the great merits of the Declaration of Alma-Ata was however to clearly formulate the community based approach to health, in a coherent and internationally "marketable" form (23).

Primary health care is therefore much more than a level of health care. It is more than a strategy for health. It is a philosophy (25). It proceeds from a new concept of development. For the 25 years following WW II, increased production was viewed as the solution to the problem of underdevelopment. Health, and other social services like education, were considered as non productive consumption sectors. It was thus believed that an increase in the average national income (GNP), taken as a measure of progress, will "trickle down" to improve the standard of living for all, and consequently better health status" (23,26).

That increased production did not automatically result in fair distribution of incomes and resources soon became apparent, as demonstrated by the "Green Revolution" which in some cases led to no improvement in the productivity of poor farmers, and to growing marginalisation of subsistence farmers (23).

It was then suggested by the International Labour Organization (ILO) that progress in development should be measured by access of the people to basic needs (27). Improvement of health will thus become a major contributing factor to development. The Primary Health Care approach is part and parcel of this so-called "modernization theory" of development. The final aim is to foster development through improved health. As put by Dr H. Mahler : "Just as health promotes development, so development tends to promote health" (28). In the context of the so-called strategy of basic needs, the underlying goal is to promote social justice. This is well illustrated by the Declaration of Alma-Ata, paragraph II: "The existing gross inequality in the health status of the people particularly between developed and developing countries as well as within countries is politically, socially, and economically unacceptable." (20)

The joint report presented by WHO and UNICEF at the Alma-Ata Conference stresses that :

"Primary health care is the key to achieving an acceptable level of health through the world in the foreseeable future as part of social development and the spirit of social justice... This

requires international agreement on the adoption of a worldwide primary health care policy and strategy with the goal of making essential health care available to all the people of the world" (22).

In 1981, the Thirty-Fourth World Health Assembly fixed a schedule for the implementation of Primary Health Care, by endorsing the "Global Strategy for Health for All by the Year 2000 (HFA 2000)" (resolution WHA 34.36), whose paragraph 5 reads:

"(the Assembly) invites Member States (1) to enter into this solemn agreement for health of their own volition, to formulate or strengthen, and implement their strategies for health for all accordingly, and to monitor their progress and evaluate their effectiveness, using appropriate indicators to this end; (2) to enlist the involvement of people in all walks of life, including individuals, families, communities, all categories of health workers, non-governmental organizations, and other associations of people concerned." (9) As stated by Mahler: "health for all is thus a holistic concept calling for efforts in agriculture, industry, housing, and communication, just as in medicine and public health". (6)

However desirable is the purposed aim, and however prophetic might be these declarations, a lot remains to be done to actually implement the primary health care approach and make it fully operational.

Several large categories of difficulties should be mentioned:

- (1) The PHC approach calls for a total political commitment, together with a shift in the allocation of resources in favor of underprivileged groups of populations. In this respect, it is truly a revolutionary strategy for change (29,30,31). It emphasizes social control over health services and it is part of the wide process of democratisation of the masses (32).

Consensus however is one thing, implementation is another. How seriously governments are ready to effect drastic changes

is open to question (23). It is a long way between endorsement of a recommendation in Geneva and actual implementation in the countries.

- (2) Primary Health Care is basically multisectorial in its approach; it requires for it being successful the enrollment of the politicians, other departments of the government, the communities, the individuals, in addition to the medical profession and public health managers.

For many people, including part of the medical profession which do attend Alma-Ata-type conferences or the World Health assemblies, the primary health care approach is coming from the blue. For most of the people, medicine has always been and still is equated with cure and services. For them, the doctor should do its job which is to attend and if possible cure the sick, and they do not see why they should suddenly be given a participative role in this new and unusual approach to health promotion.

- (3) In spite of considerable efforts to give practical directives for implementation, especially by WHO, PHC is too often defined as "should not" rather than "should", as a reaction against the shocking discrepancies observed between the needs and the type of care provided in many LDC's. This is exemplified in the Alma-Ata report: "There is a wide disenchantment with health care throughout the world...provision of medical care is dispensed by growing numbers of specialists, using narrow medical technologies for the benefit of the privileged few" (22).

Great emphasis is placed on the need to avoid sophisticated technologies and keep within local resources using methods acceptable by the people, including traditional medical practitioners. While all this is correct, it could however deviate and easily lead to an anti-technology bias.

- (4) PHC has to some extent a "reductionist" element which tends to condense a complex problem into some basic components such as community involvement or appropriate technology, or even to

trim it to concepts, such as horizontalization or integration. In addition, PHC is held as a dogma by some of its tenants, who forget that slogans and catch-words are not substitutes for facts, and organizational structures are a means to achieve objectives and not an end in themselves.

- (5) The PHC proponents indulge at times in overenthusiasm. While the greatest possible benefit for the most possible number of people is a very noble goal, it raises also a dilemma, since it is never possible to maximize two independent functions at the same time (33). "What is efficient to achieve equity may not be efficient to achieve health" (34). Loss of credibility could be the price to pay for such simplifications.

In summary, PHC is proving a remarkable stimulus for rethinking the approach to health in a spirit of social justice and individual dignity. To what extent results will be achieved on the scale expected remain to be seen.

3.2. Selective Primary Health Care

In view of these difficulties, a new approach has recently been advocated as a substitute to PHC, that is Selective Primary Health Care (SPHC), as opposed to "comprehensive" primary health care as defined in Alma-Ata.

This approach, proposed by Walsh and Warren in 1979, has been presented as "health care directed at preventing or treating the few diseases that are responsible for the greatest mortality and morbidity in less-developed areas and for which interventions of proved efficacy exist" (35). It is based on two main arguments: (1) PHC as proposed by the Alma-Ata Conference (CPHC) is "unattainable because of the cost and numbers of personnel required"; (2) PHC would cost billions of dollars, even if the water and sanitation components are excluded. As stated by its proponents: "Faced with the variety of health problems facing mankind, not all ills can be attacked now... To do the greatest good, health services should be directed toward controlling those diseases

producing the largest amount of death and disability, and care should be made accessible to the greatest numbers."

In the SPHC approach, health problems should be prioritized on the basis of four factors, i.e. (1) prevalence; (2) morbidity, or severity of disability; (3) risk of mortality; (4) cost of control (including relative efficacy and cost of intervention).

In brief, instead of a full health infrastructure based upon primary health care, the SPHC approach would reduce the scope of health services in accordance with the findings of cost-effectiveness analysis (36). The approach should be strictly categorical and selective, targetting specific diseases for control and excluding all the rest. For example, an effective program could consist of :

- (1) measles and DPT vaccination for children over 6 months,
- (2) tetanos toxoid to pregnant women,
- (3) encouragement of long-term breast feeding,
- (4) chloroquine for children under 3 years of age,
- (5) oral rehydration.

The Selective Primary Health Care Approach has attracted a great deal of interest from international or bilateral agencies such as the World Bank and USAID. To some extent, the WHO-sponsored Expanded Programme of Immunization (EPI) can be considered a categorical intervention of the type advocated for SPHC. In 1982, UNICEF endorsed the selective approach with the GOBI-FF program aimed at children and pregnant women. It consists of the following: (G) mass use of growth charts to monitor child development, (O) widespread availability of oral rehydration salts, (B) promotion of breast-feeding, (I) immunization of all children against measles, diphtheria, pertussis, tetanus, tuberculosis, and poliomyelitis, (F) food supplements for pregnant women and young children, (F) family planning, emphasizing birth spacing.

It has also stirred heated debates and scientific polemics. The examples provided by its authors, mainly an experience in Haiti (37), for supporting their approach, are much open to criticism (38). The problem is however much broader and goes back to the unending controversy between vertical vs horizontal programmes,

specialized vs comprehensive services, health vs development, medical vs social, disease-oriented vs comprehensive care, experts vs people, sophisticated vs appropriate technology, foreign vs local, centralization vs decentralization, dependency vs self-reliance, short-term vs long-term, and finally effectiveness vs equity.

One of the main confusion in this debate is on the term of priority. Priority should not be taken to mean exclusivity.

It is quite possible that the effectiveness to be expected from the Selective Approach in the short-term will be greater in terms of results for dollars than the admittedly vague benefits looked for in the Primary Health Care comprehensive approach. It has been objected that the results of previous vertical programmes of that kind (malaria, yaws, and now onchocerciasis) have never been maintained in the long-term in the absence of an horizontal health infrastructure. This is however no sufficient reason to incriminate categorical programmes for all ills, including to have hindered the provision of primary health care. They have undoubtedly saved millions of lives and made life a little more worth living for tens of millions of people.

Placing the debate a step further, it is precisely this expected efficacy of the selective approach which should induce extreme caution.

Narrowly focussed health programmes overlooking the multisectorial aspects can be responsible for ecological, social and economical catastrophies: overgrazing and famine in Sahel, unemployment in South East Asia, demographic explosion, misery. The great advantage of Primary Health Care as defined at Alma-Ata is precisely that it is a soft end ecologically sound approach which takes all other aspects of development into consideration, in order to ensure a balanced progress. It is perhaps the relative unobtrusiveness of comprehensive primary health care which is its best warrant for success in the long-term.

4. HEALTH SYSTEM RESEARCH

4.1. The components of health systems

Four elements should be considered in health systems :

(i) knowledge; (ii) technology; (iii) method; (iv) strategy.

- i. Knowledge is necessary to identify these factors amenable to intervention. After centuries of devastating epidemics and possibly millions of deaths, the identification of the mosquito, Aedes aegypti, as the vector of the yellow fever virus made possible to envisage the control of this dreadful disease. Basic research aims at increasing such knowledge.
- ii. Technology is applied knowledge (39). It refers to available means, both for prevention and/or cure. It includes vaccines, drugs, insecticides, screening devices, diagnostic tests, surgical procedures, prothesis, water supply, together with information systems and managerial procedures. The vaccine against yellow fever is technology, as are insecticides to control the insect vector. It is the aim of applied research to develop such technologies.

There is no intervention possible if either knowledge and/or technology is lacking. Intervention is possible when both knowledge and technology are available, even in the absence of methods and strategies. In such cases, it however runs the risk to achieve irrelevant, and at times, grotesque results. It may result in large expensive campaigns for rare diseases, huge hospitals with specialized services to be used only by a few, or transfer of irrelevant technologies. When this happens, the reason is often that the objectives were set up on a very fragmented view of the situation, on the basis of professional incentives (physicians), prestige (politicians), vested interests (industry, foreign governments), or ignorance (donor agencies).

iii. Methods may be taken as referring to the use of an effective technology based on appropriate knowledge, or to the combination of several technologies, together with the logistics required to apply them. Yellow fever vaccination targetted at high risk groups identified by serological surveys, is a method, as is the insecticide spraying of the vector's biotopes. It is the aim of operation research to define the optimal methods according to cost and effectiveness.

Accurate measurements in terms of both economics (cost) and epidemiology (expected impact) are here essential. Such measurements raise however great difficulties. Cost factors are extensible, depending on how they are defined (free labor, donations, discount for results expected in the long term). Epidemiological indicators such as mortality, morbidity, handicap, loss of productivity, absenteeism from work, often do not provide a basis for deciding priorities between several categorical disease oriented programmes.

Calculating net social benefits is therefore fraught with methodological and ethical difficulties (40). It concentrates on measurable parameters and does not take into account suffering, worry, or quality of life. Ideally, interventions should be based on the measurement of quality-adjusted life years gained (15), but this at the moment is more a concept than a reality.

Disease-oriented vertical programmes have been largely based on the cost-effectiveness approach. It has also been applied to the elaboration of model for health care planning, the best known example being the so-called CENDES methodology in Latin America, in the late 1960ies. Equating cost and lives, using sophisticated method of discount for age and other factors, may prove highly sensitive to arbitrary values introduced in the model and, in addition, psychologically unacceptable.

Selective Primary Health Care is based on the same simplifications of the cost-effectiveness methodological approach using a limited number of measurable parameters.

- iv. A strategy refers to a combination of methods in a political context, "providing the broadlines of action required in all sectors to give effect to health policy" (9). It requires setting up objectives and defining priorities on a comprehensive basis, taking the whole health situation and needs into account. It could better be termed "system". Beyond cost effectiveness, it implies that societal values, such as social justice or equity in the distribution of services, be taken into consideration.

Primary Health Care is a strategy, as is Selective Primary Health Care.

4.2. Definition of health system research

The opening sentence of a recent book on Health Systems Research (HSR) reads (42) "...health systems research is important, but there is little general agreement as to what it actually is." This may look as a candid statement, but it reflects well the state of a relatively recent and rapidly expanding discipline.

Health Service Research has been defined as: "... an integral part of health services development and any group of activities which involve the generation of information or the application of knowledge on a scientific basis with a view to providing more effective, efficient and equitable health care for defined populations. Giving due regard to the social, epidemiological, economic, legal, operational, theoretical and political dimensions, health services research aims to assist in the improved design and management (planning, implementation and evaluation) of health services" (43).

Since it is now recognized that health depends to a large extent on variables outside the health services, "Health Service Research" has recently been relabelled "Health System Research" in order to encompass the system as a whole (42).

4.3. Scope of health system research

Health system research lies at the interface between theory and practice. It encompasses many domains, such as the selection and evaluation of health strategies, the conditions for transferring technologies, the study of anthropological factors determining community participation, the management of services, manpower development, training, to take only a few examples. It can be compared to a black box. On one side, there is a number of inputs: knowledge, techniques, concepts, objectives, resources. On the other side, there are outputs : health, quality of life, decrease of mortality, trained personnel, optimal use of technology, appropriate managerial practices, cost-effectiveness, fulfillement of the health needs of the populations.

Why is it that often, and more particularly in LDC's, the output does not correspond to the input. Why is it for example that, in spite of considerable theorizing and the mobilization of large resources, health interventions in many developing countries present, according to The World Bank, the following characteristics (5):

- (1) health facilities are not geographically accessible to all;
- (2) availability of services is erratic;
- (3) services are of doubtful value;
- (4) many persons are excluded due to economic barriers;
- (5) curative care is emphasized to the detriment of prevention and early detection;
- (6) services provided are of low priority;
- (7) basic health care facilities are inadequate as compared to sophisticated hospital care facilities;
- (8) medical education is often inappropriate;
- (9) adequate support and supervision of health workers is lacking;
- (10) health services are not focused on the community needs;
- (11) there is inadequate supply of drugs and equipment as well as inadequate use of health facilities;
- (12) quality control is non existent;
- (13) patients are not complying with health measures and treatment.

The response to these questions is out of the scope of basic research. Accumulation of new knowledge will remain useless if it cannot be translated into practice in the field.

Health system research is addressing these multifarious problems. By its very nature, it is multidisciplinary.

4.4. Methodology of health system research

There is at the moment no universal methodology for Health System Research. "The discipline is inclusive in its approaches, and methods are to be borrowed from many disciplines. Since the field is still evolving, it would be unproductive to be restrictive in specifying which methods should be used." (42)

A number of methods may be used. The types of health services research are classified as follows by C. Taylor (42):

1. Descriptive analysis of health care situations and policies,
2. Operational research for incremental improvement of management,
3. Adaptative research to test alternative interventions and management procedures,
4. Fields trials,
5. Natural experiments and comparative analysis,
6. Field experiments testing total health packages.

Before and following Alma-Ata, numerous primary health care experiments have been initiated. The application of the HSR methodology to the evaluation of their actual accomplishments is urgently needed, in order to establish the basis for the generalization of the approach.

Another avenue for health system research in the future will be the assessment of these new technological tools for detection and prevention, resulting from accelerating breakthroughs in fundamental research, and their integration into primary health care.

II. RESEARCH PERSPECTIVES

5. EVALUATION OF PRIMARY HEALTH CARE PROJECTS

5.1. Actual implementation of Primary Health Care

The report of the Alma-Ata Conference outlines clearly and without ambiguity the concept of Primary Health Care. However, as stressed by the Director-General of the World Health Organization, it "did not elaborate detailed definitions or plans of action; this was left to individual countries" (44). In the meantime, WHO has undertaken considerable efforts to translate principles into facts by tackling concrete issues. Regional strategies have been designed. Indicators of effectiveness, efficiency and equity have been developed. The present status of PHC in the countries has been systematically reviewed (45).

Implementation is however meeting with difficulties. As stated by Walt and Vaughan : "In order to remain practically uncontentious, WHO policies may be so general and so comprehensive, as to be non operational... While there is little disagreement about the underlying principles of the Primary Health Care approach, they do not add up to an operational policy". (23)

The term Primary Health Care means different things for different people (21). A review of official reports on the implementation of primary health care at the national levels clearly indicates that a number of health services or projects are presented as PHC which have little to do with the concept, or even represent its counter-image (44,45,46). Many justify their PHC appartenance through one or a few components only of PHC, generally some kind of community participation, use of local auxiliaries, or collaboration with traditional healers.

A considerable amount of work remains to be done in order to sift actual primary health care projects from their surrogates, identify obstacles to their implementation, and define the conditions for their replication. It calls for the development of a specific methodology of evaluation using well-defined and standardized criteria.

A number of reports relating the successes, the failures, the constraints and the shortcomings of various primary health care projects have been published. Although these are often selected reports, providing only part of the picture, and most likely the brightest part since they come from the health managers most interested in this challenging endeavour, an analysis would be helpful to monitor the implementation of PHC.

The common problems met in primary health care were summarized as follows by Richard A. Smith (138) :

1. Fragmented approach to health sector development
2. Lack of broad base of support for a national program
3. Obsolete organizational structures for delivery of primary health care
4. Inadequate management support
5. Failure to develop a planning capability
6. Lack of overall manpower plan
7. Ineffective and inefficient training
8. Lack of on-the-job continuing education
9. Failure to involve local community in national and regional primary health care programs
10. Cost

As stressed by WHO, one of the principal constraints to the implementation of the present PHC strategy is that it has to be put into operation in situations which are constantly changing, due to social-political and economic changes, movements of population and natural disasters (45).

5.2. Political problems in the implementation of PHC

At the central level, the implementation of primary health care calls for a drastic reallocation of resources. Such a reallocation requires "strong political will and support at both national and community level, reinforced by a firm national strategy" (22 report). Many political barriers have therefore to be overcome. "Governments are always tempted to allocate scarce resources to vocal groups who demand access to reasonable services - in the cities - and to economize on services for the typically politically

inarticulate in rural areas" (23). Urban elites will lobby to prevent politicians from reallocating resources if the services they are using are affected. Professionals, and more specifically the medical profession, will also exert influence to preserve resources in favor of large intellectually and financially rewarding hospitals.

Moreover, as suggested by Walt and Vaughan (23): "how seriously Governments will want to effect a national change is open to question. If health workers (at the primary village level) become "change agents" (47) or consciousness raisers, then disenfranchised majorities (48) may become increasingly aware of the maldistribution of power and therefore resources, both in and out the health sector, and try to do something about that imbalance".

The issue of decentralization is particularly important in this respect. Primary health care is based on a strong decentralization, with responsibilities transferred to the intermediate and peripheral levels. Decentralization is however a very sensitive political issue. In many countries, there is a strong tendency for centralized government to control all sectors, including health (49). Primary health care services if appropriately implemented may conflict with this policy.

Political implications are not limited to national levels (23). Even at the village level, there may be conflict between different status groups or classes resulting in the sabotaging of primary health care plans and activities (50). A tendency to idealise village communities has sometimes obscured the reality of community power structures, jealousies and divisions (23).

Primary Health Care may also be considered as second-rate medicine by political leaders and villagers. The eight components of primary health care do not necessarily correspond to their own felt needs and priorities (51).

The problem is aggravated when local communities are urged to contribute to the financing of their health services. In a large PHC project in Ghana "the villagers did not seem to want to

organize communal activities that would substitute for a government input, because they were trying to bargain for more such inputs, which they felt were their due." (74) There is evidence from a number of countries that rural communities "are beginning to question why they should be expected to pay for health while their urban compatriots can expect to have these things free." (45)

The successful implementation of primary health care requires a multisectoral approach to socio-economic development. As stated in the report of the Alma-Ata Conference: "Health cannot be attained by the health sector alone. In developing countries in particular, economic development, anti-poverty measures, food production, water, sanitation, housing, environmental protection and education all contribute to health and have the same goal of human development. Primary health care, as an integral part of the health system and of overall social and economic development, will of necessity rest on proper coordination at all levels between the health and all other sectors concerned." (22). As stated by Taylor: "The fact that health depends as much on factors outside the health system as on health services is a basic dogma of the primary health care movement." (42)

Yet in a number of countries, it appears that the PHC policy has not been fully grasped by ministries of vital importance for its development, such as housing, agriculture, environment, finance, and planning. "Primary health care is too often seen only as a health service strategy - to be initiated by the health sector alone. Given the reluctance of other sectors to delineate their own specific role in primary health care development, ... it is not surprising that the basic reorientation implicit in the primary health care approach continues to encounter resistance at many levels." (53) Also "bureaucratic jealousy and exclusiveness may lead to feeling of territoriality and protective rigidities within each sector. Incentives for cooperation are not spontaneously evident in most political or economic structures." (42)

The issue is not intractable, provided there is a definite commitment from the Ministry of Health. The experience of Zambia is

interesting in this respect, where as a first step for stimulating interest and intersectoral collaboration a document explaining primary health care was distributed to all ministries and administrative authorities (54)

This lack of commitment trickles down from the top central level to the regional and peripheral levels, although there can at times be more collaboration and exchange as one goes down the administrative scale, for people in the field are faced with common problems.

