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to health of gross and micro-pollution of air, soil and water by pesticides and radio-active residues are difficult to foresee precisely, since they depend on the extent to which effective controls are maintained or introduced.

For the health planner who often has to look ahead some ten to twenty years, there are additional areas of uncertainty. Population and morbidity projections based on existing national trends are not adequate for estimating future health-care needs and health manpower requirements unless they are adjusted to take account of the probable consequences of biomedical advances and socio-economic changes. Estimates of future health manpower requirements have to be based not only on disease and population projections but also have to take account of such factors as the future organization of health services and the future functions and work-load of doctors and other health workers. For these reasons, in long-range planning, straight statistical extrapolations which may be invalidated by new discoveries and applications which could not be foreseen at the time have to be complemented by non-quantitative forecasts of a more general character.

In this paper it is proposed first, to refer to certain non-quantitative forecasting methods and the broad changes which can be expected in disease patterns and organized health care services during the next twenty to thirty years, and then to examine, in the light of these facts, the problem of estimating future health manpower needs.

II FORECASTING ORGANIZATIONS AND METHODS

Until recently, the only source of general forecasts was the intuitive conclusions of individual experts in various fields. Now, however, the era of exclusive dependence on the opinions of men of eminence as a guide to the future has given way in many countries to forecasting by more objective methods. Large and medium-sized commercial and industrial undertakings the world over now do technical forecasting on a regular basis; governments are beginning to use forecasting methods in many areas; and in a few countries the establishment of "institutes" for the future is contemplated.

In the USA, the home of technological forecasting, there are specialized institutes such as the Rand Corporation and the Hudson Institute which have taken a special interest in forecasting for some time. The Stanford Research Institute has offered a Consultant Long Range Planning Service since 1958. The Federal Government has a function-oriented, sliding, five-year planning scheme (Planning - Programming - Budgeting System).

In France, the "Groupe 1958" has supplemented the Fifth National Plan by a twenty-year forecast in more than thirty sectors, and the B.I.P.E. (Bureau d'Information et de Prévisions Economiques), owned jointly by government and business, has been entrusted with technological forecasting for the Sixth Plan.

In the United Kingdom, the assessment of national goals is accepted, and systematic social research into the future is fairly well established.

In WHO, many headquarters activities are oriented towards future developments as distinct from the application of existing knowledge. "Health in the World of Tomorrow" was the theme of the World Health Day in the Anniversary Year, 1968.

It should be remarked here that all forecasts involve more than the unfolding of natural events. Thus, for instance, the form which will be assumed by health services in the future will depend to a considerable extent on decisions which have already been taken and choices between possible alternative decisions which have yet to be made. The "think tank" forecasters are as much concerned with visualizing alternative futures between which some measure of choice exist as with unconditional prediction. In this context, the particular future we get depends to some extent on the line of action we deliberately choose to follow up.

Non-quantitative forecasting methods

Among the formal techniques and approaches employed in forecasting are:

- (1) the normative relevance tree method;
- (2) systematic consensus methods;
- (3) argument by analogy from comparative studies;
- (4) morphological analysis and systems analysis, which though not strictly forecasting techniques are used for helping to define and formalize forecasting problems.

The normative relevance tree method

This method is not unfamiliar to the health planner although the title may be less well-known. With objectives and targets as starting points, deficiencies in the present state of health services and biomedical science are identified, and where feasible schemes based on weighted numerical criteria are prepared and calculated priorities assigned to development programmes and researches to meet the deficiencies and to enable a scheduled plan to be prepared - as, for example, in manpower planning. Generally, some desired state of affairs which does not exist is visualized and the argument proceeds backwards from this image to means, and forwards from existing means to objectives, to bridge the gap between them.

Systematic consensus methods

As we have seen, forecasts on which health policies are based depend only partly on data of a numerical character. They are rarely derived exclusively from well-established theory and the use of mathematical models. The expectations of informed experts in different fields are an important element in health planning. Intuition also plays a considerable part in assessing not only the validity of the assumptions made in constructing models of population structure, morbidity patterns and health services, but also in judging the range of applicability and the meaning of model-based conclusions.

Among the new techniques for giving greater objectivity to intuitive insight is a method known as the Delphi Technique developed mainly in the Rand Corporation. Though a crude tool compared with mathematical models,

it is often a valuable planning instrument. The aim is to sharpen expert group consensus in some area in a sequence of iterative rounds of questions at each stage of which the replies are successively refined. The method is in effect a "brain-storming" technique but with the difference that the participating experts are enabled progressively to refine their own thinking without meeting or exchanging opinions with one another. An initial survey might be made, for example, by inviting the experts to name the breakthroughs they expect to see within thirty years or so. Next, the ten or twenty commonest mentioned breakthroughs are listed and the same experts are severally asked to range them in order of probability and to say in which decade they might be expected to occur. An example of the way in which the final results are set out is illustrated in the diagram which is based on the published results to an enquiry carried out by the Rand Corporation in 1960, using twenty eminent respondents.