Research should be conducted on the way to develop better communication and natural understanding between sectors. This infringes on the whole field of what could be termed "institutional engineering". It is not an easy subject, which possibly has more to do with cultural anthropology.

5.3. The role of community health workers

Community workers are the cornerstone of primary health care at the village or peripheral level (22). "He is a man or a woman who can read and write, and is selected by the local community or with their agreement to deal with the health problems of individuals and the community. He will be responsible both for the local community authorities and to a supervisor appointed by the official health services. He will follow his supervisor's instruction and work with him in a team. (He/she) will be paid for his work, in cash or in kind, by the local community." (195)

The concept of the health worker rooted in the community is clearly inspired by the Chinese barefoot doctor, which "has fired the imagination of the international health establishment" (212). While there had long been paramedical workers in all parts of the world, the Chinese model was particular due to his close link and active interrelationship with the community.

It is not certain that this model can be generalized everywhere (109). Serious problems are encountered with respect to the selection, training, role, supervision, remuneration and acceptance of the community health workers.

Selection is closely linked with motivation, social status, conferred advantages and political structure. Ideally, community health workers should be young people from all social classes, selected by the villagers. In many instances, members of the village's elite will be more inclined to propose their services, and more likely to be selected. In some cultures, such as Western Samoa, this will be the rule (135). Relatives or friends of political influential people can also be chosen, regardless of suitability and commitment (109). This will not necessarily favor a fair distribution of the services and may even enter in conflict with the claimed purpose of equity inherent to the primary health care approach.

Whatever his/her mode of selection, the situation of the community health worker is ambiguous in many respects, vis a vis the leaders of the community, the elders, the traditional healers, trained health workers from other programmes, and community workers in other sectors.

It is not sufficiently realized that the tasks given to the primary health care worker represent a formidable affair. He should at the same time be, albeit in miniature, a sanitary engineer, a doctor, and an educator. More difficult, he must be able to recognize these problems he is supposed to handle, and to handle well, and those he does not know enough about and should refer.

"Lists of tasks and functions drawn up for community health workers by ministries of health have been based, to a large extent, on the eight essential components of primary health care outlined in the Declaration of Alma-Ata. This means that they are often expected to take responsibility for a wide range of functions, including home visits, environmental sanitation, provision of a safe water supply, first aid for injuries, treatment of simple and common ailments, health education, nutritional surveillance, maternal and child health and family planning activities, communicable disease control, community development activities, patient referrals, record-keeping, and the collection of data on vital events. To these, some administrators have recently suggested, should be added responsibility for occupational health programmes for local agricultural and factory workers. A list of this kind would daunt

many a professional health worker: surely it is absurd to expect village workers to shoulder it. Considering their level of general education, the type and duration of their training, their likely means of transport, the standard of their equipment, and the health needs and size of their communities, it is difficult to see how they can perform effectively and safely in all these areas".(53) Moreover, he should take an active part in the collection of health information at village level and in the establishment of local health profiles, for "the health information needed to indicate the existence of a health problem or to facilitate the management of primary health care must be provided by the same personnel" (56).

By contrast with the multiplicity and complexity of his tasks, the training of the community health worker is limited. Curricula are often unrelated to the job to be done, because this has not been determined beforehand. Much training is theoretical and not adequately supervised. Manuals and other learning aids are often available centrally but not where they are actually needed. Also they are frequently irrelevant to the specific problems and socio-cultural circumstances of individual communities (53). The essential inconsistency lies in the magnitude of the results expected and the very meagre resources and efforts invested (24). In addition, training is sometimes divorced from the expectations and needs of the primary health care strategy (57).

In other words, one is probably expecting too much from the community health workers (24).

Supervision is probably still in a worst condition than training. "Inspection is often substituted for education, criticism for consultation, and irritation for understanding." (24) There is a critical need for training in supervision, and in the development of adequate methods for this particular training. "Without careful, appropriate, adequate, and sustained preparation followed by supportive supervision from informed and sympathetic professionals, community health work must inevitably fail." (24)

Central to the issue is the mode of remuneration of the community health worker. Apparently, he should be a volunteer, who can experience "gratification and satisfaction not only from short-term curative responses but also from new community relationships that produce long-term results" (42). There should be no salary. The failure of community development as advocated in the 50ies was in part attributed to the appointment of paid community development workers, who had received some education and were external to the communities in which they were to work (55). "Payment negates the unique, and the most effective characteristics of the community health workers - that of being one of the people. With that very special quality gone, the community health worker becomes just another worker in the health care system." (53) This argument is rather specious, since the traditional healer, this topmost of care at the primary level, is paid, as is the Chinese barefoot doctor. In Burkina Faso, the minimum charge in traditional medicine is of the value of one chicken (51). In China, the remuneration of the male barefoot doctor varies with the resources of the community, commune or other entity, varying in Shanghai County between 700 and 1300 yuans per year (the salary of the female barefoot doctor being inferior to that of the male) (58).

In any event, where poverty is paramount, to expect voluntary work from the indigent at the subsistence level is somewhat unrealistic (24). To obviate this difficulty, a number of PHC projects pay a small salary or give other types of incentives or rewards to the community health worker. It has been recommended that a "nominal or financial payment be made in kind, but not to the extent that the worker may abandon his customary villager occupation. The reward system should for preference be traditionally based" (24). Token salaries paid by the community have also their shortcomings. They create a relation of dependency between the health worker and the villagers, who will then tend to exert all kinds of pressures for services. As mentioned earlier, villagers from poor rural areas will also not understand why they have to pay for basic health services while inhabitants of cities will get (at time free) sophisticated care.

One solution is to pay the village workers a fixed percentage from drug sales, but this may lead to overprescribing (53). It also supposes that health care is not free, which opens a new debate as to whether when, under which conditions and for whom some services delivered within the health care system should be given for payment, another major topic for research on health systems in developing countries (42,51).

The issue is so complex that it has even been suggested to drop volunteer village health workers, and replace them with outside health educators whose mandate will be to promote self-reliance and encourage the villagers to handle their own health affairs (53).

As a consequence, it is the whole role of the community health worker which should be analysed. He or she is at the interface of complex delivery systems and a socially complex community. His/her training is limited. Still, he is supposed to react to all possible conditions, screening the ones he can cope with and referring the other. He has a highly ambiguous social status, since the local community and the government do not understand his role in the same way (59). The responsibility placed upon him is immense (24). In case of failure, the blame will fall on him rather than to the inadequacy of the system (60). No wonder therefore that the turnover of community health workers is rapid. In some countries, the drop-out rate reaches 30 per cent per year (61).

An analysis of the utilization and working conditions of the community health worker in different contexts on the model of what has been undertaken by WHO (127) is therefore essential.

5.4. Community participation

The role of the community health worker in primary health care outruns the narrow issues of motivation, remuneration and training. It raises the whole problem of community participation which, together with the intersectoral cooperation and the peripheralization of services, is at the core of the primary health care approach (42).

According to the Alma-Ata report: "Community participation is the process by which individuals and families assume responsibilities for their own health and welfare and for those of the community, and develop the capacity to contribute to their and the community's development (para. 44). Strengthened by the guidance and information (from central planning authorities), members of the community are better equipped to participate fully in the formulation of their primary health care programmes, by analysing their own health problems, taking decision on priorities, making local adaptation of national solutions, and establishing their own community organization and support and control mechanisms (para 57)" (22).

The knack of the system is whether the process will be top to bottom, or the reverse. Guidance from the central level may be resented as mostly artificial and authoritative by the peripheral level, that is by the villagers far away from the capital city, and counterpoised appropriately. Bottom to top definition of priorities and design of solutions, as is advocated, might at times be inadequate, to say the least. The heart of the matter has not been solved. It depends of course on the local context, and will vary from country to country, region to region, even from village to village.

Meanwhile, the concept of community participation can be siphoned of its original context by all sorts of diversions. Using various kinds of indicators, community participation can become simply one more abstract parameter in planning (51). Or, instead of being genuine, and based on truly voluntary involvement as well as on a sense of responsibility to the community at large, it can represent no more than window-dressing, where "community representatives are included for show, while the real power continue to be exercised in centralized and traditional ways" (62). Still further, what should one make of compulsory community participation compelled by all means when "work is complicated by the existing social structure and tradition" and one has to "struggle against apathy and ignorance and sometimes active opposition", and when as a consequence "it is not surprising that the methods used to deal with those opposing the work may be rough and ready, and that disputes that arise are

sometimes settled with fists rather than with speeches" (63). To make things more difficult, community participation can be taken as a convenient explanation for status quo, when "health services professionals ..., recognizing their failure to achieve adequate primary health care coverage, tend to use this new emphasis as a convenient excuse for shifting responsibility back to the community" (42).

Last but not least, there can be no organized community. This is the case in urban slums and in displaced or disrupted populations, a most common situation those days. It is not possible to artificially set up a community, but organizing loose groups and identifying potential leaders is not an impossible task as it has been shown for example in Colombia (64). It however requires much flair and perseverance. Setting up village committees for the sole purpose of enhancing the implementation of primary health care may however often be an artificial solution, for these committees may dissolve once the local health post or other similar facilities has been constructed. Local organizations established for other purposes may prove more stable, such as agricultural cooperatives, women's club, local committees of political party, or religious organizations (31).

It is therefore not surprising that, according to a review carried out by WHO in a number of countries, community participation was found to be one of the weakest elements in health planning and sectoral decision-making (45).

Before putting the accent on participation of the community, two questions should be addressed; namely (a) how does health ranks as a priority for the poor people of the world to whom primary health care is mainly directed ? (b) what does primary health care as presently publicized mean for them ? The problem was raised by MacKay, who referred to the picture of rural masses seeking desperately for some means of obtaining primary health care as an erroneous one, and argued that there was no felt needs by people of the developing countries for medical care services, concluding "Perhaps we have in the past too readily assumed that we knew what

people ought to want, and transposed that into what we thought they really did want" (65). In this respect, the relative underutilisation of primary health care services where they do exist (45) is sometimes baffling.

It is indeed by no way clear that health is a major priority for most people or more precisely health as embodied in the primary health care approach. Illness is the real issue at stake, the issue people know. "Many of the people in underprivileged territories are not even aware of health; they are aware of sickness and the absence of sickness." (66) A story goes that a survey carried out by sociologists in South India exposed health (excluding malnutrition) as the twenty-sixth priority, trailing land ownership, education, and many others. People do not know what good health is, and in many countries live in such a state of dereliction and hopelessness that they go thinking cataract is an inevitable attribute of old age, smallpox (formerly) a punishment from the gods, and schistosomiasis with hematuria in boys the male equivalent of menarche.

As for primary health care, it stands in the middle between traditional medicine, and Western medicine. Traditional medicine, a highly respected trade in many cultures, clearly responds to a number of high priority and common ailments, such as traumatism (bonesetters in Burkina Faso), dermatological diseases, psychic disorders, and psychosomatic problems. People have good reasons for resorting to the traditional healers. They are accessible, they have social prestige, they understand the local social context and know the environment, they have sufficient supply of drugs (herbs and others, often Western medicines) (51). As a consequence, the healers are willingly paid by their services.

Regarding Western medicine, the assertion that the villagers would prefer primary health care is another of these assertions which need serious ascertainment. As soon as these populations have access to some kind of satellite television - and this is part of education - they are fascinated by the modern health technology available to their fellow citizens.

Where thus stands primary health care, and the community, in the middle of poverty, frustration, tradition, and television? How, when, where and to what extent primary health care responds to the desire of the rural populations remain to be studied. No amount of expert wishful thinking will make do, and pledges for health education are no substitute.

There is a wide field of study open to the cultural anthropologist. The problem has to be addressed, and answered, in order to make primary health care successful for the large numbers.

5.5. Health education

Education is the key to progress. Health education is a most effective tool to support and reinforce activities aiming at improving health. It is an essential component of the Primary Health Care approach.

Health education should however not be made into what it is not. To make of it the ultimate panacea to muddled issues is at the same time a fallacy and a deadlock. To advocate health education as the way to convince people that primary health care is best for them amounts to a "chicken and egg" situation (65). While it is supposed to be based on felt needs and local conditions, people have to be told what needs they should feel. Primary health care then runs the danger to become a circular issue.

Health education should therefore be targetted to specific activities: knowledge about the transmission of major diseases, preventive control measures, compliance to treatment, and many others. Inasmuch as no health measures can be successful without information of the community and its full participation, specific studies should be made of the reasons for no participation and the best ways to remedy it.

5.6. Verticalisation of primary health care

Many policy-makers tend to view primary health care in isolation, whereas it is "an integral part both of the country's health system and of overall economic and social development" (22). While

primary health care delivered by community health workers focuses on individuals and families at the community level, it is much more than primary level care. "Primary health care does not begin and end with the village health worker: it cuts right across the entire national socio-economic development. And for primary health care to succeed, it must be supported and integrated with the secondary and tertiary health systems" (29).

The narrow view of primary health care being restricted to peripheral care may conduct to an isolation of primary health care within the whole health system.

The coexistence of activities conducted in parallel, such as specific control campaigns, immunization programmes, and an approach based on Selective Primary Health Care, may contribute to further isolate primary health care from the remaining components of the health system. At the extreme, this may lead to a "verticalization" of primary health care (189), as a special often second-rate care entity at village level, which will eventually be directed by a special department in the Ministry. This encapsulated primary health care then may become little more than an alibi.

The mechanism for such a tendency should be properly analyzed.

5.7. Organizational problems

Care at the community level needs back-up, support and supervision at the intermediate level. Often, the articulation between the primary and the secondary care levels is poor. Transport is rare or difficult, adequate referral services are inexistent, training and supervision are deficient. Still worst, supplies are oftentime quite inadequate. "It may be possible to identify essential drugs, but what is even more essential is ensuring their distribution on a routine and consistent basis" (23). In spite of the definition by WHO of the essential drugs for primary health care and of the progresses made in many countries for formulating a national drug policy and for listing essential drugs, the distribution of drugs is still often reported as erratic. Health units run out of stock, and the non-availability of drugs leads to the closing down of

rural health facilities (45). By contrast, even though government facilities, including primary health care workers in the villages, are chronically short of drugs, the private sector, including traditional healers "invariably manage to purvey basic medicaments, even in remote areas" (42). As a result, the quality of services at the peripheral level is often poor (187), which does not help in their advertising and does not boost the credibility of health worker.

This calls for operational studies regarding ordering of supplies, local production, storage, packaging and delivery systems at the peripheral level.

5.8. Replication of PHC projects

The ultimate end of primary health care is to ensure health coverage to the entire population according to the needs. Although the majority of the countries have taken steps to implement primary health care at the national level, most of the achievements recorded at present concern localized projects. An abundant literature has been devoted to a relatively few number of such projects. In 1975, before the Alma-Ata conference but not unrelated to its inspiration, Newell (12) has reviewed a number of such projects: the Chimaltenango development project in Guatemala; the comprehensive rural health project in Jamkhed, India (109); a project in Central Java, Indonesia; the West Azerbaijan project in Iran; the village health teams experience in the Maradi Department, Niger. Other published examples include Kasongo, Zaïre (67,68,118); Ivanjica, Yugoslavia (55); Pikine, Senegal (109); Jacaltenango, Guatemala (71); Lampang, Thailand (72); Gaoua, Burkina Faso (73); Danfa, Ghana (74); Narangwal, India; Savar (People's Health Center), Bangladesh (63); Nicaragua (76).

Since some of the rationale for the primary health care approach has come from the recognized successes of a number of local projects (23), the immediate issue is their replication at the national level. Reporting on the well-known San Jacintos Project in Chimaltenango, Guatemala, Dr Behrorst writes: "True, San Jacinto is not the world, but a million San Jacintos might transform the

world" (77). Replication from community-based locally initiated projects is particularly attractive for they represent the bottom-to-top approach which is central to the primary health care philosophy.

How is it thus that "the effectiveness of national scale replication of successful pilot programmes has not yet been convincingly shown" (78).

One of the reasons could precisely be the uniqueness of these local projects in an environment which is generally hostile to the primary health care approach. Hence in their description the frequent emphasis on "what was before", or "how it is elsewhere".

A salient feature of many projects is that they are attributed to the initiative of some individuals (23) (a couple of doctors who arrived in 1929, a missionary, a leading community headman...). This may be due either to preferential publications of projects based on individual initiatives (would it be only to pay tribute to some passed away personage), or to the fact that successful projects actually need some catalysts in the form of a charismatic initiator or a special context. "The successful community based health care programmes generally have someone - a local leader, a member of the church, or a particular health worker - who understands the villagers and can galvanize and inspire them to activity." (60)

The pity is that good attitudes cannot be mass-produced (259,279). If primary health care truly requires special personalities to meet with success, one may question the possibility of replicating these projects on a wide-scale. Then, there is a danger that primary health care remains an extraneous concept imported from outside, once again an example of cultural domination cogitated by experts, the supreme paradox being that it trumpets the needs to make do without experts and let the people decide. This is a serious problem, because on its answers will depend the ultimate goal of Health for All.

Projects can be strongly affected by local circumstances, - particularly epidemiological profiles, patterns of migration, modes of work, religion, social and cultural norms -, which may raise obstacle to their replication (23).

More often than not local projects are operating under peculiar conditions. When they are conducted by non-governmental agencies or supported through various international schemes, additional personnel is a common feature, as is collateral funding. Some of these projects are heavily staffed with experts and consultants. "The criticism is often leveled that the resource mix available to these projects (leadership, finances, equipment, manpower) is so rich as to make it unlikely that the same results could be obtained if the activities were to be expanded to large-scale national efforts" (79). Also, the very fact that they lend themselves to evaluation is associated with an observer bias. Even when budgets for evaluation are established separately, evaluation is likely to introduce a placebo effect on the output.

These projects are often "administrated and managed outside the formal bureaucracy and thus have distinct advantages over large-scale programs" (31), which may favor the tendency of "external donors and consultants... to push too hard, too fast, regarding their own ideas of what ought to work. (79). Thus, "some of the initiatives that come from outside the normal administrative channel (can)be difficult to duplicate, quantitatively or qualitatively, elsewhere" (72). As a consequence, "While PHC programmes have been shown to be successful in reducing mortality and morbidity on a small scale, it is not clear to what extent they can be successful on a national scale, as part of a widespread programme, organized within institutional constraints." (78)

The problems generated by outside support creates therefore a major obstacle to the wide-scale extension of local primary health care projects.

The premature extension of such projects to other parts of the country can be a failure. "A common difficulty has been the

tendency to take a pattern of services evolved in a special project or as part of a centrally designed detailed plan, and then attempt to apply this model generally to a health system. The frequent lack of local adaptation and flexibility usually results in such a model having little impact." (42) Counterproductive results may also result from the multiplication of pockets of pilot projects that could not be replicated on a national scale, since this could lead to conflicts and frustration (29). It is therefore currently stressed that the extension or replication of primary health care project needs feasibility studies in order to bring the necessary adjustments.

"The issue is not whether a project is to be repeated, but rather how services are to be extended... The process of adaptation is evolutionary and requires a trial demonstration area." (72) For Taylor, the main emphasis in health systems research should be to improve services incrementally, step by step: "The innumerable obstacles and constraints that interfere with effective functioning need to be resolved in a progressive fashion through field studies. For every problem solved, others will emerge. This kind of continuing health system research can be an integral part of improving health services" (42). He recommends to conduct research following three main approaches: a) field projects to test alternative interventions and management procedures; b) natural experiments and comparative analysis; c) field experiments for testing total health packages. The great majority of health system research efforts should concentrate on "focused, small-scale, practical projects to test, under conditions that permit quantitative comparisons, specific interventions or altered management procedures".

One may question the need to set up more small-scale primary health care projects, while most of the general constraints and difficulties are already identifiable. What is needed is a systematic analysis of the shortcomings encountered.

One current recommendation is that of designing and testing minimal effective packages for primary health care, flexible and varying by

place and time as necessary (79). Nonetheless, the major problem which prevents the replication of these projects is donor leverage. These packages should therefore be tested only under conditions precluding or at least strictly controlling outside input of any sort, be it in terms of finance, expertise, or administrative facilities.

5.9. Generalization of PHC

The ideal primary health care project has been described as one having the following characteristics: a wide coverage, with potential for multiplication, beyond the terms of charismatic leadership, effective, low cost, acceptable to the population, capable of generating government support (55).

These are however not sufficient characteristics for allowing replication. There is no such thing as self-multiplication. Large scale replicability will depend in great part on the absorptive capacity at national level (79). The best and most relevant project can remain unique for lack of organizational capacity in the country concerned (78).