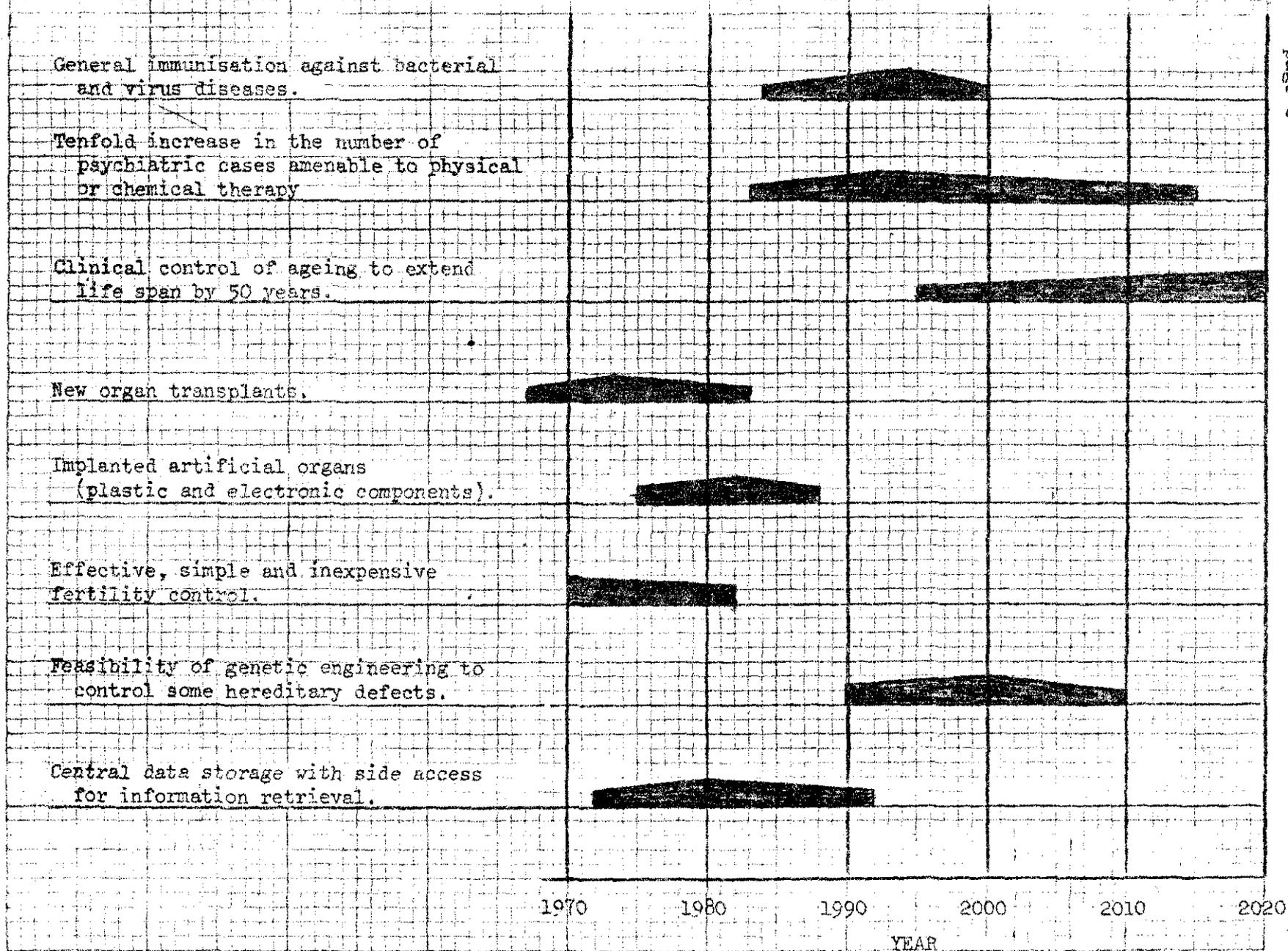
The chart shows the inter-quartile range (the middle 50 per cent) and the medians of the final responses. Thus, for example, a quarter of the respondents thought that general immunization against bacterial and virus disease will be available in the early 1980's and half of them thought it would occur between the early 1980's and the year 2000.

It should be remarked that the wider applications of discoveries already made and the extension of practices already established in limited areas can be foreseen with greater confidence than new discoveries, and that developments at some time in the near future can be foreseen with near certainty although there may be considerable uncertainty about when exactly they are likely to occur.

Comparative studies

The essential feature of this method is to argue from known present situations in developed countries, or in favoured groups within a country to the probable future situations in less-developed countries, or from favoured groups within a community to their entire population. It is

DIAGRAM BASED ON AN ENQUIRY BY THE RAND CORPORATION IN 1960.



assumed that inter-group comparisons within a country and inter-country comparisons can, with appropriate modifications, afford a useful indication of what the future holds. It is assumed, for instance, that in any particular country the now prevailing disease patterns in the more favoured sections of the community and the kind of health care they now have will in time become the lot of the less favoured. Similarly, the disease patterns now prevailing in the highly developed countries, suitably adjusted for ecological differences, provide a general indication of what might be expected with the passage of time in the less developed. There is, however, an important limitation. Until such time as validated generalizations about the relationship between socio-economic and health levels are available, the probable time scale of improvements is largely conjectural. Nonetheless, the information now available in most countries and the facts provided in such publications as the World Health Situation Reports and the United Nations year books are a sufficient basis for a great deal of practical forecasting.

It should be remarked also that trends in the development of health services in the developed countries are usually a better guide for planning services in the less developed countries than are the services which now exist. It is obviously unsound for developing countries to commit themselves to patterns of health care which are at present being radically revised in the developed countries. The emphasis on community care, the emergent functions of the hospital and the greater use of auxiliary and paramedical personnel in the developed countries to which reference is made later, are examples of trends which less-developed countries will wish to take into account. By having before them the example of developed countries, the less-developed countries enjoy a considerable advantage in planning their health services. They are also able to plan many services rationally without the encumbrance of replanning established services of great complexity, many of which are recognized to be obsolescent.

Morphological analysis and systems thinking

These are methods used in complex situations to enable the elements of a problem and their inter-relationships to be identified and defined. Morphological analysis is the familiar approach which breaks the problem down into manageable-researchable parts. The services of a health centre, for instance, might be considered as a set of operations in relation to which various categories of health personnel discharge functions or have activities, and similarly in the estimation of future health manpower needs (see page 17) the community's global disease experience is considered disease by disease, age group by age group, occupation by occupation and so forth.

Systems thinking, on the other hand, means looking at complex situations and relationships as a whole and in their entirety. The word "system" is used to denote a wide range of physical and conceptual entities, such as number system, physical system, biological system, social system, which consist of inter-dependent parts. A health system is an instance of behavioural or social system, that is a system designed by man and subject to human control. It consists of a combination of men and material resources and is designed to fulfil certain objectives. In the systems approach, it is not the physical resources, premises, equipment, supplies, not the health personnel employed, the patient or public, not the results of health care but the combination of these in a process directed towards specific objectives that is considered. The systems approach is used to assist formalized decision-making and action through planning.

What is considered as a system depends on the scope and purpose of the investigation proposed. For some purposes single activities or devices employed in health care are considered as systems, whereas for other purposes they are treated as sub-systems of a larger complex. An aggregate of health centres and hospitals can also be regarded as a system for some purposes, though they are clearly parts of a total health system which itself is in turn a sub-system of a larger politico-social complex.

III DISEASE TRENDS AND FUTURE HEALTH CARE SERVICES

(a) Present and Future Disease Trends

Systematic consensus methods have not yet been widely used in the health field. The comments which follow are based on selected published papers, opinions expressed in meetings of experts and personal discussions, supplemented in Annex I by a summary of major advances foreseen by a number of WHO technical units whose opinions were solicited by means of a questionnaire.

For the first time in history we live in a period where medicine can apply a large part of its resources to the primary and secondary prevention of disease. During the past twenty years there have been prodigious advances in biomedical science, and a growing body of research workers using new techniques and improved instrumentation continues to increase profoundly our understanding of biological processes. The application of their discoveries have already led to an extension of our ability to prevent and control many diseases. In the developed countries, the incidence of infectious and parasitic diseases has already been reduced to a low level, so that in the transformed disease situation in these countries, cardiovascular disease and the cancers are now leading causes of death, followed by respiratory disease, violence, genetic diseases and malformations.

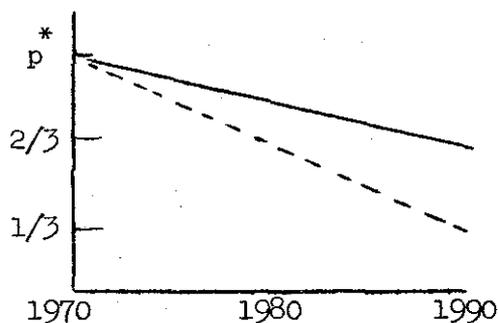
Resumé of certain forecasts

1. Generally, it is confidently believed that the application of discoveries already made, will bring about widespread improvement in world health, and that in the developing countries disease patterns are likely to approximate progressively to those which now exist in the affluent industrial countries.
2. It is thought by many experts that we are now approaching the time when the modification of immunological and other host reactions will be more important for the prevention and control of many diseases than the limitation of exposure to risks. The use of multiple antigens in small volumes for

vaccination and the virtual disappearance of the common communicable diseases of childhood can be expected within ten to twenty years.