As stated by Golladay and Liese, "health bureaucracies are generally weak institutions, ... staffed by health care professionals rather than administrators. This pattern of staffing... is inadequate to operate system of health care that rely heavily on para-professionals functioning in isolated communities. ... The greatest deficiencies in the formal administrative structure are at the local level" (31). Implementation of primary health care therefore confronts health administration with new challenges for which it is not prepared, such as manpower management, logistics of supply, quality control, mobilization of financial resources, promoting (or accepting) community participation, and liaising with other sectors. It requires an "administrative-intensive approach that is qualitatively different from present administrative patterns... If institutional capacity is not sufficiently developed and particular efforts are not made to build this capacity, the most likely outcome is that the existing bureaucracies will either ignore the appropriate primary health care package, or mutilate and

transform it until it is congruent with institutional requirements and adapted to the actual level of bureaucracy efficiency" (31).

Strengthening of the institutional capacity at country level is therefore the preliminary requirement for a large scale implementation of primary health care. At present, it is often characterized by inadequate management, underdeveloped administrative machinery, and lack of organization among the concerned communities. Demonstration projects serving as testing grounds or "primary health care laboratories" are only part of the picture. Failing the necessary organizational and managerial skills, the best small scale pilot projects are self-defeating and will remain pet projects. They can even be counterproductive by "emphasizing the powerlessness of the community within the larger society intent on preserving the statu quo" (23). As a consequence, primary health care projects should be developed in phase with the capacity for replication at the country level, in order to develop manpower, organization, and managerial skills, which is a slow and time consuming process (79).

In the meantime, strengthening the institutional capacity of the health administration at all levels requires research and support, as much, and possibly more, than developing still more small scale projects.

5.10. Integration of vertical programmes

Ideally, primary health care should be given the responsibility for the delivery of all necessary and relevant health services at community level. No parallel top teleguided centrally directed services should be allowed. Categorical disease-specific interventions, such as control campaigns for communicable diseases, and special activities, family planning for example, should be integrated into primary health care.

The issue at stakes is once again the horizontal vs the vertical approaches, which is "closely linked to another slogan, that of integration" (78). However desirable the "integrated holistic horizontal approach" to health represented by PHC, it should be

mitigated with some pragmatism. The debate should be moved "from thinking about these (approaches) as if they were mutually exclusive alternatives, and towards greater attention to the proper balance among these alternatives" (79).

That the two approaches are not mutually exclusive is demonstrated by the Diarrhoeal Disease Control Programme initiated by WHO in 1978. Although its strategy is directed at a specific target, i.e. the reduction of diarrhoea, associated mortality and malnutrition in children, it serves as an important entry point for primary health care interventions and seeks to strengthen national self-reliance. It is also based on typical appropriate technology, that is the use of home-prepared solutions and ORS (Oral Rehydration Salts) for the prevention and treatment of dehydration (206).

The fact is that whatever the righteousness of the primary health care approach, specific vertical programmes will continue to exist, and non-integrated activities will continue to be carried out. There are many reasons for it.

First, health activities in developing countries will continue to get support from external donors, be it international, governmental or non-governmental agencies, through bilateral, multilateral, or private programmes. Whatever the adhesion to the primary health care approach, what donor agencies seek in the first place is cost-effectiveness, efficiency, and prompt and demonstrable results. Hence it is not unlikely that they will increasingly shift their policy toward supporting vertical programmes. This tendency is already manifest in several international, national and private technical and financing agencies. If necessary, the programmes will be rebaptized under the vocable of primary health care of some sort (what Ghish has termed "old wines in new bottles" (26).

A second reason is that national governments too are concerned with the visibility of health activities, even to the detriment of long term results. Primary health care is a nice concept to give lip service to. It is however basically an agent for social change,

and as such has more thorns than flowers. In addition, governments look for aid and currency where these are available. They are unlikely to refuse money for vertical programmes if so offered.

A third reason is that the primary health care approach is costly. Studies made in India, Iran, Jamaica and Nigeria have shown a cost per capita varying from 0.40 to 7.50 US\$ per year (79). Calculation of the cost of PHC is often likely to yield underestimates, for they rarely include indirect costs, mixed costs shared with other sectors, salaries of international staff, and free services (such as food aid). It has been suggested that when all costs are truly recognized, primary health care is generally many folds more expensive than it is claimed to be (80). The magnitude of total resources that will be required to finance the extension and operation of PHC for the population of developing countries by the year 2000 has been estimated in the range of 49 to 103 billions US dollars (in constant 1978 dollars) (79). Vertical crash campaigns against specific diseases are much less costly. That their early successes cannot be maintained for, among other factors, lack of permanent infrastructure, as seen for malaria, yaws and possibly soon for onchocerciasis, is for the next generation to be concerned about.

Finally, there is also a technical aspect which may justify the continuation of vertical disease-specific programmes or a delay in their integration into primary health care. One example among others is leprosy, for which great efforts are being honestly made towards integration, often with the support of foreign donor agencies. The emergence of drug-resistance and the consequent need for multiple drug therapy raise difficult problems of logistics. Thus, integration of leprosy control into non existing or poorly operating health services at community level could jeopardize the results obtained for the last 30 years and bear dramatic consequences for the future. Some diseases are also considered too important as to be left to the responsibility of primary health care. This may be due to a number of reasons: their potentially severe human and economic consequences, the complexity of the technical tasks required for their control (45), or emergency. In

many countries, trypanosomiasis control is run as a specific programme. If tomorrow there was a large epidemic of yellow fever, or AIDS for that matter, it is doubtful that much will be made of the primary health care resources.

Integration is also a catch word, with many different meanings (78). There can be a gap between what is stated on paper, and what actually takes place.

As a result, in many conditions, whatever the successes of PHC, health needs will be covered by a dual system. The fact has to be faced squarely. Community based social oriented erratically staffed soft technologically primary health care will have to coexist with technically efficient well organized properly staffed vertical programmes. The two approaches, the poor and the rich, the enduring and the fugacious, will have to be articulated, the more so that vertical programmes are by definition limited in time. If not shouldered and consolidated in the long term by the permanent community based services, their achievements are short-lived. Such a transfer of responsibilities from the transient vertical programmes to the permanent community based services (be it basic health services or primary health care) has been until now unsuccessful, as demonstrated by the experience of the malaria and yaws eradication campaigns of the 50ies and 60ies (15).

The absorptive capacity of primary health care for following-up the achievements of vertical programmes should therefore be developed. This wide field of health system research deserves careful and probably arduous studies.

In the meantime, mechanisms should be explored in order to help health planners to make the best possible decisions for the allocation of resources when faced, willingly or not, with the difficult choice between vertical and integrated programmes. The methodology of epidemiometric models, of which there are a number of examples (81,82,188), should be expanded and made to incorporate economic considerations (78).

5.11. Cost-studies

"Primary health care is not cheap health care." (29) In any event, it is much more expensive than the usual care system prevailing at present in rural areas, be it only because it replace a quasi-vacuum.

In the previous paragraphs, the issue of cost has crept in regularly. Several problems were mentioned, from the cost of primary health care in general to the specific problem of how to remunerate the village health worker. A most important issue is the financing of primary health care schemes at village level, either through self-financing or from subsidies. Generally, public services should not attempt to provide free medical care unless they are prepared for the heavy cost involved, which eventually include remuneration of the community health worker. A major question for research is therefore to explore ways whereby people will pay for some items that they will be ready to purchase privately, preventive and other community programs being of course free (74). It should be stressed that there will be no community autonomy and participation without at least some actual control over expenditures (23).

All these problems are linked and raise essential philosophical and political questions.

Economic studies are out of the scope of this report. Guidelines for costing primary health care development have been outlined by WHO (198).

Money finally is "le nerf de la guerre". No amount of enthusiasm and dedication, or dogmatic pretense and fairytale, will hide this inescapable deadlock. It has been estimated that in 1978 assistance for health from all external sources totalled 3 billion of dollars. Yet, this represents less than one quarter of the total estimated public and private expenditures on health in the 67 poorest countries of the world (excluding China) (199). Scarcity of money for health is definitely a critical limitation on progress towards the goal of Health for All by the Year 2000, and financial constraints will be an overriding consideration in the foreseeable future (200).

5.12. Research orientations

The implementation of primary health care offers a wide and open field to health systems research.

- (1) A systematic analysis of primary health care achievements would be useful, in order to identify the shortcomings and obstacles preventing the replication of ongoing projects or the extension of the PHC approach at country level.

Such analysis should not focus on well-known apparently successful projects, but rather on weak projects which are unsuccessful in spite of favorable conditions.

- (2) Methods should be designed to study the mechanisms of inter-sectoral collaboration for primary health care at national and local levels. Ways of fostering or improving this collaboration should be explored.
- (3) Additional data should be collected on the working situation of the community health workers in different contexts: their motivation, mode of selection, tasks, training, supervision, role, acceptance by the community, and mode or remuneration. Such studies should be conducted in close collaboration with specialists in human and social sciences.
- (4) Operational studies on the logistics required by primary health care, especially regarding its articulation with the intermediate supporting level, are needed.

Such studies should be conducted in close collaboration with specialists in managements and experts from other disciplines, such as for example engineers and designers.

- (5) Limited health packages for primary health care should be designed and tested in well-defined conditions. Special caution should be exercised to prevent external non measurable inputs. Projects with significant donors' input should not be eligible for testing.

- (6) Studies on the institutional capacity of health administrations to manage primary health care deserve a high priority, in order to identify their weaknesses, constraints, and shortcomings, and to design and test ways for strengthening managerial capabilities at all levels.
- (7) The coexistence of vertical and horizontal approaches in the same set-up should be studied in a limited number of situations, in order to record the problems and define the conditions for an effective and efficient linkage of these two approaches.

One of the most important avenue for research into primary health care is possibly cultural anthropology. A number of questions should be addressed regarding the value systems in different populations, particularly the meaning of health and disease, the understanding of the primary health care approach by the populations concerned, the capacity for self-reliance, the organization of the community and the capability for community participation, as well as the benefits that the people expect from health care an promotion.

It does not seem useful at this stage to launch or multiply more small scale pilot projects of primary health care. The existing projects have yielded a large amount of worthwhile information part of it is still in need of being analyzed. Ongoing projects may be used for testing limited health packages, or studying anthropological and social variables. While additional projects are necessary as demonstration areas or to test the feasibility of primary health care in specific localized contexts, this should be a national responsibility.

As an ultimate word of caution, it would be an exercise in futility to set up projects for the sole use of proving the superiority of one or another type of approaches, thereby feeding the ongoing manicheistic debate on selective vs comprehensive primary health care.

6. INFORMATION FOR HEALTH MANAGEMENT

6.1. The need for information

No health management can be appropriate in the absence of information to support it. Information is required for planning, implementation, and evaluation. At the planning stage, it will serve to identify problems, determine priorities, and select the type of intervention: what has to be done and how, what has to be done today and what can be postponed, what should not be done.

Regarding implementation, it will indicate what resources are needed and how much of them, in which way to deploy them, and how to monitor their utilization. With respect to evaluation, it will provide the intelligence for adjusting and correcting the plans and programmes if necessary.

Information is important at all levels, from the long term planning office at the Ministry of Health to the health worker organizing his daily schedule. As stated in the Alma-Ata report (22): "In order to plan and manage primary health care, the right kind of information is essential... Any information-gathering and analysis required should be an integral part of primary health care activities and their supporting services...".

This statement is welcome, because there has been at times a tendency for some primary health care theoreticians to make do with a minimum amount of information. "One cannot but feel that there is a strong, albeit not explicit, tendency in the whole primary health care approach to do without statistical or other extrinsic information. No semantic seduction can substitute for measurable facts. Whatever the enthusiasm, the righteousness of concept and the magnitude of needs, decision still require information on which to be based and subsequently assessed." (83).

6.2. Qualitative vs quantitative information

Information for health management can be qualitative or quantitative. Qualitative information for example deals with the potential

occurrence of a communicable disease, general acceptability of a birth-spacing program, nutritional habits, awareness of services, or the type of water supply. Quantitative information deal with figures, using various indicators to measure health needs, resources, and interventions: number of deaths, number of people affected with or developing a disease, number of people exposed to a risk, number of children vaccinated, number of physicians or other health personnel, number of latrines built. Quantitative information is usually reported to a denominator and consolidated as indices, such as rates (death rates, prevalence, incidence), ratios (comparisons of rates), percentages (relative proportions), average (duration, delay).

Qualitative information is generally looked down by experts. While it is true that this type of information do not allow measurements of risks and valid statistical comparisons, this does not mean that it should be discarded. Very often, qualitative information is the only kind which is available, or the only one which can be available within a short period of time. In a review of the achievements of various countries in the context of Health for All by the Year 2000, it is plainly stated that for some countries, "because of data deficiencies, the choice of indicators often has been difficult or impossible" (45). In addition, qualitative information is often the only type of information understood by the non-epidemiologist. As stated in the Alma-Ata report : "In many instances it is more important to start with qualitative information on the health and demographic situation than attempt to gather precise quantified data. Quantitative precision can be built up in the course of time" (22).

There is at the moment a great interest in the development of assessment methods based on qualitative information, such as the Dephi-method, nominal group technique, consensus development conferences, and others. The possibility of developing similar methods for the interpretation of qualitative information collected in the field in relation with the PHC approach, should be investigated.

Quantitative information provides measurements which can be studied statistically. While they are indispensable for a scientific assessment of the situation, their validity however depends on the way they have been collected. To quote Sir Josiah Stamp (cited in 33), "The Government are very keen on amassing statistics. They collect them, raise them to the xth power, take the cube root and prepare wonderful diagrams. But you must never forget that every one of these figures comes in the first instance from the village watchman, who just puts down what he damn pleases."

One of the greatest danger of quantitative assessment is to use "hard methods" on "soft data" (33), that is to martyrize poor data in order to present solid looking conclusions. This danger is increased when this type of analysis is used in conjunction with arbitrary figures based on value-judgment, for example in order to determine priorities. As mentioned previously, this serious shortcoming was apparent in the CENDES studies of priority ranking of diseases based on death rates compounded for age discount. The results showed a high sensitivity to changes in the values allocated to death at different ages. The same shortcoming is also manifest in the studies presented to support the Selective Primary Health Approach.

6.3. Epidemiological and operational indicators

Accurately describing the health needs and measuring the respective contribution of the components which affect the health of the population is an extremely difficult endeavour. For the sake of simplicity, indicators can be arbitrarily divided in three groups: (1) operational (or resource) indicators; (2) epidemiological indicators; (3) comprehensive indicators.

1. Operational indicators

Operational indicators measure the resources which are affected to meet the health needs, such as expenses for health per capita, proportion of GNP spent on health (Table 1), and ratio of doctors per thousand population (Table 2). Presumably, these indicators should reflect the extent to which the health needs are fulfilled. This is far from being the case, since

no concept of optimality, or even relevance, in the allocation of resources is taken into account. A greater per capita expense for health may reflect large sums of money wasted in the building of hospitals for a small portion of the population. A high ratio of physicians per population may be totally irrelevant to improve health, especially if these physicians are concentrated in cities, or even contradictory if such a situation is associated with a low number of auxiliary health workers.

Operational indicators immunization can however be extremely useful, provided they relate to specific targets relevant to ascertained needs (for example immunization coverage).

2. Epidemiological indicators

Epidemiological indicators aim at measuring the respective contribution of specific problems to the health of the population. These indicators deal mainly with mortality, morbidity, disability and other quantifiable disease parameters.

Commonly used indicators are (44):

- access to water
- nutrition surveillance
- infant mortality
- child mortality
- life expectancy
- specific morbidity rates
- mortality rates
- access to health services
- children immunized
- MCH coverage
- literacy rate

Epidemiological indicators raise two orders of difficulties.

First, their specificity varies according to the type of problems measured. While disease oriented indicators, such as the prevalence of malaria, are highly specific, infant

mortality reflects a large array of social and health conditions not all of whose are determined (Table 3). Specific indicators therefore point to easily identifiable methods of intervention, using the available technologies. Non specific indicators, although they give a much more comprehensive view of the health situation, do not lead to simple intervention.

Second, the very multiplicity of indicators for given disease problems makes of the definition of priorities a delicate issue. How should one compare in young adults a problem of low incidence but high mortality, with a non lethal disease of high prevalence associated with temporary disability. An example of the latest type is dracunculiasis, a filariasis considered for long of such little importance as to be even not considered a medical problem, which now emerges as an important indirect cause of malnutrition and even famine due to the crippling it causes in agricultural populations of the Sahel during the harvesting season.

Economic parameters can be introduced to rank priorities, carry out cost-benefit analysis, or evaluate intervention measures. The use of such indicators may however lead to a fragmented view of the situation and to serious distortions. For example, in Indonesia, it has been calculated that the prevalence for hookworms, ranging from 45 to 85 per cent, was responsible for a 19 per cent loss of productivity, which could be corrected by iron administration at a cost of 0.13 US \$ per worker, i.e. a cost/benefit ratio of 280:1 (5). In Panama, the cost of additional food in persons suffering from diarrhoea would represent 10 \$ per year (5). In Upper-Volta, now Burkina Faso, the cost of digging wells was once calculated in terms of calories saved in women used to walk long distance to fetch water (60 women walking 16 kms per day 150 days per year being equivalent to 23 millions calories, i.e. one metric ton of sorghum or 12.000 francs CFA).

While it is impossible to cost human life and suffering, it should be stressed that "ascertaining in quantitative terms

the economic value of health services does not carry with it the prescription that economic consideration should be predominant" (84).

The more specific the indicators, the more amenable is the situation to technological intervention, whose cost can then be assessed and effectiveness evaluated in the short term.

3. Comprehensive indicators

In many situations, epidemiological indicators, however alluring they are for the technicians, are of little use to plan intervention. In some countries of Latin America, specific risks of morbidity and mortality make no differences for a peon which at the same time suffers from tuberculosis, leishmaniosis, syphilis and Chagas disease, chews coca, drinks pisco, and is chronically malnourished. There is no overall indicator of rural hopelessness (12). The only valid indicator in such cases is poverty. But how to measure poverty ?

It has been suggested that the most important indicators would be the ones measuring the reduction of inequalities in health states (44). Such indicators of equity are interesting, but their manipulation needs caution since their use may lead to fallacious conclusions. At the extreme total reduction of inequalities would be no health for anybody.

Attempts have been made to develop comprehensive indicators which would reflect the overall situation of health. An example is the quantitative method of assessing the health impact of different diseases developed by the Ghana Health Assessment Project Team (85,86). It consists in measuring the impact of specific diseases as measured by the number of healthy days of life which are lost through illness, disability and death. This procedure takes into account the average age at onset, the case-fatality rate expressed as a percentage of those affected with the disease, the average age at death of those who die of the disease, the expectation of life at average age of onset, the percent disablement in the period

from onset until death among those who die of the disease, the percent of those affected by the disease who do not die of the disease but who are permanently disabled, the percent disablement of those permanently disabled, and the average period in days of temporary disablement among those who are affected but neither die nor are permanently disabled, multiplied by the proportion disablement of those temporarily disabled. A formula then leads to the ranking of disease according to their impact in terms of days of healthy life lost. The results show that malaria, measles, childhood pneumonia, sickle cell disease and severe malnutrition are the five major causes of loss of healthy life, accounting for 34 per cent of the years healthy life due to all diseases.

In spite of their theoretical interest, it is doubtful that such comprehensive indicators may greatly help in developing countries where vital statistics are deficient or inexistent and adequate epidemiological personnel is lacking to carry out surveys.

6.4. Information at the peripheral level

"One of the main features presently characterizing evaluation and monitoring of the health system is the lack of basic national information and statistics... Basic information is then in short supply for evaluation and planning purposes. Often it has not been collected, or if it has, it may be unreliable, or unavailable." (45). These remarks, quoted from a WHO review conducted in 1982, summarizes well the present situation.

The most important type of information systems lacking at the moment are the ones required to direct the work at the peripheral level and to provide the health planners with appropriate data. Despite all the emphasis on primary health care, the need for appropriate information at this level is often overlooked (87).

It has been emphasized that the information needed to indicate the existence of a health problem or to facilitate the management of primary health care systems should be provided by the same

personnel (56). This raises the issue of developing data collection system and indicators which can be used by community workers with minimal training.

There is at the moment great interest to foster reporting of health information by community health workers (190) and even lay workers (87). A prior requisite is the definition of indicators, generally based on signs and symptoms rather than diagnostic headings, which can be easily recognized by the primary health care or other community workers. It will require in the long term an adaptation and a simplification of the International Classification of Diseases to make it useable by local workers. The World Health Organization is pursuing efforts in this direction. Short lists have been established and tried in the field in several countries of South-East Asia (56,87).

As an example, a recording and reporting system for leprosy (OMSLEP), has been developed under the sponsorship of WHO, for use at the primary health care level by community workers with a minimum amount of training (88). The OMSLEP system permits the follow-up of the leprosy patient as well as the monitoring of the new multiple chemotherapy regimens used at present in the treatment of this disease. Prevalence rates as well as detection rates can be computed on an annual or on a cohort basis. The system, now adopted in some 25 national or regional leprosy control programmes, is complemented by a manual for the middle level managers on how to use the data for planning and evaluation (89).

The collection of simple information is also required for the establishment of health profiles, an important tool for the planning and programming of primary health care at the national as well as at the local level. The World Health organization has set up guidelines for preparing such country profiles (90). In the present situation, there is a danger that the preparation of elaborate profiles at various levels, from the national level to the village level, can become a costly, as well as time-consuming and possibly self-defeating, process. Rather than aiming at sophisticated and elaborate profiles, it has been recommended that

simple profiles could be established at the village or district level, by using simple questionnaires devised by the epidemiologists and the managers, working in close cooperation and in association with local staffs. Besides constituting an exercise in management, the resulting profiles can be used as a basis for immediate action.

6.5. Research orientations

There is a great need for research in what could be termed "appropriate information for primary health care".

- (1) Simple and correct data collection and registration is a prerequisite to the development of epidemiological and operational indicators. These indicators should be relevant to the decisions to be taken in the local context. They should be robust, that is they should be useful for decision making even if yielding approximate values. They should be easy to collect under adverse conditions by community workers with minimal training. They should not require elaborate calculations and should be amenable to a presentation easy to understand for the manager as well as for the local community concerned. The term "quick and dirty indicators" has been coined to describe such indices.
- (2) Simple and rapid surveying methods should be developed for the identification, assessment and epidemiological surveillance of communicable and other diseases, on the model of what has been achieved in the field of nutrition. There is a need for simple yet statistically valid sampling procedures.
- (3) Definition of the necessary information is pointless in the absence of precise guidelines on how to collect, retrieve and analyse the information for actual decision-making. Simple information systems should be devised and tested. They should include definition of the format for recording, design of the forms for reporting, instructions for consolidation of the data into simple indices, and guidance for the interpretation of the indices in terms of corresponding decisions.

This calls for the whole development of an ergonomics of health information for field use.

7. TECHNOLOGY FOR PRIMARY HEALTH CARE

7.1. Definition

Technology is a prestigious word. From flintstone to satellites, it encapsulates the power of man on nature. Being synonymous with modernization and progress, it is generally associated with this doubtful offspring of the Western society, namely efficiency. It can be viewed as a tool for development, or conversely, is made by some into the source of all ills. It is also a catchword, and therefore calls for a definition.

Technology has been defined as: "the body of tools emerging from the interplay of scientific knowledge and practical operations applied to specialized purpose" (40). In other words, technology is what makes knowledge applicable to action: a vaccine, a microscope, a computer, a thermometer, a transducer.

No technology however runs by itself (91). The Alma-Ata report has therefore stressed an additional dimension of technology: "(It) represents an association of methods, techniques and equipment, together with the people using them" (22). Technics are no substitute for people. Technology in a vacuum means nothing, and leads to nothing.

Health care technology has been defined as "products, services or processes that support a health care system". (92). "It includes all techniques, drugs, equipment, and procedures for medical prevention, diagnosis, treatment, and rehabilitation, as well as their organization and administration." (33)

This definition is important since it encompasses not only equipment, but also the whole process, from technology development to its acquisition, management, and delivery, as opposed to the narrower view of equipment-embodied technology, which addresses the

issues of "medical technology primarily dependent upon capital equipment to perform health care tasks" (40).

Health care technology can be classified according to its function (93).

Clinical technology is used in the provision of direct patient care, including medical and surgical services (40). Examples are screening tests (preventive), ultrasound (diagnostic), renal dialysis (therapeutic), limb prosthetics (rehabilitative technology).

Ancillary technology is used directly to support clinical services. It includes diagnostic radiology, radiation therapy, clinical laboratory (40).

Coordinative technology is used to facilitate and support the provisions of health care services, while not being directly associated with patient care.

A fundamental distinction should be emphasized, i.e. the difference between definite technologies for the prevention, cure, and control of diseases, and half-way technologies, for palliation and repair (93). Examples of definite technology are immunization and chemotherapy for the control of communicable diseases, and correction of nutritional deficiencies or endocrine disorders (avitaminosis A, scurvy, rickets, goiter, diabetes). Half way technology is designed to make up for damage after it has occurred. Examples are renal dialysis, organ transplants, open heart surgery and intensive care units (93). The antipoliomyelitis vaccine is a brilliant example of definite technology, while at the other extreme the iron lung is the obvious illustration of half-way technology.

When effective definite technologies are developed, they are relatively inexpensive and simple. Half-way technologies by contrast not only are often of marginal benefit to the patients in terms of quality-adjusted years of life gained, they are also very expensive (93). Half-way technologies by their very nature are at

the same time highly sophisticated and quite primitive (94). They are the kind of technologies celebrated by pop-medicine and by the media. Some of it could be called placebo technology (95). Half-way technologies are also often machine-embodied technologies, requiring costly equipment. Much of the complexity and spiraling cost of medical care in industrial societies results from the use of half-way technologies, used mainly to postpone death.

New technologies can be classified roughly as substitute technologies and add-on. According to Bennett (92): "A substitute technology provides a better, more efficient, or more productive way of accomplishing an existing task. Substitute technology, often taking the form of automation, requires fewer workers for the same unit of production or service, hence increasing productivity by substituting capital investment for labor costs". On the other hand: "An add-on technology makes possible the accomplishment of something that was previously impossible or economically impracticable". This distinction is important with respect to health since many of the new medical technologies are add on. They do not increase productivity, and generally do not reduce the costs of health care as a whole, because of the additional costs being generated in order to achieve results which were not previously possible.

An enabling technology has been defined as a technology which permits a variety of applications rather than serving an individual health care purpose. For example, information technology is typically an enabling technology. Like primary health care, whose one long term goal is to foster development through health promotion, technology for health should whenever possible be enabling, aiming at strengthening the local capability of solving problems rather than providing specific technical solutions.

7.2. Health technology in developing countries

For whoever has visited hospitals and health centers in developing countries, one of the most striking observation is the simultaneous occurrence of consultation rooms, laboratories, or surgical theatres devoided of any equipment, together with the accumulation of unpacked crates in the halls. In case the equipment has been

unpacked, it is most generally non-functioning, and this for a number of reasons: wrong specifications, power failure, breakdown, lack of spare parts, among others. If it eventually works, there is a good chance that it is put to a different use than the one it is purported to. A quick glance in the refrigerator will sometimes reveal more bottles of beer than vials of vaccine.

This is common place observation. It serves nothing to hide the facts. The question one has to address is rather: why is so much technology unused or irrelevant ? It raises three issues:

- (1) the technological environment in LDC's;
- (2) the human factor;
- (3) decision processes in the acquisition of technology.

7.2.1. The technological environment

In many developing countries, even in the leading hospitals or medical schools, many of the products of technology are not in use, often for lack of an adequate servicing, inexistence of maintenance infrastructure, and shortage of spare parts (91). There is generally no full and realistic account of the recurrent operating costs of break downs (193). A survey conducted in Mexico in 1981-83 on the availability and utilization of new technologies for health care has identified a large sub-utilization of the equipment in the 231 institutions which accepted to participate in the study. The causes were as following: obsolescence of the material due to prolonged storage, lack of infrastructure, shortage of pieces or reagents, lack of trained personnel, custom regulations preventing importation of essential parts, administrative breakdown, inadequate funding for recurring expenditures (96).

The reasons for a large part of the medical equipment being not used in developing countries have been described by Abel-Smith: "Complex mechanical equipment usually has to be imported at a considerable expense in foreign exchange. Skilled personnel for maintenance and repair are usually in very short supply and are badly needed to work in the manufacturing sector. There is not enough mechanical equipment of a

particular kind in the country to justify the establishment of specialist maintenance firms... Thus, mechanical equipment that has been installed in hospitals in developing countries is often out of order, awaiting repair or the importation of spare parts." (84)

In other words, technology is much more than equipment and machines. In order to be put to good use and perform adequately, it needs a complex technological environment in which every component interacts at the right place and at the right time, otherwise the whole system may collapse. The more complex the technology, the greater the risk of some links in the chain breaking down.

Introduction of technology should therefore be considered as the transfer of a package with multiple components: training, maintenance, quality control, capacity to translate the results into decisions, resources for actually implementing the decisions (for example, second level diagnostic screening, treatment of the patients, preventive or control measures). An important and often overlooked aspect deals with the legal and administrative constraints (import restrictions for some components of the system, regulations for its utilization). The best software for an information system may be made useless for some trivial custom regulation preventing the import of the required type of floppy disk.

7.2.2. The human factor

"Technology is not limited to gadgets and machines. Technology is people, always has been people, and always will be people." (91) Equipment should thus be viewed in conjunction with the people who are supposed to make it work, together with the training of this people, within the complete system of technological management. "Technology transfer is not simply the acquisition of equipment and devices but it is the development of people in terms of their skills, their livelihood, and their culture." (97) Adjusting techniques to people

and devising training for technological tasks calls for a new branch of health care ergonomics.

The socio-cultural environment may also bring severe limitations to the efficient use of technology. In a number of countries, the social system is such that those who are able to do a job prefer not to do it but oversee those who cannot (91). Technology may bolster this unfortunate tendency.

The transfer of technology as a package should therefore include training. At the moment, the introduction of new technologies proceeds at a much faster pace than the development of skilled manpower.

7.2.3. Decision-processes in the acquisition of technology

Everybody will agree that it would be a waste of resources for a country to buy a electronmicroscope while it is not able to repair a stethoscope. Still, while the electronmicroscope is a facile example, similar situations are common.

One may therefore wonder why so much resources are wasted on irrelevant technologies. One may recognize several reasons for it:

- (1) As said by the Director-General of WHO: "Technology for the sake of technology is a dangerous addiction producing drug" (in 98). For politicians, it represents prestige. The least developed countries want the best equipment, assuming that what is most complex and consequently costly will be best. Technology dignifies the physician, especially when he/she was trained abroad. The manager thinks that it will solve all the ills of poor management.

The technological addiction is not restricted to the professionals. The population can also be transformed into worshippers of techniques. While the phenomenon is particularly noticeable in developed countries, it is probably as widely spread in developing countries, especially among the well-to-do and in urban settings.

Even the rural population often prefers needles to tablets.

- (2) There is generally no established mechanism for planning the acquisition of new technologies. Transfer is made on an ad hoc basis, according to various vested interests, pressures, and prejudices. When there is some form of control, to a large extent the acquisition of new technologies is controlled locally by the physicians, and more likely than not by those clinicians trained abroad (93). Those are generally not the best persons to perform this duty. While the medical profession can readily pinpoint a non-functioning problem, it generally has no idea of the complexity and extent of the engineering problems and of the level of training required to solve them.

- (3) Notwithstanding direct politically-supported commercial interests, the most uncontrollable factor for technological irrelevance is technology philanthropy, that is the unplanned uncoordinated donation of equipment by foreign agencies and charities. This process leaves developing countries totally defenseless, because while it is still possible to try making reasonable decisions when you have control of the money, it is hardly fitting to refuse donations. Technology philanthropy is responsible for an unmeasurable amount of useless medical equipment to be found in developing countries, from sophisticated laboratory apparatus to incompatible computer, if not for upright frustration, a sense of hopelessness, and a loss of confidence in the countries' own capacity for deciding how to solve their problems (91).

7.3. Adverse effects of technology

The most relevant and best technology may have a number of adverse effects. For some of these effects, the better the technology, the more severe the adverse effects. Some of the most noticeable adverse effects are :

(1) Overreliance

A case in point is the use of automated or similar standardized tests for screening of diseases in large populations. Lack of sensitivity, due either to the choice of an inappropriate test, the selection of incorrect values for detection, or plain incorrect operation of the equipment, may result in the failure to detect large numbers of patients, resulting in a high proportion of false-negative.

An additional and related danger of technology for screening is the large proportion of false-positive which may occur with perfectly valid tests, when the prevalence of the condition in the population is low. The sensitivity of the test required to detect the largest number of patients with the condition will by necessity falsely recognize a much larger number of false-positive. Retesting these patients at a higher level of screening is expensive and will require resources which either are lacking or could, if available, be used more profitably. There are many instances of such poorly studied screening campaigns, for example for cancer, in developing countries. Costs of the second-level screening should always be included in the assessment of a new technology for diagnostic screening.

(2) Iatrogenic effects

Technology can be a source of iatrogenic illnesses, which may have severe consequences in terms of mortality and morbidity. A survey conducted in a developed country has revealed that 36 per cent of the patients were affected with iatrogenic problems, a proportion of them severe and even leading to death (99). The risk is increased when the technology is used by personnel lacking adequate training in its application, as will often happen in developing countries.

(3) Side-effects in healthy population

Technology in developing countries should be community-oriented. The rationale for testing new technologies is their potential application to large populations (diagnostic

screening, immunization, chemoprophylaxis). It should however be reminded that, depending on the prevalence of the condition to be detected or to be immunized for, the utilization of the most effective technology in large number of people may still result in more cases of adverse side-effects in the healthy that it prevents new cases of diseases (33).

(4) Abuse

Technology may lead to abuses when used for other purposes than the one it has been intended for. "One of the major problem related to the introduction of new technology is...the expansion of its use beyond the marginal indication." (33) An example is the widespread over the counter delivery of antibiotics in developing countries, which is at the origin of widespread drug-resistance. In some countries, special foods with high energetic content, to be dissolved in cold unboiled water, an interesting procedure after disasters or in refugee populations lacking basic cooking tools, have been incriminated as the source of cholera and other water-borne diseases. The most celebrated example of technological abuse is milk powder (the more so when unfortified with vitamine A), which initially was definely developed to save children from death and not to kill them as it may happen when used inappropriately.

(5) Dependence

Technology may tend to make the developing countries overly dependent on foreign support in many respects, political (bilateral aid), industrial (suppliers), cultural (donor agencies).

In the moderately or more advanced developing countries, transfer of manufacturing processes should to the extent possible replace transfer of equipment. This however does not necessarily reduce, and might even increase, dependence, since manufacturing will often require the permanent assistance of foreign technicians. Reduction in the number of foreign

doctors may quickly be compensated by the import of clinical engineers and other experts (91).

In addition, one important factor sustaining technological dependence is the training abroad of doctors from developing countries.

(6) Brain drain

An important consideration is the retention of the manpower, once it has been trained in a particular technology. "One of the most exportable items is people with problem-solving skills." (91)

7.4. The concept of appropriate technology

The concept of Appropriate Technology has been introduced by Gadgil (100) and developed under the term of "intermediate technology" by E.F. Schumacher (101). It has produced a large volume of literature and led to much theorizing. The term is often taken as to refer to "technologies that are ecologically well-adapted to the local environment, small in scale, and sparing of such resources as energy... (it) generally means a wide-range of low cost technologies" (106).

Technology can be said to be appropriate only when the resources are fully available, its introduction has been planned, it can be managed, and the social and economic priorities justify its support. Going a step further, matrixes of appropriateness have been developed to scale the appropriateness in terms of resolution of the problem, budget, acceptability, and cultural as well as environmental fit (91).

Appropriate technology has also been presented as the "technology of liberation", a theory for the development of society based on the spiritual autonomy of the individual, self-determination and self-sufficiency, and on the concept of the science serving the masses instead of serving mass production. The values behind the assumptions of appropriate technology have been summarized as follows (103):

1. Man is basically good and gifted with talents. Society should stimulate the development of those properties;
2. The accumulation of private money is not justified. The protection and maintenance of the capital of life, represented by the ecological system, is always more important than the accumulation of monetary capital;
3. Spiritual, economical and political autonomy are development goals in accordance with the fundamental needs for existence, relations and growth.

Appropriate technology is somewhat the antidote to the "techno-structure", a concept introduced by Galbraith (104), whose side-effects are overproduction, world wide dependence of poor countries, spiritual, political and economic dominance of masses by the elites, and finally underdevelopment and the alienation of man (the "one-dimensional man" of Marcuse).

These remarks may seem far off from the subject. They are however essential to show that technology is a philosophical and a political issue as well as, or even more than, a technical one. The more so that these concepts underlie the emphasis put in the Primary Health Care Approach on the use of indigenous materials for small-scale local manufacture of equipment (22).

Appropriate technology has become a growth industry. From some 15 groups working on the subject in 1970, the number has increased to about 1000 well-established institutionalized groups in 1980. During this time, an enormous gap between expectations and achievements has progressively developed. It has been demonstrated that some types of local technologies can be economically competitive with large scale modern technology, socially acceptable, and technically viable. Two most celebrated examples are small-scale labour intensive sugar mills in India, and the building of roads and digging of canals without using heavy equipment. However, "the range of appropriate technologies that have proved to be economically and technically operational is at present too narrow to enable them to make more than a marginal contribution to economic and social development" (102).

7.5. Appropriate technology for health

The Alma-Ata report stresses appropriate technology as an important factor for the success of primary health care (22). In the words of the Director-General of WHO, Dr Mahler : "We must break the chains of dependence on unproved, oversophisticated, and overcostly health technology by developing another kind of technology that is more appropriate because it is technologically sound, culturally acceptable, and financially feasible." (6)

According to WHO (22), "the word technology means an association of methods, techniques and equipment which, together with the people using them, can contribute significantly to solving a health problem. Appropriate means that besides being scientifically sound the technology is also acceptable to those who apply it and to those for whom it is used. This implies that technology should be in agreement with the local culture. It must be capable of being adapted and further developed if necessary. In addition, it should preferably be easily understood and applied by community health workers, and in some instances even by individuals in the community. Although different forms of technology are appropriate at different stages of development, their simplicity is always desirable."

Tentative criteria have been set up for selecting appropriate technologies for health, namely: (1) relevance to the health problem to be solved; (2) acceptability by the local community; (3) accessibility by all in the community and applicability as determined by local supportive resources; (4) simplicity and possibility to be used despite minimal training and servicing constraints; (5) self-reliance, i.e. local production; (6) stimulus to community development; (7) effectiveness; (8) low cost; (9) flexibility in utilization (105).

The concept of appropriate technology for health calls for three remarks:

- (1) appropriate does not necessarily means simple;
- (2) since low developing countries are far from being homogeneous, the concept of appropriateness will vary accordingly;

- (3) the conditions change with time. In one country, what is inappropriate today can be appropriate tomorrow, and conversely. The concept of appropriateness should therefore be adaptable (149).

Appropriateness will consequently differ according to places and times. "What may be appropriate for one country or even for half a continent may not be appropriate for the rest of the developing nations of for the rest of the continent." (91) It implies being suitable to or compatible with needs; it also means constructive and socially useful in a given cultural environment. It is not necessarily "compatible", as often is suggested (a calculator may be quite appropriate at the village level, yet is a sophisticated technological item).

It results that opposing appropriate technology to imported technology is a false problem, as is the usual contrast between appropriate and simple. The appropriate technology approach does not mean ending importation of technology, nor does it lead to the necessary conclusion that capital-intensive technology is bad (94). While sticky paper (so to speak) can be appropriate for fighting tse-tse flies in trypanosomiasis control, imported sophisticated capital-intensive technology, such as satellite-based reconnaissance of biotopes and helicopters for insecticide spraying in onchocerciasis control projects, can be appropriate if no substitutes are available and the objectives to be achieved justify the cost and the complexity (106).

Conversely, simple locally developed labour-intensive technologies can be inappropriate. One may wonder why obstetrical stethoscope made of clay (45), or bamboo clutches (107), should necessarily be better than simple convenient industrially produced equipment serving the same purpose. Appropriate refers to appropriateness to serve a specific purpose within a given complexe, not to folklore. It is doing a disservice to appropriate technology to equate it with cottage technology. That a technology is labelled appropriate according to some broad concepts does not make do with the need to assess its appropriateness in actual real life conditions.

7.6. Advanced health technology

Considerable developments have taken place in health technology over the last few years, which for various reasons are of benefit mostly to industrial countries. To what extent some of the recent breakthroughs could be used for improving health care in developing countries has been little investigated. Appropriate advanced technology (AAT) for health could be defined as those new techniques which, provided they are adjusted to the local context, could contribute to promote health of the developing world both at individual and community levels. It encompasses prevention, diagnosis and screening, treatment and disease control, epidemiological surveillance, rehabilitation, information systems and health management.

Advanced technology is not mere gadgetry. It should be viewed as a package together with its whole supportive environment, from maintenance and supply to training.

Five types of rapidly developing research areas are at present recognized as having potentials for health care technology in developing countries (108,).

- (1) biotechnology,
- (2) computer technology and microelectronics,
- (3) systems technology (expert systems, artificial intelligence),
- (4) medical imaging,
- (5) new materials and surfaces.

7.6.1. Biotechnology

Basic biomedical research is progressing to an accelerated pace. Considerable advance has been achieved in the recent years, particularly in the field of molecular biology. The problem is now, to quote Joshua Lederberg, to harness biomedical research to the health needs (110).