3. Excepting Africa, south of the Sahara, twenty years from now malaria will have ceased to be a health problem which cannot be managed by general public health services. In previously malarial countries the main problem will be the early recognition of cases and adequate 'fire brigade action' to control the situation.

4. The volume of tuberculosis disease will be reduced to between two-thirds and one-third of the present volume in almost all countries in twenty years time, and will cease to be a problem of special public health importance in all but pockets of endemicity. The projection on which this forecast is based is shown below:



————— natural trend
----- trend assuming use of immunization and ambulatory chemotherapy within existing resources of almost all countries.

5. There will be a general improvement in nutrition. Severe protein-calorie deficiency will become rare.

6. In the view of many experts, it is not unreasonable to expect a breakthrough in the chemical or immunological control of cancer in the not distant future.

7. Researches on the process of aging should bring us nearer to the postponement of old age.

* Present volume.

To quote MacFarlane Burnet (Melbourne):

"My feeling is that, within the next twenty years, we will find out how the body looks after incipient malignancies, incipient degenerative changes - and the greatest discovery of all might well be if we could eliminate, or at least postpone, malignancy, by some non-specific method and see to it that people, if they were genetically sound, stayed healthy until they died of old age."

8. Hypertensive disease will become a smaller and less serious problem partly by the earlier detection and proper treatment of urinary infection in infancy and childhood, and partly by improved control by drugs.
9. Kidney disease is likely to become rare because of a lower incidence of streptococcal nephritis and the early treatment of urinary infections.
10. Progress in immunology, which is needed to improve the safety and feasibility of organ transplantation, will have consequences beyond the immediate needs of surgery.
11. The feasibility of preventing or controlling certain common diseases of the heart and blood vessels in the foreseeable future is more problematical. The upward trend of these conditions during the last twenty-five years, and the striking geographical and other differences in incidence - in particular of coronary disease - show that they are potentially to a large degree preventable, but their aetiologies are at present insufficiently understood for large-scale preventive action.
12. Surgical advances will doubtless save the lives of an increasing proportion of the seriously injured, but the evidence suggests that deaths and disablement from accidents will everywhere continue to increase.
- 13 Mental Disorder and Subnormality

Reliable evidence upon which estimates of the future prevalence of mental disorders can be based is scanty. Such statistics as there are tend to show that: (a) the organic psychoses have declined considerably in the

last fifty years; (b) schizoid and depressive states have shown little change in incidence; (c) the senile psychoses have increased in volume approximately in proportion to the number of aged persons in the community.

Developments in the control of psychotic depressive states can be expected to continue and will continue to influence favourably and progressively the treatment of these conditions. The control of schizophrenia is also likely to improve, but something like half these conditions still become chronic in spite of treatment. A WHO scientific group, reporting in 1969, was satisfied that research on the biochemical basis of 'affective disorders appears to be entering a promising phase' and they were not unhopeful that basic neuro-chemical research, (i.e. into the composition and metabolism of the brain) and research in the fields of genetics, nutrition and psychosomatic interaction are promising. The group concluded, however, that the primary prevention of these disorders is not in sight. On the other hand, there is reason to expect age-specific decreases in senile mental deterioration and depression because of the realization that much can be done to avert and control these conditions by social and welfare policies. The effect will be to offset the implications of aging populations.

The situation of the psycho-neuroses is somewhat obscure. The available evidence points to a change in the mode of expression in these disorders over the years, rather than to an increase in the total volume. In one view, these states are mainly learned behaviour disorders which will become the concern of psychologists and sociologists rather than clinicians. A broad conclusion, on which there is general agreement, is that there is no reason to expect an increased incidence of psycho-neuroses in the foreseeable future, assuming that individual adaptation to social and technological demands and changes continues to be as good as in the past. Insufficient is known about the aetiology of these conditions to make a reliable forecast about their future preventability, or indeed, to frame the necessary questions in scientifically researchable form.

As to serious subnormality, the volume has altered little in recent years and is likely to remain unchanged as far ahead as can be foreseen. Improved antenatal and child care will continue to reduce further the incidence of some abnormalities at birth, but better case management keeps more subnormals alive for longer. Advances in the biochemistry and genetics of subnormality may ultimately change the situation, but there is no indication that they will offer more than fringe benefits in the foreseeable future.

14. We venture to add the comment that disease patterns in the less developed countries will not necessarily pass through the evolutionary phases which have characterized the developed countries.

In the sequence:

- I high incidence of transmissible diseases (past);
- II reduced incidence of transmissible diseases with increase in malignant and degenerative diseases (present);
- III reduced incidence of both (expected);

It is by no means inconceivable that the second phase, which is now characteristic of the developed countries, will be skipped in the less developed. If advances in the prevention and control of malignant and degenerative diseases be such that they can be applied concurrently in all countries and if, as there is good reason to expect, the transmissible diseases are progressively mopped up in the developing countries, as they have been in the developed, a doubly favourable situation in the less developed countries could come relatively early.

(b) Outstanding Trends in the Structuring and Operation of Personal Health Care Services

The evolving and future form of health care services is too vast a subject to review at length in the present paper. It is proposed, therefore, to comment briefly on recent developments and trends which are almost universal. (For summary see Annex II).

General

The character of health care has changed greatly in the last ten to twenty years and can be expected to do so at an increasing pace. Clinical practice is becoming increasingly scientific. There is increasing technical sophistication in both diagnosis and treatment. Diagnostic and therapeutic parameters are being progressively quantified and minaturization and other refinements of instrumentation are now almost taken for granted. The early detection of disease, by such means as mass screening supported by multi channel automatic biochemical analysis and other automated diagnostic procedures, is progressively becoming a regular aspect of medical practice. Personal prevention is now an accepted part of medical care. The social background of patients is now normally taken into account in a complete diagnosis. Health surveillance and periodic medical examinations, now restricted to special groups and the well-to-do, are being offered, in a few places, to entire communities.

A health service is now accepted as a social service in close relations with other social and welfare provisions. Social legislation is increasing in volume and complexity. Comprehensive health care coverage for whole populations is a common aim and national health planning is the rule in most countries. These developments and advances in the control of many diseases of public health importance, have led to many organizational changes, of which, perhaps the most important is a growing preference for care in the community whenever this is feasible, and a consequent expansion of domiciliary care.

Primary Health Care Services

Health centres, large and small, on a basis of local and regional planning, in some instances, incorporated in the fabric of a district hospital complex, will progressively replace the surgery of the single handed general practitioner working in isolation. Access to laboratory and other special diagnostic facilities and closer co-operation with social

services are features of the emerging pattern. In some places, the general practitioner will remain the doctor of first contact, although it is likely that a move away from the availability of a doctor on demand to his availability on need, will gain strength. Team-work where groups of doctors work with nurses, social workers and auxiliaries will become the rule, if only because this development is necessary to make the best use of medical manpower and to make the benefits of modern medical technology available to whole populations. Automation of records systems and data linkage and the improvement of secretarial and technical help will extend the quality and range of clinical work. Computer recall will reduce much of the routine work in the health centre and the automation of hospital diagnostic facilities will give the general practitioner open access to hospital diagnostic services. The doctor himself will become increasingly a team leader and an interpreter of primary facts about patients provided by others. More of his attention will be devoted to personal preventive medicine and screening procedures, pre-symptomatic diagnosis and health surveillance will occupy an increasing proportion of his time. As a consequence, the doctor will increasingly initiate contact with patients and groups of patients at risk, instead of being almost exclusively concerned with the sick who seek his advice.

Sooner or later these developments will almost certainly mean that personal health care in the community will be provided mainly through a whole time salaried service of doctors and other health personnel in most countries.

Hospital Services

As a result of population changes, improved hygiene of food and water, immunization, improved diet and the use of antibiotics, there have been great changes in hospital practice and administration in developed countries during the last twenty-five to fifty years. In these countries, bed population ratios are of the order of 8 per 1 000 to 10 per 1 000 of the population and half to two thirds of hospital beds are now occupied by geriatric and

psychiatric disorders, subnormality and congenital malformations. The large special hospitals for infectious diseases and tuberculosis sanatoria of fifty years ago have almost disappeared. Far fewer children's beds are needed and with the virtual disappearance of rickets, osteomyelitis, bone and joint tuberculosis and paralytic poliomyelitis, orthopaedic surgery has become an obsolescing speciality.

The hospital is becoming increasingly a centre for diagnosis and assessment, with a corresponding expansion of laboratory and other special diagnostic services. In many places, acute psychiatry and many infectious diseases are becoming a part of the function of general hospitals. There is an increasing tendency to separate the medical care and hotel functions of the hospital and for almost all diseases, the average length of in-patient stay is being progressively reduced. The grading of medical care requirements, ranging from intensive care to the convalescent home and half way house, is becoming common. An increasing proportion of patients are ambulatory and patient self help, as far as circumstances permit, is widely accepted. The development of some existing specialities and the introduction of new specialities, such as traumatic and plastic surgery, medical physics, tissue and organ transplants and medical engineering, already an accomplished fact in places, can be expected to become widespread. The installation of a comprehensive E.D.P. service for purposes of administration, medical records, statistics, patient monitoring and other patient care, and the automation of laboratory and other diagnostic procedures, is extending rapidly and will become the rule.