(i) Hybridoma technology

A development of vast potential is the production of monoclonal antibodies from cloned hybridoma cells obtained by fusion of specific antibody producing lymphocytes and myeloma cells. Monoclonal antibodies, or antigens purified by means of monoclonals, can then be used for the specific diagnosis of a number of communicable diseases. More important in developing countries, it could be used in large numbers of people for epidemiological purposes: identification of individuals or groups at risk, determination of target populations for vaccination, early detection, study of the spread of disease and of the dynamic of transmission, identification of vectors and reservoirs.

(ii) Nucleic acid probes

These probes allow the detection of microorganisms causative of disease, possibly independently of their serological variations, as well as the distinction between latent and active infection.

(iii) DNA recombinant technology

The manipulation of defined coding sequences of DNA and their controlled expression in host cells, as well as techniques for the controlled expression of microbial genes into suitable vector systems, can be used to prepare on a large scale antigens with protective properties which can be used as vaccines.

(iv) Synthesis of peptides

Chemical synthesis of oligopeptides corresponding to major epitopes of a protective antigen of a pathogen makes possible the preparation of synthetic vaccines.

At present, attempts are underway to develop rapid and simple procedures based on the hybridoma technology and which could be applied for the diagnostic of rabies and for identifying risk factors in dengue, an important and widespread disease with severe complications (dengue hemorrhagic fever) occurring as violent urban

outbreaks in several parts of the world. Other diseases for which the application of sensitive diagnostic methods using monoclonal antibodies (e.g. ELISA or passive agglutination) will likely in the future revolutionize the approach are chlamydial infections and tuberculosis. The biotechnological approach could also soon provide new diagnostic tools for hepatitis B, louse-borne typhus and gonorrhoea. Rapid sensitive tests for AIDS are being developed for the screening of blood donors. There is also a need to develop rapid, sensitive and specific immunodiagnostic kits for acute respiratory infections (ARI), malaria and filariasis (111). In filariasis, immunodiagnostic methods based on the use of monoclonal antibody systems could serve to detect parasite antigens in blood and urine in order to measure the presence and intensity of infection in human populations, as well as to identify larvae in vector mosquitos or flies that are human rather than animal parasites (113). New monoclonal antibody based differential diagnostic techniques are likely to be available in the future for a complex of enteric pathogens such as enterotoxigenic E.coli, Campylobacter jejuni, rotavirus, and Yersinia (113).

The World Bank/UNDP/WHO Special Programme for Research and Training in Tropical Diseases (TDR) is actually pursuing vast and coordinated efforts in these directions (1).

While diagnostic tools based on new biotechnological techniques are rapidly developing for acute respiratory diseases, including tuberculosis, enteric (diarrhoeal) diseases, parasitic and viral diseases, there is an urgent need to improve the technology of the test systems themselves. It includes standardization, quantification and simplification of the systems for rapidity and field use (113). ELISA methods, which allow the identification of bacterial and viral antigens in small clinical specimens, holds great promises in this respect.

The application of novel diagnostic technologies in developing countries meets however with a number of difficulties (114).

- (1) the laboratory personnel often lacks familiarity with these techniques, including basic knowledge and operating instructions;
- (2) the cost is generally still high, both capital cost and recurring expenditures;
- (3) locally produced reagents are often of poor quality;
- (4) quality control procedures are inadequate;
- (5) there is insufficient or no maintenance of the laboratory equipment

New vaccines are also being developed using DNA recombinant techniques for the expression of genes in suitable vectors, or the direct synthesis of antigenic peptides. An example is a new vaccine against hepatitis B virus. The development of a synthetic vaccine against leprosy, using cloning of the genes for a specific epitope of *Mycobacterium leprae* (PGL-1), is also a possibility in the future.

7.6.2. Microelectronics, information and communication technology

Adequate information is the key to adequate primary health care. Most of the health information collected at present in the developing countries is very poor, be it with respect to vital statistics, epidemiological surveillance, functioning of services, or management. Accordingly, the health departments in most countries have made great efforts to compile national health statistics data. However, manual collection of data takes too long a time for the data to be utilized effectively. The data, when compiled for use, are often obsolete (115).

Modern information technologies could be effectively applied in a number of areas for solving health problems in developing countries. The areas considered include: (a) national health information systems; (b) hospital information systems; (c) administration and finance support systems to improve management; (d) logistics of supply and delivery, particularly stock control of drugs and vaccines; (e) epidemiological surveillance; (f) recording and follow-up of patients (115).

There have been several attempts to use computers in the context of primary health care, mainly in developed countries. A framework has been recently proposed for a comprehensive system that will take into account all the aspects of PHC and provide a computerized assistance tool to the health care providers all over the world (116). At the moment, the COSTAR (Computer Stored Ambulatory Record) is one of the best known package available in the market. It is essentially oriented towards resources and financial management, for use in group practices in the context of a fee-for-service system. It has been adapted in Finland (FINNSTAR) to manage health care delivery oriented activities. There is also a plan to introduce such a system in Malta. Consideration of such system for developing countries is probably out of scope, but they could however provide a framework for systems appropriate to tackle issues relevant to the delivery of care in those countries.

From an epidemiological view point, microcomputers are probably best suited for use at the peripheral and intermediate levels. In connection with the collection of data by lay and community workers, the possibility of using microcomputers at the peripheral level should be actively explored. At present, the worker in charge of gathering information in the field spends a minimum time collecting data and most of his time is taken for lining up columns and cross-checking tabulations, if not inventing figures. Microcomputers could free these workers in such a way that they can actually collect data, at the same time ensuring validation of the figures. The above-mentioned OMSLEP system for the recording and reporting of leprosy patients within the context of primary health care has been adapted for microcomputer use at health center level using a simple software (88). It has proved flexible, well accepted, and relatively cheap.

At the intermediate level, microcomputers or network of microcomputers will find their best use for strengthening the managerial capacity, in particular regarding stocks and supplies. The most profitable applications were suggested as:

health information, financial management, management of staff, drug distribution and equipment, and medical supplies (117)

The interest of microprocessor networks for data acquisition has been recently stressed. An experience has been carried out in two governorates of Egypt to process the data from all health centers on such a network (119,120).

Another application of microelectronics is display technology, with solid state LCD and similar devices, as well as flat panel displays, which could be particularly convenient for personnel concerned with measurements and procedures in primary health care and with a low level of training. One may even imagine hand-held microelectronic devices that display likely diagnosis and suggestions for action with a simple programme based on dichotomic answers to predetermined questions (109).

Communication technology is another related field which is essential for primary health care. In Easter Islands, a somewhat elaborate care provided by the young doctor in charge of the small hospital can be guided by satellite relayed telephone communication with continental Chile. Point-to-point satellite communications, now restricted to maintain communications at sea (INMARSAT), will possibly be extended to ground communications in the coming years, which could offer great opportunities for health care in remote areas. In the meantime, two-ways radios are extremely useful.

7.6.3. Expert systems

Expert systems are part of the expanding new field of research known as "artificial intelligence". They address problems which normally are considered to require human specialists for their solution (121).

The development of expert systems stems from a shift in the approach (paradigm) to Artificial Intelligence, from a power-based strategy, that is the use of powerful techniques to

handle large amount of data, to a knowledge-based approach, i.e. how to represent large amounts of knowledge in a fashion which permits their effective use and interaction (122). It implies systematization and codification of knowledge previously thought unsuited for formal organization (121).

Expert systems consist of "detailed descriptions, expressed as computer rules, of the thought processes human experts use to reason, plan or make decision in their specialties." (123)

They are composed essentially of a computer programme with four components (124):

- (I) a "knowledge engineering" programme, to capture knowledge. This knowledge may be presented in various ways: experience from professionals, factual information, insights and perceived relations between observations, general impressions elicited through various mechanisms.
- (II) an "inference mechanism" programme, to identify the structure and logical inter-relationship of the expert knowledge captured by the knowledge-engineering process, making it explicit, and providing the means for generalizing from the basic knowledge;
- (III) a "problem solving programme" to attempt the solution of new problems using the generalized expert knowledge;
- (IV) a programme that, if required, can explain the mechanism ("reasoning") which led the problems - solving software to the solution output.

The interest of such a system lies in the fact that it "captures" prior experience, organizes it in a structured way, and makes explicit the totality of the information it contains, using the principles of logical inference; by this means, it "acquires" experts' ability, and can then be used to solve related new problems. Expert systems are best suited to the "diagnosis of problems whose solution depends primarily on

the possession of a large amount of specialized factual and empirical knowledge" (199).

Several expert systems have been developed in the health field (192) include the MYCIN system, devised to aid physicians in the selection of antibiotics for patients with severe infections (125), and INTERNIST-1, a program designed to undertake diagnosis in internal medicine (126).

The possibility of using "expert systems" in health system research has been recently reviewed by the WHO Third Meeting of the Advisory Committee on Medical Research (Tokyo, October 1985). It was recommended that, as a pilot project on expert systems in health, WHO undertakes to construct such a system dealing with vaccine production.

Two fields where the development of "expert systems" could possibly help in Primary Health Care are (1) the structuration of the risk-approach (see below, 8.1.) and (2) the definition of optimal decision-tree for referral (see below, 8.2.).

Regarding the risk approach, there is a large number of observations and epidemiological data referring to the determinants of diseases in populations and results of interventions of many kinds. Studies performed in maternal and child health provide a model of the way information should be presented. Scores and weights to define priorities have been proposed. The feasibility should be explored of designing an inference programme which could organize these data in a structured way and provide the optimal strategies in various contexts.

The same applies to decision-trees for diagnosis and referrals from the peripheral level of PHC to the intermediate (second-line) level. A number of manuals have been published (with norms and standing orders). Although these guidelines are rather limited in scope, studies have been carried out to measure the validity of these decision-trees in terms of

sensitivity (false positive), specificity (false negative), the associated costs and the resulting outcome (128). In addition, a vast amount of implicit knowledge is lying dormant in a multitude of experienced practitioners, or is only available in a fragmented, disease-oriented, anecdotal form. An "expert knowledge" system could possibly help in defining optimal decision-trees according to different epidemiological and societal conditions in developing countries. It could even be expanded to define the tasks to be performed at the various levels of PHC, the training needs, and the type of equipment and facilities needed at the different referral levels.

7.6.4. Diagnostic imaging

The interest of diagnostic imaging lies in its capability to study physiological and pathological changes inside the body by non-invasive techniques (93). Diagnostic imaging includes the following techniques: conventional X-rays, computed tomography, ultrasound, nuclear magnetic resonance, digital radiography, and nuclear medicine.

Among the relatively recent developments in diagnostic imaging, ultrasounds deserve a special mention regarding its use for diagnosis in developing countries. It is easier to manipulate than X-rays and safer. Besides its considerable interest in pregnancy, it allows a number of diagnosis than conventional X-rays do not. It can now image the thyroid, liver, pancreas, kidneys and most abdominal tissues. It is also a useful aid to the diagnosis of many cardiac tissues (129).

A 1979 survey carried out in 37 developing countries has revealed that about half had equipment for ultrasonic fetal examinations (130). The percentage of developing countries with the technique was 31.6% in Africa, 70.0% in Asia, and 62.5% in the Americas. From the countries with ultrasonic diagnostic facilities, half had this equipment available in one institution only. In the countries with more than one

facility, the distribution of the equipment was often quite uneven. In Mexico (1981-83), 28 per cent of the ultrasound facilities inventoried (36 per cent of the total) was concentrated in the Northern part of the country, with 15 percent of the population, while the Gulf of Mexico area had only 4 per cent of the equipment for approximately the same number of people (96).

Diagnostic imaging is at the forefront of the medical electronic market, ahead of the other sectors (i.e. patient monitoring, therapeutic device design, medical laboratory instruments). It is a field in full development which will force its way into developing countries. Projected revenues worldwide are estimated to some 2.5 billions US dollars by 1987 (131). The conditions for an efficient and relevant use of this technology should be carefully laid out.

7.6.5. Material science and surface technology

Material science is a fast growing technological area of great potential importance. A number of techniques, for example ion implantation and laser treatment, make it now possible to control microstructures, both in the interior and at the surface of materials (91). Unique structures can be produced. Metals which cannot mix under usual conditions can be made into alloys. Ion implantation of surfaces can increase resistance to wear and corrosion by a factor of 100 or even 1000. Surfaces from materials such as glass, ceramics and polymers can be tailor made that differ radically in composition from the bulk of the object (132). Surface-active biomaterials forming bonds with specific tissues have great potentials for implants: hydroxylapatite ceramics, surface-active glasses, glass-ceramics, and surface-active composites. Controlled-porosity macrodefect free cement have been developed which could be used in water engineering for filter beds and filtration devices. Other applications are the use of solid-state electrolytes in solar energy systems, metallic glass instruments (low-weight electric transformers), and carbon-coated stainless steels for prosthesis.

New surface technologies could yield methods for binding biological materials to different supports for improved immunodiagnosis systems (133).

Material science, and surface technology are essentially enabling technology. This new area of technology transfer should receive attention in the future.

7.7. Transfer of advanced technology

7.7.1. Rationale and objectives

"Modern technology introduced into a developing country can be of great help to its development only when the appropriate kind is introduced on appropriate terms and conditions at the appropriate point in time." (134)

The objectives of introducing new technologies in primary health care in developing countries is threefold: (1) it should aim at maximizing the productivity of available resources (substitute technology); (2) alternately, it should aim at making possible new accomplishments; (3) it should strengthen the technological capacity of the country.

Consequently, technologies for primary health care should be definite and appropriate (which does not necessarily imply simple or low-cost). As much as possible, they should be enabling. Transfer of technology should never be equated with import of ready made solutions, since the solutions required generally differ from area to area. What needs to be transferred in the first place are problem solving-techniques (91).

7.7.2. Matrix of problems addressed/level of intervention

The application of novel technologies to the solution of health problems in developing countries may be approached along two dimensions: the type of problems involved, and the intervention level at which the technology is applied.

The types of problems involved are :

- (i) prevention
- (ii) diagnosis (individual) and screening (population)
- (iii) treatment (individual) and control (population)
- (iv) rehabilitation

The intervention levels are essentially:

- (a) primary health care at the peripheral (rural and urban) level;
- (b) the intermediate (second-line) referral level;
- (c) the central referral level for specialized care.

The needs of developing countries for advanced technology are fundamentally different from those in industrial countries. In developed countries, emphasis is put for the most on half-way technologies directed to diagnosis or treatment of the individual patients, such as diagnostic imaging, patient monitoring, and therapeutic devices. By contrast, in developing countries, advanced technology should be directed to the community at large and benefit society by improving prevention, screening for and detection of highly prevalent diseases, control of major causes of death and disability, and epidemiological surveillance.

Table 4 gives as an example the allocation of some of the new technologies according to the type of problems addressed and the level of intervention (excluding the central specialized level where at the moment the largest share of technology, mainly equipment, is concentrated). In rural areas, the peripheral level is the village, while the intermediate level is constituted by the district (or any other relevant administrative division). The distinction will of course vary according to the structure of health care delivery in the various countries (health stations, health centers, etc...).

7.7.3. Interface between health systems and technology

The effectiveness of a technology, and thus the rationale for its introduction, depends on the type of health care system.

It is particularly so in the case of technologies used for population-based measures, such as immunization or screening for diseases. New technologies, be it substitute or add on, will be more efficient and effective if applied in the context of vertical programmes. The adoption of a technology and the selection of a health system are therefore mutually dependent. The problem is not to make technology fit the system or the system fit the technology, but rather to strike a balance between the intended specific purpose and the theory. It calls for flexibility. Technology should be adjusted to health systems like health systems may indeed need adjustment in order to accomodate new technologies.

The introduction of new technologies in developing countries raises however a serious issue of affordability and cost. At the moment, most of the technology has been developed for use in developed countries. It is costly, both in capital cost and in recurrent expenditures, to which should be added the cost of training personnel. It is doubtful that industry will make an effort at developing cheaper equipment when there is no guarantee of an ensured market.

Although these problems are beyond the scope of this report, two considerations should however be kept in mind, which could facilitate the introduction of advanced technologies in the future.

- (1) Detection procedures at the peripheral level have to be sensitive rather than specific. It is usually less important to wrongly diagnose a disease in a healthy person (false positive) than to miss a case (false negative). This is the essence of multi-stage population screening and of referral supported diagnosis at the peripheral level. Such procedures are generally not acceptable in developing countries, where the physician is supposed to make a "correct final diagnosis", and the equipment standards are set up accordingly. What makes equipment costly is for a large part the requisite of

high specificity, which is less of a requirement for the current use in developing countries.

- (2) In developed countries, and especially in those countries with no structured referral system and no obligated passage through the general practitioner office, the hospital serves often as entry point into the system. Due to the sky-rocketing cost of medical equipment, this situation is becoming unbearable. At the moment, through the industrialized world, the theme of cost containment is a major item for discussion. For a number of reasons, among whose political ones, increasing the productivity of health resources in a more acceptable way to contain cost than other alternatives such as raising fees or reducing quality of services (135). One manner to increase productivity is to change the basic role of hospital and to shift a number of activities to the home of the patient, the physician's office, or to decentralized facilities. The industry is starting to feel the pressure to develop appropriate products for home care technologies, mainly in relation with treatment.

Continuing growth in home diagnostic testing can also be anticipated, although in a first period these tests will mainly be used in the physician's office (136). This will call for new, simplified, and cheaper types of tests, with greater importance given to the sensitivity of the results. This is precisely the type of technology required in developing countries. It may therefore be expected that when the day will come equipment devised for the industrialized world will meet the cost requirements of primary health care in developing countries.

7.7.4. Assessment of health technology

The new discipline of health technology assessment, a part of health system research, has as its objective to provide decision-makers with valid information regarding the value of a given technology, namely its efficacy and its safety. "The

process of technology assessment also includes determining the relationship between a technology's medical effects and its resource requirements, that is its cost-effectiveness, i.e. the extent to which it can reach a defined objective with minimum resource consumption, or can provide maximum benefit with a given supply of resources." (33) In addition, assessment of health technology considers the ethical and social consequences associated with the utilization of a technology.

Assessment of health technology is a multidisciplinary procedure in essence. It uses epidemiological and statistical as well as sociological methods, cost-effectiveness and cost-benefit analysis, and a number of methodological approaches for the formal synthesis of the results, mainly literature reviews and group methods (Delphi technique, nominal group technique, Glaser's "state of the art method", consensus development conference) (33, 137).

This new approach is a countermeasure to what has been termed the "technological imperative", i.e. the "tendency to take action, whatever the cost, if it offers even a slight possibility of utility". (33) At the moment, the diffusion of a medical technology generally follows the publication of early, enthusiastic, but methodologically weak studies. Enthusiasm then declines as results from better controlled trials are reported. In developing countries, the matter is complicated by the multiple issues related to technology acquisition.

Investment in technology is too often at the moment made on the basis of the effectiveness for the individual patient rather than its benefit to society at large, when compared with alternative investments. The case is clear in industrial countries where there is a claim that a large market do exist for CAT-scanners in small clinics and individual physicians offices (130). The situation is probably accentuated in developing countries where alternate facilities may indeed not be accessible except by travelling overseas. It is ethically not justifiable to let the planned development of a

technology be sabotaged by spontaneous application on the basis that it is necessary for the care of a few individual patients (33).

The consideration of ethical values is therefore one of the major, and more difficult, dimensions in the assessment of health technology. How to decide whether allocating scarce resources to effective technologies which can only be offered a few, and less effective ones which can benefit larger groups? (33, 130) One of the objectives would be to ensure "equitable technology". Hence, in order to prevent the present irrelevance in technological acquisition in developing countries, and to take the best of the opportunities offered by new technologies, a methodology for assessment prior to their acquisition has to be developed. Assessment should address the following questions: what difference does a particular technology make? What groups will it serve within the population? If more equipment is obtained, who will receive the corresponding services, and who will be denied it? (91). It should also include consideration of the policy implications. Will the new technology be capital (mostly add on technologies) or labor intensive? Will it decrease employment (substitute technologies)?

Technology not only requires management. Not only is technology no substitute for management. It can be questioned whether in many instances a proper management cannot indeed substitute for technology. A crucial question should be: what does new technology bring that a better management of existing technologies could not achieve? Assessment of managerial procedures should be part of this assessment.

The call for assessment of a health technology prior to its introduction in developing countries is perhaps utopian. With some noticeable exceptions, such as the polio-vaccine, most medical technologies widely used at present in the industrialized countries have developed in an empirical way, through practice, and without prior critical assessment. A number of

them have been discarded according to the same empirical mechanism.

A number of barriers to technological assessment should be mentioned, that is the cost of collecting data for evaluation, the ethical problems involved in trials (such as randomized clinical trials), the delay to obtain data useful for the decision makers. There is also a technological obsolescence problem. "If the technology is changing rapidly, or if user competence improves dramatically with experience over long periods, early results may lose their applicability before they are published." (40) These difficulties call for a step-by-step process to "assess holistically the potential short-term impacts and long term consequences of emerging technologies on societies" (139). In each case, there will be a trade-off between the cost of the method to be selected for and the quality of information to be obtained (40).