Psychiatric Services

The future care of mental disorders and subnormality merits special attention because of its size and special character. Perhaps the most noteworthy feature of psychiatric services during the last ten to twenty years is the greater emphasis on the community care of mental patients by home supervision, day hospitals and so forth, with a consequent sparing of hospital

provisions. Also, acute psychiatry, both in-patient and out-patient, has increasingly become a part of general hospital practice under the supervision of visiting psychiatrists. It seems, unlikely, however, that the conceptual approaches to psychiatric disorders and physical illnesses can be unified in the near future and special mental hospitals are likely to be needed for many years to come. They will be smaller in size, accommodate mainly voluntary patients. More active treatment and an 'open door' policy will become the rule. The main categories of patients treated in mental hospitals in the future will be chronic schizophrenics, some depressives, the severely subnormal, psychopaths, drug addicts, deteriorated epileptics and the mentally deteriorated following severe head injuries. Also, unless there is an increased provision for senile psychotics in geriatric units, the elderly with mental deterioration will occupy a high proportion of mental hospital beds.

IV THE PROBLEM OF ESTIMATING FUTURE MEDICAL MANPOWER REQUIREMENTS

The problem of estimating future health manpower needs affords a good example of how the methods described earlier are used in combination and shows the importance of unquantified forecasts in long-range planning.

The total number of doctors needed in a country includes, of course, not only doctors needed for health care services but also doctors needed for administration, teaching, research, laboratory services, occupational health and so forth. As an illustration of the method, however, we shall restrict the argument to doctors required for personal health care.

Estimation of Present Needs

The first step in estimating future manpower requirements is to define a base for projections by the ascertainment of existing needs, i.e. by estimating the number of doctors needed to provide curative and prophylactic services for the present population at prevailing levels and patterns of morbidity and health care practice. The items of information needed are:

- (a) Demographic data, including the existing population age/sex and occupational structure;
- (b) Statistics of disease incidence and prevalence by age, sex and occupational groups;
- (c) Statistics of patient contacts for medical care and other health care;
- (d) Statistics of the work done by doctors, including acceptable average work-loads and the average number of hours worked by a doctor in a calendar year.

Whilst utilization statistics provide a satisfactory measure of doctor/patient contacts and other items of medical care, they are less satisfactory as a measure of current population needs. Estimates of need based on current utilization fall short of estimates based on medical surveys since they tend to relate to demand rather than to professionally-determined need. Many who need hospital care, for instance, do not demand it for reasons of ignorance, cost, custom or personal attitude. Where there are long hospital waiting lists, many who need and ask for hospital care may fail to get it. Ideally, therefore, the volume of disease needing medical care is ascertained by medical surveys of whole populations, such as those conducted in recent years in the USSR. In this country, five towns with a total population of 1 500 000 were systematically investigated by teams of doctors and other health workers for the purpose of establishing levels of morbidity and curative and prophylactic care requirements.

Given the above items of information, the estimation of present needs is a matter of arithmetic. To take a simple example. For any one disease of short duration(X), if - (1) the number of incidents per 10 000 of population in a year is (V); (2) the average length of doctor time consumed during the year in the medical care of each incident is (N) hours (based on the number of consultations and/or visits and their duration); and (3) the average number of working doctor-hours available for medical care

per annum is (H); then the number of doctors required for the medical care of the disease (X) for every 10 000 of population is clearly: $\frac{V \times N}{H}$.

The number required per 10 000 of population for all personal health care is obviously obtained by a straight forward, though laborious summation process.

The global need for the national population is then obtained as a multiple of the norm per 10 000 of population, and the needs of geographical areas and special groups by introducing appropriate weighting which takes account of their particular age and occupational structures and special features of their morbidity experience.

Estimation of Future Manpower Needs

For estimating the future volume of disease, projections of incidence and prevalence rates have to be applied to population projections, using methods such as trend analysis and familiar demographic procedures. In forecasting the future frequency of different diseases such expectation as were cited in Section III(a), though neither certain nor quantifiable, have as far as possible to be allowed for, and in estimating future manpower requirements, in addition to the arithmetical computation account has to be taken of expected changes in the volume of work done by doctors, the organization of health services and the probable effects of socio-cultural factors, including improvements in general education. Under the heading "Work done by Doctors and the Structure of the Medical Profession", for instance, the relevant factors include:

- (a) expected future standard work-loads for doctors in various specialities;
- (b) the average length of the doctor's working day in different specialities and circumstances;
- (c) the expected number of working hours per calendar year of doctors in different specialities, distinguishing between men and women doctors;

(d) the average professional life-span of doctors in different specialities, again distinguishing men and women doctors;

(e) the expected ratio between the number of doctors and the number of auxiliary and paramedical workers in various parts of the health care service.

It will be clear that even estimation of future global needs is a highly complex procedure, and when estimates of the future volume of primary care needs, hospital care needs and so forth, are required, the complexity of the problem is increased considerably. The volume of hospital care needs is obviously influenced by the amount and character of non-hospital provisions and by the criteria for referrals adopted by doctors. These, in turn, are influenced by such factors as housing standards, family structure, population distribution and transport, social security provisions and therapeutic advances. The need for hospital care also varies with changes in therapeutic practice - in some cases it is shortened by therapeutic advances and improved procedures and in other cases, lengthened. Such factors as these provide an indication of the complexity of the problems to be solved in estimating future health care and manpower needs. They point to two broad conclusions. First, that the existing need, which is one of the bases for all projections, can only be adequately ascertained by professionally-conducted surveys; and, secondly, that statistical projections require to be adjusted so as to take into account a wide range of probable future technical, organizational, socio-economic and cultural developments.

The following extracts from a report on manpower planning in the Soviet Union¹, highlight some of the uncertainties which have to be faced.

"There are substantial differences in indices of prevalence of particular diseases among people of various ages and different sexes, e.g. acute diseases (influenza, sore throat, catarrh of the upper respiratory tract, etc.) are more frequently encountered in children and adolescents; chronic diseases (diseases of the cardiovascular system and malignant

¹Paper presented by Professor I.D. Bogatyrev to the WHO Consultant Group on Health Practice Research (December 1968).

neoplasms) are more common among the elderly; diseases of the kidneys and urinary tract, thyroid diseases and appendicitis are more frequent among women than among men; and men suffer more frequently from gastric and duodenal ulcers, gastritis and hernia and are more often injured in accidents.

These features of morbidity, hospital admissions and attendances at out-patient and polyclinic establishments among the population in different age-and-sex groups have a great influence on the level of medical staffing requirements and particularly on structure by speciality. For this reason demographic features must be studied in detail and assume particular importance in long-term forecasts of medical staff requirements. General trends such as a continuous increase in the proportion of old people in the population and a reduction in the birth-rate must be taken into account when studying the problem of medical staffing.

The forecasting of general morbidity is a complex problem. Two main factors are acting in opposite directions. The improvement in the general cultural level of the population and living conditions is bringing about a reduction in some diseases, while the increase in the proportion of old people - potential sufferers from chronic diseases - is contributing to an increase in morbidity indices. The frequency of chronic diseases, for which effective treatment and prevention are not yet available, can be forecast accurately.

To forecast the future frequency of communicable diseases and diseases dependent on environmental conditions, it is obviously necessary to take into account the feasibility of controlling these diseases and the tendencies towards a reduction in the rate of decrease in morbidity from these causes.

Research work on this problem includes a wide range of investigations, drawing on various medical specialists, statisticians and economists.

The huge volume of work involved both at the data-collection stage, and at the stage of statistical processing requires the use of modern computers and other auxiliary technical devices. Sampling methods are widely used and require the establishment of special centres in various economic, geographical and climatic zones.

Before work in such centres begins, a number of organizational measures are needed to ensure completeness of ascertainment, high standards of medical care and the provision of modern technical equipment."

It is hardly necessary to remark finally that the approach to estimating total manpower needs, which has been used to illustrate the problem, is only a small part of medical manpower planning.

Hospital size, functions, locations, utilization within the hospital system, the apportionment of beds between general medical and surgical, geriatric, psychiatric, obstetrics and other specialities, the volume and character of non-hospital care provisions and their relation with hospital provisions are obvious examples of the additional factors which are relevant to manpower planning for any health care system in its entirety.

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ANNEX I

SUMMARY OF MAJOR ADVANCES FORESEEN BY A NUMBER OF
WHO TECHNICAL UNITS

Note: A probability rating I, II or III were assigned to each expected advance.

- I = Likely or virtually certain;
- II = Reasonable expectation;
- III = Possible but not foreseeable with any certainty.

Foreseeable major advances	Decade Expected		
	1970/79	1980/89	1990/99
(a) <u>Communicable diseases</u>			
Identification of aetiological agents of infectious and serum hepatitis	I		
Development of hepatitis virus vaccine(s)		II	
Influenza			
Development of more effective inactivated vaccines	I		
Development of effective live vaccines		II	
Control of serious respiratory infections in childhood		II	
Possibility that as a result of environmental changes and successful treatment trachoma will cease to be public health problem in most parts of the world		II	
Possibility of development of effective trachoma vaccine		III	
Use of multiple purified antigens in small volumes for vaccination	I		

Foreseeable major advances	Decade Expected		
	1970/79	1980/89	1990/99
(a) <u>Communicable diseases, cont'd</u>			
Chemotherapy or chemoprophylaxis of viral diseases	II	I	
Chemotherapy of certain malignant new growths		III	II
Virtual disappearances of common communicable diseases of childhood		II	I
Elucidation of role of viruses in human blood and lymphatic malignant new growth		II	
Aetiology (?viral) of some chronic neurological diseases (e.g. multiple sclerosis)		II	
Control of common cold			III
Understanding of immunological mechanisms underlying development of vaccines against Group B arboviruses <u>as a group</u>		II	
Cholera (live vaccine)	II	I	
Dysentery (live vaccine)	I		
Typhoid fever (live)	II	I	
Meningococcal vaccine	II	I	
Gonorrhoea		II	
Streptococcal infections (prevention of rheumatic fever and acute glomerulonephritis)	II	I	
Syphilis (yawa, treponematoses)	II	I	
Leprosy - cultivation of <i>M. leprae</i>	II	I	
- vaccine		II	