The World Health Organization is envisaging the establishment in some countries of Research and Development units which would evaluate technology transfers in relation to the needs. These units should advise on the type of equipment to be obtained. They would be staffed by trained personnel who could interact with the suppliers of technology at different levels, in matters such as the design of equipment, engineering expertise, or awareness of service requirements. When necessary, they could carry out limited studies to test equipments for reliability. Their function will also include maintenance services, training, and feed back to suppliers for further improvement of the equipment (124).

It would therefore be important to compile the major health problems in developing countries, together with an assessment of the contribution that existing or emerging technologies could make toward solving these problems (124).

7.7.5. Training for technology

The training of personnel is an essential component in the acquisition and transfer of technology. This training technology should not be restricted to how to operate the equipment, but also and as importantly should intend to teach how to recognize when the technology is useful and when it is useless (91). To the extent possible, training should preferably be conducted in the countries concerned, either on a national or a regional basis. The training offered in developed countries to medical students from developing countries is often totally irrelevant and counterproductive, bent to specialization, and overrelying on inappropriate technology. Training for technology should not only deal with the acquisition of skills, but importantly aim at developing appropriate attitudes. As mentioned earlier, in some parts of the world, there is a great tendency for qualified personnel to exert supervision on untrained people. In order to ensure proper training, the whole socio-cultural environment will have to be taken into consideration.

An important factor for the underusage or misuse of technology is the absence of an appropriate manpower development policy that identifies the type and number of personal needed (140). The prevention of brain drain will require the establishment of incentives and the definition of proper career structures (111).

7.8. Research orientations

It is impossible to augur which ways research will wander and what landscapes will unfold from the burgeoning of knowledge. Advanced technology should not be condemned on the ground that it is too sophisticated or cannot be applied in poor countries. What is too sophisticated or too costly or too prestigious today can be common place tomorrow. So was it with the pocket calculator and the transistor radio. Perhaps it had been a time when the optical monocular microscope was consi-

dered by some as too sophisticated for being used in Africa. Application of advanced technology in developing countries surely needs caution. but it also needs alert watching and a certain degree of serendipity.

Research orientation can be summarized as follows :

- (1) Methods should be developed for the assessment of health technologies, particularly advanced technology, in developing countries, special attention being given to the issues of relevance, equity, cost, effectiveness, and possible counter-effects. The development of appropriate methods of assessment will require much imagination, for it is difficult to judge what is good and what is better, particularly so when the judgement must be made in advance, without much practical experience. An assessment at an early stage is however essential, else the unbridled introduction in the coming years of technologies of all sorts will make the matter worse.

A systematic review of the problem could also act as a force for standardization, which in turn will help for quality control, an important consideration.

Much could probably be gained from conducting studies on the general "technological environment" in developing countries, in such a way that the introduction of health technologies can benefit from experience in other fields, such as agriculture or engineering. This calls for the systematic exchange of information on a multidisciplinary basis.

- (2) Appropriate methods should be designed for training in health technology. In this perspective, training should be viewed as a package, including studies on remuneration, incentives, and career structure. Besides training in skills, the promotion of right attitudes, especially regarding supervision and interpersonal relations, should be promoted. Studies on the socio-cultural environment will help in this matter.

- (3) The mechanisms and procedures involved in the acquisition of new technologies in developing countries should be comprehensively reviewed. Cases-studies should be conducted, in order to identify the most common constraints or short-coming in the decision making process as causes of inefficiency, waste of resources and frustration.
- (4) There are great opportunities for applied research stemming from recent scientific breakthroughs in biotechnology. Screening methods using monoclonal antibodies techniques and kits for the rapid and specific diagnosis of communicable diseases, especially enteric diseases, are available. Those techniques should be simplified in order to make them available for use in the field by personnel with minimal training working under adverse conditions.
- (5) Simple new methods of diagnostic imaging, mainly echography, should be tested in the context of primary health care. Their indications according to the epidemiological context and the conditions of their utilization should be studied in carefully selected projects.
- (6) In a number of countries, microcomputers are now spreading at an accelerated pace at the peripheral and intermediate level of primary health care. New applications will be found. The prospects of information networks should be explored in pilot projects, in connection with the development of information systems for primary health care.

8. OPERATION RESEARCH

Five issues in the Primary Health Care system call for special consideration :

- (1) the necessity to solve the dilemma between efficacy and equity, that is how to reconcile catering for the most important needs while promoting equal access to health for all;

- (2) the isolation of the community health worker which is at the same time supposed to carry out a number of preventive and even non-technical activities and to provide adequate medical care, if not to actually replace the doctor;
- (3) the definite managerial weakness of the secondary referral level as an intermediate link between the peripheral and the central levels;
- (4) the disorganization of laboratory support for diagnosis, screening and follow-up at the peripheral and at the intermediate level.
- (5) the lack of basic radiological services at the intermediate level.

8.1. The risk approach

8.1.1. The dilemma between efficacy and equity

Central to the Primary Health Care approach is the concept of equity, as expressed in the goal of "Health for All by the Year 2000". According to the Alma-Ata declaration: "Primary Health Care is the key to achieving an acceptable level of health throughout the world in the foreseeable future as part of social development and in the spirit of social justice" (22). At the same time, the strategy should be such as to provide to all the people in the world by the year 2000 "a level of health that will permit them to lead a socially and economically productive life" (Resolution WHA 30.43). It should be clearly understood that the objective is not to provide health services for all in the limits of the resources available. Although this approach had been considered during the discussions in Alma-Ata, it was categorically rejected (141). The objective is positively to improve health, in a comprehensive manner, by all means.

The crucial difficulty in implementing the primary health care approach rests in this dual objective. How to define an effective strategy which will lead all to the same level of health, while ensuring equity in the allocation of resources. In any country, and most particularly in developing countries,

there are immense variations in the health needs between different groups of populations, and consequently in the requirements for services.

How then to define equity ? As stated by Professor Abel-Smith :

"One possible definition of equity might be spending the same amount on health services per individual in every part of the country. But health services of a given standard cost more for dispersed rural populations, partly because of travel expenses and difficulties.

A second possible definition would be to improve the same standard of services everywhere, even if this cost more per head in rural than urban areas. Moving toward this definition of equity and using it as a basis for services would lead to a heavy concentration of such services for the poor" (142).

While the first conception offered by Abel-Smith will obviously increase the gap between the rich and the poor, the second one will not necessarily meet the criteria of efficacy. Improving health requires more than shifting resources according to social class or other economic indicators. In order to ensure that a strategy be effective, one has to identify specific needs and fix targets.

This conflict between equity and efficacy has been to a large extent shunned by the theoreticians as well as by the practitioners of PHC. It is generally assumed that by implementing comprehensive multisectorial action along the lines indicated in the Strategy for All, the overall level of health in the population will in the long-term be improved. While examples from recent history has shown that it might be the case, this is not sufficient to ensure both efficiency and efficacy of the strategy. It may result in a tremendous waste of resources.

The promoters of the primary health care approach have been relatively slow in catching with a quantitative evaluation of

the health needs. Epidemiology as the discipline which quantifies health is not mentioned once in one of the classical books on the matter (143). Diseases-specific indicators are so to speak anathema, since they conjure up the large-scale eradication programmes and vertical campaigns of yesteryear. The indicators recommended for evaluating PHC interventions are mainly operational (144).

There is a number of PHC projects which strives to measure unquantifiable parameters and/or broadly defined outcomes which are so variable as to make comparisons impossible or require decades to show significant changes.

How, then again, to identify parameters which at the same time (1) measure efficacy, in terms of needs to be met and problems to be solved for improving health for all; (2) measure equity in acceptable terms for the individuals.

Apart from other considerations dealing with the major objectives of PHC, the four criteria proposed by the tenants of Selective Primary Health Care, i.e. mortality, morbidity, technical feasibility, and cost, fulfill the first conditions. They measure efficacy, if only for selected priority diseases. They do not provide however an indicator of overall efficacy, since for the problems not selected as priorities actual efficacy is equal to zero. As for equity, they fulfill this aim only on a statistical basis. Regarding the individual, it is a yes or no system, provided one is or is not exposed to or suffering from one of the priority disease. It could be said jokingly of the Selective Primary Health Care Approach that to have access to health, please join the anonymous cohort of people affected with or exposed to the major statistically significant diseases.

The "risk approach", provides a way to reconcile at the same time efficacy and equity, both for the population and the individual.

8.1.2. The "Risk Approach"

As defined by Backett, Davies and Petros-Barvazian :

"...the risk approach is both a method of measuring the need of individuals and groups for care (thus providing a means of assisting them to determine their priorities) and a tool for the reappraisal and reorganization of health and other services to meet that need. Its aim is to improve care for all, and at the same time to pay special attention to those in greater need. It is thus not fully egalitarian in its approach but shows how to discriminate in favour of those in needs in proportion to their needs". "This approach aims to redress the inequalities in health that afflict almost all societies and is pragmatic in that it seeks social justice in health. Human and other resources should go where the need is the greatest, and assessment of the risk of future illness, accident, or death is a useful shortcut to the measurement of that need both for individuals and communities." (145)

This imaginative and innovative approach consists in using measurement of the risk of individuals or communities as a proxy for the measurement of needs. Instead of using indicators of poor health (i.e. frequency of diseases, or lack of services) for establishing an health policy (that is to identify priorities, fix targets, define strategies, and allocate resources), it uses the risks of an individual or a community to lose health (and develop disease, or need services) as a result of a number of risk factors. Since risk factors are not exclusively biological, but cover a large array of other determinants of poor health, be it ecological, environmental, psycho-social, or societal, the "risk approach" is particularly appropriate for an inter-sectoral health policy.

The "risk factors" are defined as detectable characteristics or circumstances of individuals or groups that are associated with an increased probability ("risk") of having or developing an undesirable condition. For example, regarding the so-called "undesirable outcome of pregnancy" (which includes

perinatal mortality, prematurity, low weight at birth, growth retardation, maternal death at or following delivery, birth of infants with congenital anomalies, among others), the risks are teen-age pregnancy, pregnancy over the age of 40, high parity, too frequent pregnancies, previous child loss, malnutrition and poor obstetric services. For the infant, large families, early weaning, crowding, parental illiteracy and poor sanitation are risk factors for post-neonatal infection and mortality.

The approach is epidemiological in essence. It stems for the concept of multifactoriality of health (and consequently diseases), which in individuals and in groups depends on a number of interacting characteristics, biological, environmental, psycho-social, ecological and organizational. It is based on the measurement of three kinds of risks: the absolute risk to the population, the relative risk, and the attributable risk.

The absolute risk measures the frequency of the undesirable conditions (let us say "unwanted outcome of pregnancy") in the population, for example 20 perinatal deaths (between the 28th week of pregnancy and the 7th day following birth) per 1000 births. The absolute risk is the usual epidemiological rate provided by vital statistics.

The relative risk measures the frequency of outcome according to one or a combination of the various factors involved. For example (simplifying much and overlooking the need for standardization if multiple factors are involved), if the risk of perinatal death for babies not delivered in hospitals is 30 per thousand instead of 20, the individual relative risk of non-hospital delivery is 1.5 (a 50 per cent excess risk of perinatal death as compare to all the babies born in this population). If the risk of perinatal death in babies from mothers smoking during pregnancy is similarly 30 per thousand (with the same simplification regarding standardization for multifactoriality as per above), the same will apply: an individual relative risk of 1.5.

The relative risk is well suited for use at the individual level in developing countries. It helps to estimate the risks of inappropriate life-style, exposure to adverse environmental conditions, lack of services, or other conditions.

The attributable risk measures the overall result in the population should the risk factor be removed. For example, if non-hospital delivery represents 2 per cent of all births, and births in smoking mothers represent 20 per cent of all births, even if the relative risk for both factors is the same, the removal of the latest factor in 20 per cent of all the mothers will result in a 10 times greater decrease than providing hospital delivery for 2 per cent of the mothers (the saving of infant lives will be respectively 20 and 2 per 10.000 births, and the perinatal death rates will be decreased from 20 to 18 per thousand in the first case and 20 to 19.8 in the second case).

The attributable risk is policy-oriented. It yields a measure of what could happen to the community's health at large if interventions are taken to remove or to decrease the risk by bringing together three ideas: the frequency of the unwanted outcome when the risk factor is present, the frequency when the factor is absent, and the frequency of occurrence of the risk factor in the community. "Estimations of the chances of an adverse outcome when one or more risk factors are present, measurement of their interaction as predictors, and calculation of what might happen to the health of the population if the risk factors were removed make possible a number of applications in preventive medicine." (145)

The "risk approach" applied to PHC at the community level may be summarized in one sentence: "Something for all, but more for those in need, and in proportion to that need." (145). It therefore reconciles both the aims of efficacy and equity in primary health care. Rather than setting arbitrary targets for ensuring health for all, it measures the differences between the present health level of individualized groups measured as risks and the average level of the population,

while at the same time indicating selective interventions for policy-making. By doing so, it turns up the strategy in a way which will benefit the most needy. Moreover, although established on firm epidemiological methods, the targets are not based on broad statistical indicators, but rather discriminate according to the needs of the individuals.

The risks can be computed in small groups of populations, taking into account the local context. This procedure circumvents the difficulty of defining appropriate specific and sensitive health indicators and collecting epidemiological and statistical data, which until now has constituted a major obstacle to the identification of priorities, to the definition of comprehensive health strategies in developing countries, and to evaluation. It thus disposes to some extent of the need for large population based databases.

In its present state, the "risk approach" is basically prevention-oriented. Developed specifically with reference to maternal and child health, including family planning, the extension of the "risk approach" to health in general will require further study. The same approach could possibly be used for curative medicine, based on the prevention of death and handicaps. It remains however to be seen to what extent specific epidemiological factors may be identified for most conditions, and how to combine them for multifactorial analysis.

As stated by Backett et al., the potential of the approach is great but it remains to be seen how well it can be applied. Most of its methods have still to be "tested in the real world with populations from village communities, migrants, nomads, and the inhabitants of urban slums" (145).

The "risk approach" seems at the moment one of the most promising way to establish the strategy of HFA on quantifiable grounds. It is comprehensive, taking into account social and ecological factors; it is quantifiable, helping in the

identification of priorities and amenable to evaluation; it is feasible, not requiring a large collection of statistical data; it is based on the local context while providing hypothesis for possible generalization; it is at the same time intervention oriented and sufficiently flexible to permit adjustment of the ongoing programmes.

While the risk approach applied to the individual is by no way a new concept, its use as a policy and managerial tool and its applicability in PHC urgently require research. The achievements already accomplished for the application of this approach for Maternal and Child Health (for example in Cuba, Columbia, Ghana, Honduras, Malaysia, Turkey), could serve as useful models (45).

8.1.3. Risk approach and expert systems

The "risk approach" could be a prime topic for applying as "expert system". A large body of factual information is available relating risks to epidemiological factors, socio-environmental variables and characteristics of health services. Expert knowledge could be captured without too much difficulty from the professionals working in the field and from experience gained in a number of primary health care projects. Due provision being made for different contexts, generalization should become possible. Such an expert system applied to the risk approach could be tested first in Maternal and Child Health, where the development of strategies of that kind are already well advanced, and then generalized to other health conditions prevalent in primary health care.

8.2. Decisional tree for diagnosis and referral at the peripheral level

8.2.1. Quality of medical care as a condition for credibility

For the quasi-majority of people, and positively for the totality of people who are ill, medicine means care and if possible cure of diseases. People go to the doctor, or to the

health worker, or for that matter to the traditional healer, to be treated and get cured, "not to be told what to do to prevent illness, or worse, what should have been done to prevent their illness." (23).

Among the eight minimal components of Primary Health Care as defined at Alma-Ata, five require active intervention of the health worker vis-a-vis the community, i.e. educating, promoting proper nutrition, providing sanitation, giving immunization, and taking preventive measures. Under no conditions, unless so exceptional as to probably merit publication, would the villager come to be lectured or seek advice on how to grow vitamine A rich legums in his plot. As far as he/she is concerned, the three components of PHC the villager is interested in are : (1) being treated for his/her ailment; (2) being given drugs; (3) getting some kind of maternal and child health attention. In addition, as shown in Burkina Faso, the villager is also interested in getting a quick ambulance service to the next best hospital in the vicinity (51), a preoccupation not fundamentally different of the one displayed by his fellowpatient in the large cities of the industrialized world.

Appropriate medical care at the peripheral level, that is at the first contact point of the patient with the health system, is therefore essential to ensure the community health worker with a minimum degree of credibility. Appropriate care does not only mean acceptable to the patient, as it is repeatedly stressed, but also refers to what the patient, even the simplest villager, do expect and is asking for, that is getting well and at the same time being offered the right dose of medical ritual in order to feel reassured.

The community health worker cannot thus indulge in poor medicine, else he will fail to be accepted by the community and be unable to carry out the other and less substantial tasks he is supposed to fulfill. He can even less afford to fail than the recognized physician, who may fence himself by

displaying the right dosage of arrogance, diplomas, and social immunity.

It is therefore necessary to ensure the community health worker at the peripheral level with a maximum of safeguard in his curative work. One way is to provide him with a formal preestablished decision system, accompanied by standing orders for treatment and/or referral (146). This will help him to separate from the many innocent-appearing situations those few that are potentially serious (147).

8.2.2. Decisional systems

Such decisional systems are based on answers to simple dichotomic questions. For each type of complaints or symptoms, a decisional tree leads to the next question, indicating finally the action to be taken.

Most of the attempts to develop medical decision support systems have been carried out in hospital care settings in developed countries. The application to primary health care, more particularly in developing countries, should respond to a number of special conditions. Since primary care constitutes usually the point of entry into the health system, the range of problem encountered is wider. Psycho-social problems may constitute a large proportion of the complaints. The relative frequency of diseases in an unscreened population tends to differ from the one in an hospital referred population. Primary care requires also a lower specificity of diagnosis than hospital referred patients (148).

A WHO working group has established a detailed list of symptom associations, indicative of common health problems in various parts of the world, that lay or paramedical personnel in charge of primary health care in remote areas should be able to recognize. Field trials of this recording system have been conducted in Burma, India, Sri Lanka and Thailand. The following qualifications were set up for its utilization : ability of the personnel to read and write; sufficient

maturity to accomplish the assigned tasks; acceptance, and preferably selection, by the community served; and sufficient practical experience in health services to recognize the complaints and symptoms listed (87).

In this approach, no diagnosis are made or need to be made, as long as the action to be taken is clearly and unambiguously stated. This is particularly important in view of the fact that the community health worker is not trained, and will never be trained, to handle a number of ailments. The recurring argument that half the complaints can be handled by the community health workers is definitely specious as long as one does not specify which half he can handle and which he cannot. It is of little use that the primary health care worker can deal with trivial complaints if he cannot deal with the ones which matter.

A number of such decisional systems or trees, as well as manuals for their utilization, have been proposed, which are based either on theoretical considerations or on actual observations of physicians' practices. Projects have been conducted to test the validity of some of these systems. Some strategies, such as the one developed in Kasongo, Zaïre (68), focus on the need for standardization. Lamboray, also in Zaïre, has suggested a four-steps procedure, i.e. (1) compiling a list of complaints and symptoms registered at the patients' initial consultation, and ranking them in order of frequency; (2) listing of the diseases which can produce these signs, singling out those for which the prognosis can be improved by specific treatment; (3) for each disease, specifying the type and place of treatment; (4) establishing decision-criteria as the most likely cause of the complaints; the sensitivity and specificity of each of these criteria are then studied and balanced against the cost of making a false positive or a false negative diagnosis. A mechanism for setting up priority diagnosis is also included in the procedure. Assuming that some action can be taken, and irrespectively of their frequencies, it takes into account

the severity of diseases as identified by specific criteria (for example sleeping sickness will have priority on malaria, tuberculosis on bronchitis, rupture of tubular pregnancy on ascariidiasis) (17,128).

This approach is interesting because at the same time it involves, albeit in an implicit way, an assessment of the diagnostic procedure, and constitutes an embryo of expert-system.

8.2.3. Expert systems for referral

A large amount of knowledge has been accumulated all over the world on the complaints and signs observed at the initial point of entry into the health system, and on the decision to be taken according to the type of workers. The time seems to be right to consider organizing this knowledge into an expert system.

8.3. Reinforcement of the intermediate level

In the primary health care approach, activities in the community are supported by successive levels of facilities.

Primary health care offer general health services to the population at the point of entry into the health system.

Secondary care comprises the care provided through specialized services on referral from primary care services. This may be called the intermediate level.

Tertiary care includes highly specialized services and eventually the super-specialities such as plastic surgery, neurosurgery, and heart surgery (149).

The intermediate level constitutes the next level in the chain of referral. It is generally centered on a health center, or a district hospital. It covers a well defined geographic areas, with a population of 30,000 to 100,000 inhabitants. The secondary level is invested with responsibilities for decentralized planning,

implementation of programmes, supervision, coordination with other sectors, and evaluation. It has a key role as a point of linkage between local communities and their specific needs and concerns on one hand, and the national goals, policies and resources on the other hand (197).

The increasing health activities being undertaken by village and community health workers place many new demands for support at the intermediate level (150). A major problem at this level is management. As more and more countries have begun to implement primary health care, the weakness of middle level management and planning needed to support PHC has often become apparent (49).

The most important management activities that have to be carried out at the intermediate level, as a necessary support for health care, are listed as follows (49) :

- (1) manpower development : type of staff required, adequacy for management as well as technical activities, allocation of tasks between workers, mechanisms for administering salaries and personal matters;
- (2) training : definition of roles in support of primary health care, mechanism for in-service training, evaluation of training material, adjustment to local needs;
- (3) finance and budgeting : mechanisms for mobilizing local resources, preparation of budget;
- (4) supply, logistics and maintenance : organization of drug and supplies purchasing and distribution, transport, maintenance of buildings and equipment, repair;
- (5) supervision : mechanism for supervision, training of supervising officers, follow-up;
- (6) referrals : evaluation of referral mechanisms, adjustments and corrections;
- (7) monitoring and evaluation : record-keeping, collection of basic information for planning and programming, establishment of local profiles, evaluation of information in the context of decision-making, surveys;

- (8) coordination with other health agencies and other sectors :
inventory of other health or health related agencies, evaluation of coordination;
- (9) community participation ; coordination with community organizations, motivation, evaluation, assessment of the representativeness of community leaders, contacts with underdeserved groups, support to community health workers for community projects;
- (10) policy and planning at the intermediate level : formulation of national health policies with identification of needs and setting of priorities, broad programming, programme budgeting, detailed programming, implementation, evaluation, information support.

Action leading to improvement of primary health care should begin with an analysis of the situation, in order to develop actions plans. Guidelines on how to conduct situational analysis should be specified. They will vary according to the context.

The considerations which have been reviewed above are admittedly somewhat vague. There remains considerable uncertainty on how to convert the PHC approach into practice (49), and on how to translate the present rhetoric into actual implementation (23). The only certainty at the moment is that the intermediate level is a crucial link in the whole pyramidal structure of PHC, and often the weakest part of the system.

The reason for this situation may possibly have to be found in a completely different sphere, beyond technical considerations. Reinforcement of the intermediate level raises the whole issue of decentralization, a most sensitive political issue when it concerns the distribution of power and the allocation of resources (49). This also has to be studied.

Caution should however be exercised that the necessary managerial strengthening of this intermediate level do not drain the larger part of the resources in terms of equipment and facilities. Equipment and facilities are no substitute for management (151).

8.4. Strengthening of laboratory capabilities

8.4.1. The role of the laboratory in primary health care

Simple laboratory methods have always played a large role in tropical medicine : detection of trypanosomes in the cerebro-spinal fluid and of malaria parasites in the thick blood drop, Gram staining for gonococci, or acid-fast staining for identification of mycobacteria in the sputum (tuberculosis) or in skin smears (leprosy) are obvious examples. In the colonial period, the microscope was almost a magical attribute of the laboratory worker in remote outposts, as was the stethoscope for the paramedical workers and the multivitamine pill for the nun.

Although there are exceptions, such as a strategy suggested to optimize on a cost-benefit basis the bacteriological examination for the diagnosis of lepromatous leprosy (152,153), little rationalization of the laboratory examination has been attempted in the past.

8.4.2. Rationalization of laboratory services

Within the context of the primary health care approach, the World Health Organization is making efforts to promote the rationalization of laboratories at the primary and secondary levels. Studies have been conducted in several countries, among other Morocco and Honduras, on the type of tests to be provided at each level, the cost, the workload (total number of tests carried out and translated into units of values or laboratory units of work) and the productivity (230, 231). Training manuals have been published (180), as well as lists of equipment and supplies for peripheral health services. The major laboratory responsibilities of the intermediate level have been spelled out as follow (231) :

- (1) diagnostic support of the secondary-care referral level hospital;
- (2) quality control of laboratory work carried out at the peripheral level;

- (3) logistical support for the peripheral level;
- (4) organization of a referral level for specialized examinations which cannot be performed at the peripheral level.

Depending on the health care structure and the respective responsibilities allocated to each level, the type of laboratory examinations to be performed will vary. As an example, the following examinations have been recommended for the laboratories of health centers in Morocco : (1) white cell count; (2) sedimentation rate; (3) red cell count; (4) differential leukocytes count; (5) urine biochemistry; (6) genital discharge; (7) bacteriology; (8) Ziehl-Neelsen staining (sputum); (9) parasites in faeces; (10) parasites in urine (230).

This list provides an interesting example of a shortcoming. Under item 8, the mention of sputum suggests that the Ziehl-Neelsen staining is required exclusively for the diagnosis of tuberculosis. The bacteriological confirmation of leprosy also requires Ziehl-Neelsen staining of skin smears. Nevertheless, in many countries where leprosy is prevalent, peripheral laboratories can and do perform Ziehl-Neelsen staining for tuberculosis, while leprosy patients have to travel hours, or days, by bus, or on feet, to get a similar examination which takes a few minutes and requires minimum training.

The organization of laboratory work at the peripheral level is generally not a matter of technology (except for the equipment being out of order or the reagents out of supply), it is often not even a matter of training, (great efforts have been made in many countries to train laboratory technicians), it is generally a matter a common sense. There are three ways of considering the interface between the patient, the specimen, and the laboratory. The first is to make the specimen walk to the laboratory by bussing the patient; the second is to send the specimen in a container while keeping the patient at the dispensary waiting for the result, which is better; the third

way, which is the best, is to keep everybody as close to each other as possible, patient, physician, and laboratory. Often it is not possible. Local solution to this quiz can go to extremely imaginative and circuitous detours. Some simple management techniques could help to solve the issue.

8.4.3. Adjustment of laboratories to new technologies

New technologies for diagnosis and surveillance of diseases may be particularly suited for supporting laboratories at the intermediate level. Surveillance programmes supervised at or organized by this level require reagents and related kits, including immunological reagents, typing sera for microbiological diagnosis, sera for quality control, and special immunodiagnostic kits for special tests, i.e. ELISA and radio-immuno-assays for the diagnosis and surveillance of a number of prevalent communicable diseases.

Operational studies are required for the adaptation of such tests in order to make possible their utilization at the intermediate level laboratories.

8.5. Basic radiological services

Central to the concept of Primary Health Care is a full back-up and referral service in terms of diagnosis and treatment. Radiological services should therefore be considered as an integral part of primary health care.

According to WHO, a well-structured diagnostic X-ray service at the country level should form a pyramid consisting of three levels of sophistication : (1) Basic Radiological Service (BRS), the broad base of the pyramid and available to the mass of the population requiring uncomplicated diagnostic examinations; (2) General Purpose Radiological Service (GPRS), at the intermediate level, functioning as a back-up service for the BRS facility and as a filter station for the sophisticated department at the top; (3) Specialized Radiological Service (SRS) at the highest level, performing specialized radio diagnostic procedures, and undertaking research and training (248).

At the moment, in the majority of the countries, this pyramidal structure does not exist. Two-third of the population of the world cannot be X-rayed for a limb fracture or for a severe cough. In Latin America, 30 per cent only of the population can reach X-ray facilities (which in turn are only 70 per cent of the time in working order) (246). A survey performed in 89 developing countries has shown that out of 1,2 billions people, only 220 million have access to X-rays (248). While 1 X-ray machine for 30,000 personnes is considered good coverage, 254 million people out of 1,242 million (20 per cent) are covered with less than one machine for 100,000 persons. In Africa, the rate is less than one machine for 100,000 inhabitants in 11 of the countries surveyed, corresponding to 79 per cent of the population (248).

In many developing countries, most of the radiological services are concentrated at the top level of the referral system, mainly in university departments or in a few large urban hospitals. This situation not only leads to an inequal distribution of resources and to denial of services to the large majority of the population, it also results in poor services. The workload per radiologist in the developing countries is extremely high, from 11,500 in Nairobi, Kenya to 18,500 in Sierra Leone, as compared to 2,500 - 8,500 in developed countries. The number of films taken for examination averages 3 ± 0.3 for departments which were surveyed in the developed areas, as compared to 1.5 to 2.5 in developing countries. In developed countries (Canada, Denmark, Federal Republic of Germany, Switzerland, United Kingdom), the percentage of special radiological procedures ranges from 14 to 29 per cent of the total number of examinations performed, while this percentage is on the average 8.2 per cent in the departments surveyed in the developing countries (Bangladesh, Burma, India, Kenya, Sierra Leone, Sri Lanka, Thailand). As a conclusion, it is clear that in the developing countries the resources of specialized referral units and the services of qualified radiologists are diverted for performing basic radiological work and tasks for which they are overqualified (248).

There is thus an urgent need to reinforce radiological services at the intermediate level. The World Health Organization has initiated the development of the Basic Radiological System (BRS) to provide better radiological coverage within the context of primary health care. It should form the broad basis of the pyramid. It should be available for the mass of the population who normally requires uncomplicated radiographic examinations for the diagnosis and follow-up of a number of medical conditions which represent the majority of indications for X-ray examinations in developing countries. Basic radiological systems should therefore concentrate on the rural parts of the countries, mainly the intermediate level referral hospital, and the health centers in urban slums.

The technical specifications and low-capital cost of BRS are such that it can be introduced in areas previously inaccessible to radiologic equipment where it was thought to be uneconomic (325).

When existing, radiological units are however (over 50 per cent of the cases) not functioning for one or several of the following reasons : (1) unit not powerful enough; (2) no chart to use with the unit; (3) unit out of order for long periods, (4) X-ray tube head too heavy (105, 249). In addition, frequent and large voltage variations associated with electricity supply in rural areas do have an effect on the quality of the radiographs. The wide variation of cassettes, negatoscopes and developing reagents used also contributes to poor film quality.

Apart from their general inadequacy and inequal distribution, the existing radiodiagnostic facilities in developing countries seldom meet the real needs of the majority of the population (42). Simple X-ray procedures without fluoroscopy would satisfy 90 per cent of the radiological needs. In Zambia, a survey of 15 hospitals with radiological services has shown that chest radiographs accounted for 51 per cent, and the extremities for 40 per cent of all X-ray examinations (249). In the Shandong Province, China, chest X-rays represent over 70 per cent of all radiological examinations (120).

Basic radiological equipment at the intermediate level needs therefore not be sophisticated. It should aim at serving the major indications for radiological diagnosis in developing countries, i.e. chest, plain abdomen, and skeleton, to detect lesions resulting from tuberculosis, traffic accidents, assaults, and occupational accidents (falls from trees) (105, 249, 253).

The World Health Organization has gone to great length to promote the Basic Radiological System within the context of Primary Health Care. Technical specifications and norms for quality control have been spelled out. New equipment has been designed. Technical and diagnostic manuals have been published.

Regarding ultrasound imaging, specifications for equipment have been laid out by WHO. The ultrasound unit must satisfy the requirement of a small or medium-sized hospital and be designed for use by the duty medical officer, general practitioner or obstetrician rather than by highly skilled ultrasonologists. Such a general purpose ultrasound unit should be small, portable, rugged, and reliable (129,166).

In China, every county or district hospital is supposed to be gradually equipped with an ultrasonic unit within the next five years. The main purpose is to help in the diagnosis of highly prevalent types of cancer, such as cancers of the liver, breast, oesophages and cervix. (157)

Besides strengthening basic health services at the intermediate level, there is a need to evaluate the acceptability, the efficacy and the performances of the radiological components within the whole system of referral in primary health care.

8.6. Research orientations

- (1) Pilot studies should be conducted in order to test the feasibility of applying the "risk approach" to the common health problems encountered in primary health care.

Factors of risk should be identified and measured in various epidemiological contexts, at the peripheral level, as a

preliminary step to the possible development of an expert system applied to the "risk approach".

- (2) A systematic review should be undertaken of the existing decisional trees for diagnostic and referral at the peripheral level of primary health care. Studies should be conducted in different epidemiological and operational contexts in view of developing additional decision trees and test their relevance and validity. As a preliminary step to the development of an expert system, the data from a large number of such decision systems should be collected and structured. This implies the development of an appropriate knowledge engineering programme.
- (3) The methodology of situational analysis as applied to the management of health services within the context of primary health care in developing countries should be studied.
- (4) Ongoing primary health care projects with good systems of referrals to the intermediate level provide opportunities to study the operational aspects of public health and diagnostic laboratories in order to improve their functioning. The same applies to basic radiological services.
- (5) Further technical appraisal should be done to establish the engineering standards, the quality and the reliability of Basic Radiological Service for primary health care. Field trials should also be carried out to study its operating costs and effectiveness when used by non-specialist personnel.

9. SPECIAL PROBLEMS

A number of problems deserve a special attention. They are : urban primary health care, disaster management, the role of women in primary health care and community-based rehabilitation.

9.1. Urban primary health care

9.1.1. The trend toward urbanization

In 1965, the population of Mexico City was 6.5 million; in 1985, it was some 16 million. In 1955, some 18 per cent of the population of Republic of Korea lived in or near Seoul; in 1985, the proportion was 36 per cent, which due to the population growth in South Korea, represents an increase from 3.9 to 13.7 millions. In Ecuador, if the present rate of urban/rural population redistribution persists, in 2000 more than half the population will live in or in the vicinity of the two cities of Quito and Guayaquil. New names have been coined for these urban octopuses: Jaboteppek, Metro-Manila. In a number of countries, the trends of urban migration have slowed down (167). It is however estimated that 44 per cent of the population of the developing countries (a 50 per cent increase on the present) will be living in urban areas by the year 2000, as compared to 31 per cent in 1980 (increasing roughly by half) (Figure 1) (9). In 2000, 46 urban agglomerations of the world (excepting Europe, North America and Japon) are expected to have populations over 5 million, among which 16 between 10 and 20 million, and 4 over 20 million.

9.1.2. Health and the urban ecology

Most of these urban population will live in areas that are now underserved with basic environmental facilities, and many will probably be living at very high density in appalling and degrading conditions of squalor which defies description (45).

While health care concern has mainly focused on rural areas, nothing can compare with the living conditions of unrooted

people in the shanty towns of the developing countries, conditions made of unemployment, misery, and on the crest of it violence. True, cities are not affected by large famines like in the Sahel, the Horn of Africa, or other more limited areas of Latin America and South East Asia. Problems in urban areas are more scattered, and perhaps less visible.

Urban living is associated with a number of factors detrimental to health: low income, limited education, insufficient diet, over-crowding and underprotection. The urban environment is characterized by man-made conditions such as industrialization, pollution, traffic, stress and alienation, as well as by social and psychological instability and insecurity. Prostitution, including in children, sexually transmitted disease, drug addiction and alcoholism are growing problems. Children put to work under precarious conditions is a common situation, as is children abuse. According to UNICEF, there might be up to 40 million abandoned children in Latin America and the Caribbean (168).

A survey carried out some 20 years ago (1962-64) in 10 cities of Latin America showed that from 6.3 to 18.3 per cent of the population aged 15-74 years was dying with no medical care whatever during the last year before death. A further 20.8 to 45.8 per cent was not seen by a physician or was not receiving medical attention during the last year of life except on the day of death or the previous day (169).

Continual rural-urban migration replenishes the reservoir of infection for a number of communicable diseases, especially tuberculosis, which is highly prevalent in the cities of the developing world. Specific problems are urban malaria, still a significant problem, and dengue haemorrhagic fever, an insect born disease with great potential epidemics (170,171, 172).

9.1.3. Urban primary health care

Primary health care is particularly difficult to implement in urban areas. The presence of large hospitals and other often specialized health facilities is detrimental to a rational structure of peripheral health care delivery. In practice, many people in the city go to the pharmacists for basic advice and only visit hospitals when there is an emergency (172).

Emphasis has been put by WHO on the development of primary health care in urban areas (173). A number of initiatives are under way aiming at incorporating the primary health care approach in cities. So-called neighborhood health programs have been initiated in the barrios of Cali and the kampungs of Jakarta. Urban community health workers have been specifically trained for carrying out urban primary health care in Guayaquil, Ecuador, in the barangays of Manila and the katiwala of Davao City, the Philippines, in the barrios of Cali, Colombia, and Lima, Peru, and in Colombo, Sri Lanka (172,174, 175,176,177). Integrated primary health care schemes have been implemented in a number of cities or satellite-towns, a case in point being Pikine-Dakar, in Senegal (69).

A major impediment is that often urban populations demonstrate no defined community structure on which to base community participation. Some programs however get support from urban community involvement schemes as presently developed in a number of countries (172).

9.1.4. Research orientations

- (1) A systematic review should be made of the primary health care approach in the urban areas of the developing countries, in order to identify the common specific problems encountered in its implementation. A small number of existing projects should be monitored. Additional projects could be set up under strictly controlled conditions.

- (2) More information should be collected on epidemiology as related to urban ecology, including violence, delinquency, children abuses, occupational health, illnesses associated with pollution, accidents, nutrition, and communicable diseases.
- (3) The patterns of care delivery in shanty towns should be studied, including coverage, access, points of entry, channels of referral, and interference from private doctors, pharmacists or specialized facilities.
- (4) Special attention should be given to the organizational patterns of urban societies, as related to the need for community participation in urban primary health care.
- (5) The profile of community health worker in urban areas, and particularly in shanty towns, should be defined, taking into account his specific tasks and his position in the structure of the society.

9.2. Disasters, Refugees, and other extreme situations

9.2.1. Disasters and health

Large scale disasters, both natural (floods, earthquakes, typhoons, for example) and man made (chemical accidents, dam collapses, among others), constitute major health problems in terms of deaths, morbidity, and destruction of services and facilities. They disrupt the texture of the society and may jeopardize long term efforts at development. External aid often interferes with social and cultural patterns, engendering loss of confidence, dependence and frustration.

Although presenting specific features, disasters of slow onset such as drought, as well as civil strifes, displacement of large populations (transmigration) or concentration of refugees in camps, generate health problems and managerial issues which are not basically unlike those seen in acute disasters.

Socio-political constraints, movements of population and natural disasters have been incriminated for delays or difficulties in the implementation of primary health care (45). While it may eventually be the case, this statement represents a somewhat short-sighted view. Exposure to recurring risks in disaster-prone areas may precisely serve as a stimulus for developing primary health care. A number of studies conducted over the last decade in earthquakes and similar situations have shown that external assistance arrives generally too late and is not specific enough as to be effective (178,179). In the immediate aftermath of a disaster, the local community and only the local community can bring an adequate response in order to reduce the consequences (180). Community preparedness can make all the difference. Disasters, so to speak, represent a "hot laboratory" for primary health care under stringent conditions.

9.2.2. Health management in disasters

Although disasters were not mentioned in the Alma-Ata declaration, WHO stresses now that disaster management is part and parcel of primary health care (181,182).

It calls for preparedness at the community level, education of the people, and adequate training of the community health workers. Local profiles should be established, including mapping of hazards and assessment of potential risks. Simple information systems should be set up, which could be activated to assess the damages and needs after the disaster has occurred (191). Precise referral mechanism should be designated in advance.

Although famines and conflict situations associated or not with displacement of populations have specific characteristics, being often of slow onset, care of refugees or other population exposed to adverse unexpected conditions has much in common with acute disasters. At the moment, millions of refugees in developing countries live in camp for long period

of time. "While the need for acute emergency medical and surgical services is obvious, it is being increasingly recognized that there is an urgent need to move towards the planning of health care within an overall perspective of development." (183) Primary health care in refugee camps raises a number of specific issues such as community involvement when refugees come from different cultures, selection and training of health workers from the refugeeed populations, relationship with expatriate personnel, absorption and control of external inputs from donor agencies, evaluation, interferences from outside, relation with local populations, psychological problems, and political issues.

The World Health Organization has embarked in a training program on disaster management and primary health care for disasters.

9.2.3. Research orientations

- (1) Behavioral studies should be conducted on the way communities respond to conditions of extreme hardship, in order to gain knowledge on the motivation for and mechanisms of community participation.
- (2) Minimal health packages should be tested for use after disasters and in refugee camps.
- (3) Simple and robust indices should be designed for assessing the needs in extreme situations, and appropriate information systems should be tested to monitor and evaluating primary health care after disasters and in refugee camps.

9.3. Women and primary health care

9.3.1. The role of women in primary health care

The status of women is often very low in developing countries. Referring to Africa, Sai writes: "Perhaps the rural African women is the most underprivileged of all human beings. Various social roles, cultural practices, and the biological tasks imposed by fertility, have combined to keep the average African woman close to a beast of burden ... Although women have traditionally handled most of the family food crop production and have therefore played a major role in agriculture, in many countries they do not own land and do not have access to credit... The African woman spends between 18 and 20 years of her adult life in childbearing in comparison with 3 to 5 years for many advanced countries. Her potential for other pursuits is therefore considerably reduced" (10).

Within the philosophy of development underlying the Alma-Ata declaration, a greater role is sought for women in the implementation of primary health care. "Women are the primary users of primary health care services and the principal health care decision makers within the family. (They) are also the principal promoters and delivering agents of primary health care...as mothers, ... as traditional health practitioners,... as nurses and midwives." (184)

This role can be seen at two levels. First, women could share in a number of tasks and activities of primary health care, especially in the villages. Second, in the context of community participation, women should get organized and the collaboration of women's groups should be encouraged. In a number of countries, health professionals include an increasing proportion of women. At the peripheral level, several tasks are exclusively or preferentially carried out by women, such as maternal and child health, family planning, and nutrition. The enrollment of properly trained traditional midwives in primary health care has met with a considerable success in

some countries, leading to a decrease in the number of maternal death and neonatal tetanos.

Affirmative action schemes could be undertaken to preferably recruit women, for example as community health workers. This however will greatly depend on the local culture. In some countries, it will be impossible. In others, women will be poorly accepted (63). The recruitment may raise problems. In rural Bangladesh, a successful training of women for work in family planning and maternal and child health programmes was by necessity centered on the best educated women from "well accepted families", which does not necessarily keeps with the purpose of community involvement at the grass roots level. While the aim is at the same time to increase the output of programs by employing a major often neglected human resource and to foster the emancipation of women through the primary health care approach used as a leverage for development, caution should be exercised not to misjudge the social benefit. In one such program, it is reported that "not only it benefited to people but that it was particularly gratifying to observe the transformation of shy, reticent, village housewives into extremely confident and energetic village worker" (185). It is by no means certain that this accomplishment is relevant to the issue.

As for the involvement of women's organizations in primary health care, the World Health Organization is actively pursuing efforts in that direction. Emphasis is put on the role that self-help women's groups may play in a number of activities, namely organization of day care centers, preparing food for children from working mothers, managing village clean-up campaigns, monitoring community water resources, assembling children for immunizations, developing mini-pharmacies, and providing information for family planning (52). The Pan American Health Organization (PAHO) has undertaken a Five-Year Regional Plan of Action for increasing the participation of women in primary health care. It stresses the following priorities (184) :

1. Increased participation of women as decision makers, providers and recipients in the planning, implementation and evaluation of primary health care activities;
2. Collection and standardization of data on the role of women in these activities and on morbidity and mortality by sex;
3. Legislation to protect women working in unregulated sectors and their children;
4. Integration of self-care and self-promotion into ongoing health care and development programs;
5. Coordination with organizations in addressing the health needs of women and their families. This coordination may involve governmental or nongovernmental organizations (NGO's) working with or benefiting women, or it may include groups of women specifically organized to address women's issues.

In some countries, women's organizations do traditionally exist and have apparently played for long a certain role in the health activities. An example is the Women's Committees in Western Samoa (55). These groupings are however based on a particular social structure and reflects the chieftain ("matair") system peculiar to the country. The Committees are generally run by the wives of the senior chiefs. None of the committees have active programs of health care, the major activity being support to the visiting nurses. Such programs cannot be exported, since they are heavily depending on local cultural conditions.

Setting up women's committee specifically for primary health care where none exists seems a perilous venture. It has been suggested that one of the conditions to start a primary health care program would be participation in the decision making at the village level of women, together with landless villagers and people other than the elders (30). There is some doubt that in a number of rural populations any effort in that direction could achieve anything else than jeopardizing any future prospect for primary health care.

The most interesting approach would be to focus on a few number of rapidly growing multipurpose and promising women's organizations which have demonstrated a large and reproducible impact on the social and economic conditions of women in the concerned countries. There are several of those, an example being the Self Employed Women Association (SEWA) in India (186).

9.3.2. Research orientations

- (1) A selected number of women's organizations should be selected in order to study how to incorporate components of primary health care in their activities.
- (2) The role of women in family health, particularly regarding health education, should be further studied in selected contexts.

9.4. Community based rehabilitation

9.4.1. The need for rehabilitation

Survey results have shown that in all countries some 7 to 10 per cent of the population suffer from some kind of disability (211). Disabled persons form one of the most underprivileged groups in the societies of developing countries. Many of them live a life without dignity and in absolute poverty. They are also socially isolated and victimized by superstition. Most of the time they are denied job opportunities and can only survive through begging.

Disabilities may be congenital. Many however are sequellae, resulting from lack of health care. Blindness from trachoma, onchocerciasis and avitaminosis, paralytic poliomyelitis, and leprosy deformities are examples. Thus, the management of disabilities should start with prevention and/or adequate care at a stage where they can be counteracted. Things being what they are, care at a late stage of those whose suffering result

at least in part from neglect at an earlier stage is a duty of the health services.

9.4.2. The present situation

Rehabilitation has been defined as including "all measures aimed at reducing the impact of disabling and handicapping conditions, and at enabling the disabled and the handicapped to achieve social integration. Rehabilitation aims not only at training disabled and handicapped persons to adapt to their environment, but also at intervening in their immediate environment and society as a whole in order to facilitate their social integration." (212)

Services for disabled persons are scarce in most developing countries. The few existing services are generally institution based rehabilitation (IBR) services, requiring highly specialized personal and expensive technologies. Although oftentime supported by foreign assistance and non governmental agencies, such institutions drain a large amount of the local resources. In certain cases, they coexist with a total lack of preventive measures, whereas the resources required for their maintenance could suffice to conduct by instance efficient vaccination campaigns. It results in a vicious circle.

It has been estimated that in the developing countries some 98 per cent of the disabled have no access to rehabilitation services. For a number of decades, great effort to bring rehabilitation to the community level have been underway in China. Some 100,000 home wards for the care of chronic illnesses have been set up which serve the following functions, under the supervision of a physician: post-operative care of patients, chronic diseases (diabetes, psychosis, pulmonary emphysema, terminal tumors, cardio-vascular diseases), care of acute infections, long immobilization for recovery of fractures, crippled patients, and care to the elderlies (157).

The concept of community-based rehabilitation (CBR) has been developed to palliate the present inexistence of services. It involves measures taken at the community level to use and build on the resources of the community, including the impaired, disabled, and handicapped persons themselves, their families, and their community as a whole, in order to achieve rehabilitation (212).

The CBR approach consists of the following (211):

- promoting awareness, self-reliance and responsibility for rehabilitation in the community;
- building on manpower resources in the community, including the disabled themselves their families and other community members. The disabled and their family members are called on to take an active part in the training efforts;
- encouraging the use of simple methods and techniques which are acceptable, affordable, effective and appropriate to the local setting;
- using the existing local organization and infrastructure to deliver services, especially primary health care services; and
- taking into consideration the economic resources of the country and thus allowing an eventual extension to provide total coverage according to perceived needs.

The techniques must lend themselves to implementation within the setting of the developing countries, emphasizing the use of unsophisticated and appropriate technology.

In CBR programmes, families and community members are told how to take care of the training for their own disabling, using local resources and technology. Rehabilitation programs are essentially based on training modules, arranged as packages. Members of the community are selected as local supervisor or to identify the disabled, motivate them and their families to take part in the program, implement the training and evaluate the results.

A manual "Training the Disabled in the Community" has been published by WHO (213). It includes modules for persons with fits, hearing and speech difficulties, learning difficulties, moving difficulties, seeing difficulties, and strange behaviour.

Community based rehabilitation programs are presently experimented in a number of countries (Botswana, Burma, Kerala State in India, Mexico, Nigeria, Pakistan, the Philippines, Saint-Lucia, Sri Lanka).

9.4.3. Research orientations

The community based rehabilitation approach has apparently proved effective and technically feasible in all the different settings where it has been tried. It is economically maintainable. Its success depends however on an adequate integration into primary health care.

It would be worthwhile to further test this approach, as a component of primary health care packages in different countries. As an addition, economic studies should be carried out on its cost as compared to preventive measures for those disabilities which are preventable, in order to further demonstrate the need for strengthening preventive activities.

9.5. Mental health and primary health care

9.5.1. Importance of the problem

Mental disorders constitute a serious and often overlooked problem in developing countries. Epidemiological studies have shown no major differences in the overall prevalence of these disorders between industrialized and developing countries (41). Seriously incapacitating mental disorders affect at least 1 per cent of the population at any one time and some 10

per cent of the population may expect to be affected at some time during their life. The major functional psychosis, such

as schizophrenia and affective disorders, constitute a large part of these disorders.

Mental disorders in children and adolescents should receive special attention in developing countries, due to the large proportion of the population, up to one half, under 15 years of age. Epilepsy has been found to be more frequent than in developed countries. Brain injury resulting from accidents is likely to rise in the future. Alcohol and drug addiction associated with urban living is likely to grow in importance as urbanization increases. Mental problems associated with war, civil strife, displacement of population, famine and other exceptional circumstances, though little studied, are probably of major importance.

Regarding psychoneurosis, emotional disorders and personality problems, although anthropological differences and a relative lack of comparative criteria makes this problem difficult to ascertain, there is no evidence that they are less common in developing countries than in the rest of the world. Certain forms of acute functional psychosis have been described in a number of developing countries which, due to their florid symptoms, have often commanded public attention.

Attitudes to mental disorders in developing countries are often based on fear and more often than not are considered as being from supernatural origin (216). These attitudes lead to the rejection from the community of mentally ill persons. Often the administrators share these attitudes. Mental disorders are generally not considered as a priority.

The effectiveness of traditional healers in treating the mentally ill persons is controversial. Resources for mental health are most limited, generally based on large, isolated, poorly staffed, overcrowded large psychiatric hospitals, with mainly a custodial function.

9.5.2. Present approach

It is now recognized that conventional mental health care alone cannot hope to make a significant impact on the problem. It is increasingly evident that mental health care should no longer be provided in central institutions, nor should its provision be concentrated in the hands of a few mental health specialists (155). Efforts are therefore being pursued to integrate mental health care into primary health care.

In China, where psychiatric facilities are short except in cities, a system of home care has been established under which patients can receive medication under supervised conditions while at the same time living a normal family and social life. Primary health care of mentally ill patients is apparently widespread, with short training course for the personnel in charge in townships and rural areas. The results are reported as excellent, especially for schizophrenic patients (whose prevalence in the country reaches some 2 per thousand) (157).

A study was conducted by WHO (WHO Collaborating Study on Strategies for Extending Mental Health Care) in seven countries (Brazil, Colombia, Egypt, India, Senegal, Sudan and the Philippines) in order to test the feasibility of providing mental health care in developing countries within the framework of primary health care (215, 217). The study addressed mainly three problems, i.e. the knowledge and attitudes of health workers, the detection of mental disorders in primary health care facilities, and the community reactions. A new concept of community psychiatry for developing countries emerged during this investigation. Problem areas which should be given high priority by the health workers were identified, namely (a) psychiatric emergencies; (b) chronic psychiatric disorders; (c) mental health problems of patients attending health centres, general clinics and other curative services, particularly at the primary health care levels; (d) psychiatric and emotional problems of high risk groups. The appropriate technology required for managing these conditions in primary care settings was specified. It was shown that health

workers at the primary care level, even those with little formal education, can be trained to detect mental disorders and to initiate effective treatment, and the tasks to be carried out by them and by the community members were defined.

9.5.3. Research orientations

Training of primary care workers for mental health care should receive particular attention. Training methods have to be tried out in various contexts. Training material should be adjusted to local needs.

Other areas deserving health systems research are the setting up of appropriate networks for referral and systems for supervision, information system for monitoring care, the provision of drugs, methods for following up cases, the outcome of treatment, the range and type of drug needed, and reasons for attendance, drop-out, and relapses, as well as management at home of the mentally handicapped.

III. CONCLUSIONS AND RECOMMENDATIONS

10. CONCLUSIONS AND RECOMMENDATIONS

New knowledges and new techniques are of no avail to the populations of the poor countries of the world if they are not harnessed for actual use in the local context.

Health systems research is the appropriate tool for translating research into development in such a way that it can benefit the large numbers. It calls for a multifarious approach, drawing largely on the expertise of other disciplines mitigated by common sense.

The primary health care strategy formulated by the World Health Organization has by now been accepted by all nations as the way to promote health for all in a spirit of social justice.

New concepts, new technologies, new expectations have surged in the recent years, which can and should be used, albeit with discrimination, to meet ancient problems, needs and frustrations.

This report outlines the major areas for applying health system research in order to bridge the gap between new scientific knowledge and better health for the people of the developing world. The relevant topics are reviewed in a long term perspective rather than for potential short term accomplishments.

A number of suggestions for applied research are made. They constitute more a shopping list than an all inclusive comprehensive programme. These suggestions, which could be translated as criteria for inclusion into a research programme, are summarized in the following table.

Evaluation of Primary Health Care	Review of PHC projects and identification of the conditions for replication and/or generalization of the approach	A synthesis of the issues involved, which already have been largely identified, would be useful; special caution should be exercised to control the bias due to external output. It is suggested that no new rural PHC projects should be set up, since their potential for additional information or generalization of findings is low
	Study of the difficulties in intersectoral cooperation	Information in this respect would be most useful; the methodology is unclear, since access to government data will likely be restricted and fragmentary
	In depth analysis of the role and situation of the community worker	Including studies on motivation, acceptance, discrepancy between tasks and training, mode of remuneration. Plenty of data is available, but more should be obtained in different socio-cultural, economical and political contexts. Cooperation with experts in cultural anthropology will be necessary. This analysis should be conducted without doctrinal prejudice
	Study of the articulation mechanism between the peripheral and intermediate levels	In order to identify the major constraints. Cooperation of experts in management and logistic will be necessary.
	Testing of minimum health packages for PHC.	Special caution should be exercised to control external output; attention should be given to acceptability by the populations. Cooperation with experts from other disciplines, for example designers, should be sought.
	Study of the capacity of health administrations to absorb and manage PHC.	Such studies will require much imagination because the way to tackle this problem

varies from country to country and little generalization can be made. The issue transcends the health sector.

Needs carefully controlled studies. To be conducted in collaboration with social scientists. Requires the informal consent of the communities involved

Requires the selection of a number of such situations, which should be closely monitored. A standard protocol will be needed

To be carried out in cooperation with cultural anthropologists.

Support of health education projects on specific topics related to concrete issues.

Study of the conditions required for an effective coexistence of vertical and horizontal services, and the progressive integration of categorical programmes into PHC

Studies on the concept of health and disease in populations and on their expectation for health services

Information

Design and testing of single operational and epidemiological indices for PHC

Indicators of effectiveness, efficiency and to a certain extent equity have been proposed; indicators related to decision-making should be further tested

Design and testing of simple and rapid surveying methods in PHC contexts

Includes the identification of indicators and indices, and the design of sampling procedures to be used by community workers.

Design and testing of information systems to be used at the peripheral level for recording and reporting activities, patient management and control measures

Should be considered as total package from individual case taking to production of information for decision making to be fed back to PHC level; for manual and/or computer processing.

Technology	Development of a methodology for the assessment of health technology in developing countries.	As a first step, a general review could be conducted of the types of problems raised by the acquisition and management of health technology: mechanisms of decision, absorptive capacity, managerial capability, operational shortcomings, marketing, collateral interests, external funding. Comparisons should be made with problems encountered in other technological fields. A limited number of case-studies with a potential of generalization would be useful.
	Development of training methods for managers in health technology.	Special attention should be given to adequacy to the technological environment of developing countries, promotion of attitudes, and strengthening of supervisory capabilities.
	Development and field testing of new techniques for the diagnosis and screening of major tropical communicable diseases in the context of PHC, using recent advances in biotechnology.	In close association with basic research conducted under the sponsorship of the EC Programme on Medicine, Health and Nutrition in the Tropics, and with the WHO-TDR special programme.
	Assessment of the utilization of echography for the diagnosis and/or screening of prevalent diseases.	With emphasis on relevance, acceptability, simplicity, efficiency, and cost.
	Study on the use of microcomputers for information retrieval and management in PHC, including microprocessors networks.	Definition of the potential uses and assessment of the effectiveness, feasibility and cost compared to current methods.
Operational research	Development of an expert system for the risk approach.	Requires first the determination of appropriate comprehensive (social) as well as specific (disease oriented) indicators of

risks; ongoing experience in MCH should be closely monitored; limited projects could be set up.

Existing referral guidelines should be analyzed; a knowledge engineering programme to retrieve available data should be designed as a first step; an expert system could be set up and tested

Development and testing of an expert system for the diagnosis and referral at the peripheral level

Case-studies with a potential for generalization should be conducted a close cooperation with management experts is necessary

Situational analysis of the management of health services at the intermediate level of care

With special emphasis on the respective distribution of tasks and the articulation between the peripheral and the intermediate level; attention should be given to the possible modifications resulting from the introduction of new laboratory techniques

Studies on the operational aspects of laboratories at peripheral and intermediate levels

Limited studies are already carried out by WHO; more studies are needed to assess the effectiveness, efficiency, relevance, acceptability and cost of BRS

Appraisal of Basic Radiological Services for PHC

Urban primary health care	Determination of the conditions for appropriate PHC in urban underprivileged areas	Setting up of closely monitored urban primary health care projects are recommended
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Disaster situation	Analysis of the role of PHC in disasters and other extreme adverse situations.	With special emphasis on the experience to be gained regarding situational analysis and preparedness, community responsibility and
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roles, minimum health care packages, management of information and epidemiological surveillance.

Women and PHC	Identification of the conditions for a greater involvement of women in PHC.	Selected case studies of existing projects.
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Community-based rehabilitation	Integration into primary health care packages.	With special consideration for cost as compared to prevention.
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Table 1. HEALTH AND RELATED SOCIOECONOMIC INDICATORS (9)

	Least developed countries	Other developing countries	Developed Countries
Number of countries	29	90	37
Total population (millions)	283	3001	1131
Infant mortality rate (per 1000 liveborn)	160	94	19
Life expectancy (years)	45	60	72
Percentage of newborn with a birth weight of 2500 g or more	70%	83%	93%
Coverage by safe water supply	31%	41%	100%
Adult literacy rate	28%	55%	98%
GNP per capita	\$ 170	\$ 520	\$ 6230
Per capita public expen- diture on health	\$ 1.7	\$ 6.5	\$ 244
Public expenditure on health as % of GNP	1.0%	1.2%	3.9%

Table 2. NUMBER OF PHYSICIANS, RATE FOR 10 000 POPULATION
AND RATIO POPULATION/PHYSICIANS IN SELECTED DEVELOPING COUNTRIES (45)

Country	Year	Number of physicians	Physicians per 10 000 population	Population per physicians
Chad	1978	90	21	47,889
Upper Volta	1979	127	19	52,976
Mozambique	1979	342	34	29,822
Zaire	1979	1900	68	14,668
Central Afric. Republic	1979	84	28	35,714
Lesotho	1977	67	54	18,657
Zambia	1979	714	126	7,912
Cameroon	1979	603	73	13,678
Congo People's Republic	1978	274	188	5,328
Haiti	1979	600	122	8,198
Afghanistan	1979	21,938	275	3,639
Bangladesh	1979	7,709	91	10,955
Nepal	1979	416	30	32,956
Burma	1979	6,996	213	4,705
Indonesia	1979	12,400	84	11,973
Papua New Guinea	1978	212	71	14,151

Table 3. INFANT MORTALITY RATES AND MORTALITY IN CHILDREN 1-4 YEARS
IN A SELECTED NUMBER OF DEVELOPING COUNTRIES, FINLAND AND CANADA (45)

Country	Infant mortality rates (0-1 years) 1978-1979 per 1000 live births	Mortality rates per 1000 in children 1-4 years 1979
Angola	192	33
Benin	149	25
Burkina Faso	182	31
Chad	190	35
Ethiopia	178	36
Guinea	220	28
Rwanda	127	25
Sierra Leone	136	25
Bolivia	168	23
Haiti	130	33
Bangladesh	139	23
Somalia	177	29
Nepal	133	25
Burma	140	13
Papua New Guinea	128	16
(Finland)	8	1
(Canada)	12	1

Table 4 : Allocation of new technologies according to the level of health care

	Peripheral Level	Intermediate Level
Prevention	<u>new vaccines</u>	<u>management techniques for supervision</u>
	<u>new materials</u>	<u>expert system for organization</u>
	<u>immunodiagnosis of common diseases</u>	<u>information technology</u> for planning, implementation, evaluation
Detection/Diagnosis	<u>expert system for diagnostic decision tree and referral</u>	<u>immunodiagnosis for referred cases</u>
	<u>microcomputer for recording and follow-up</u>	<u>medical imaging (X-ray, ultra-sound)</u>
	<u>immunoscreening for major diseases early detection) and epidemiological surveillance (identification of groups at risk)</u>	<u>microcomputer networks for health statistics</u>
Treatment/control	<u>biotechnology for vector control</u>	<u>expert system for training</u> <u>expert system for drug distribution</u>
Rehabilitation	<u>new materials</u>	<u>system</u>

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