Foreseeable major advances	Decade Expected		
	1970/79	1980/89	1990/99
<p>(b) <u>Parasitic diseases</u></p> <p>Eradication from large areas of some vector-borne parasitic diseases by chemical control</p> <p>Biological control of some vector-borne parasitic diseases</p> <p>Immunization against some parasitic diseases</p> <p>The development of rational chemotherapy based on the detailed understanding of the mode of action of drugs against parasites</p> <p>The development of specific immuno-diagnostic tests for parasitic diseases</p>	<p>I</p> <p>II</p> <p>I</p> <p>I</p> <p>II</p>	<p>I</p>	
<p>(c) <u>Cancerous diseases</u></p> <p>Detection techniques will be improved and the removal of precancerous lesions will increase cancer prophylaxis</p> <p>New anti-tumour preparations which will be more effective with greater selectivity of action</p> <p>Cancer virology</p> <p>Cancer immunology</p> <p>Molecular biology and genetics</p>	<p>I →</p> <p>II →</p>	<p>III</p> <p>III</p>	<p>III</p>

Foreseeable major advances	Decade Expected		
	1970/79	1980/89	1990/99
(d) <u>Cardiovascular diseases</u>			
Computer application in clinical medicine	I		
Assisted circulation in cardiogenic shock	I		
Understanding of molecular biology of aging			II
Advance in knowledge of histochemical processes in atherosclerosis		I	
Primary prevention of myocardial infarction		II	
Secondary prevention of rheumatic heart disease		I	
Semi-automated screening of high-risk subjects for cardiovascular disease	III		
(e) <u>Other</u> ¹			
National data linkage and retrieval systems for health records	I	→	
Periodic multitest screening for total populations	I		
Immunization using mass rather than individual methods	II		
Chemical and/or immunological protection against some malignancies	I		
Discovery and application of findings related to the nutritional and environmental needs at "critical periods" leading to a decrease in mental deficiency, variations in fertility, and some chronic and degenerative diseases	II	→	

Foreseeable major advances	Decade Expected		
	1970/79	1980/89	1990/99
(e) <u>Other</u> ¹ cont'd			
Extended use of environmental methods to promote health (i.e. environmental medicine would concentrate less upon health hazards)	I →		
Simple and effective fertility control aimed at males as well as females	I		
Artificial mechanical hearts available for selective implantation	I →		
Solution of rejection phenomena leading to tissue and organ transplantation on a wide scale	I →		
Primary prevention of hypertensive		II	
Biological control of most zoonoses	II →		

¹There is some duplication with advances cited under headings (a) to (d)

ANNEX II

TRENDS IN THE STRUCTURING AND OPERATION OF HEALTH SERVICES

GENERAL TRENDS

1. The provision of comprehensive health care services for entire populations. Especially important is a recognition of the needs of rural populations.
2. A recognition that care in the community, when possible, is preferable to institutional care on medical, social and economic grounds.
3. Comprehensive national planning and organization and the progressive replacement of private medical practice by public medical care.
4. The progressive enlargement of social security provisions and a corresponding diminution of payment for items of health care service. Closer liaison between health and other social services.
5. Team-work in personal health care, with the doctor as the team leader. The team to include nurses and other paramedical personnel. The increasing use of medical auxiliary in some places.
6. The progressive introduction of health surveillance and mass screening, and better access by general practitioners to laboratory and other special diagnostic facilities.
7. The integration of personal preventive and curative services.
8. The progressive integration of special disease control programmes into the general health services.

HOSPITAL AND ALLIED SERVICES

Changes relating to hospital functions

1. The separation of medical care and hotel functions.

2. Progressive medical care - grading of levels of medical care from intensive care to convalescents' home.
3. The encouragement of provision for ambulatory patients and for patient/Family self-help.
4. The development of new specialities and super-specialities. E.g. advances in substitution therapy and replacement surgery, machine control and assessment requiring a speciality in medical engineering. The bio-engineer will become a member of the hospital team.
5. Care by teams is replacing care by individual specialists. In the future, there may be a place for a new type of specialist whose function will be to relate specialist team-work to the individual patient.
6. In the large hospitals special departments of medical physics are being developed.
7. A reduction in the number of acute bed provision.
8. Further reduction of average in-patient stay for many conditions.
9. Comprehensive EDP servicing of hospitals, and the progressive automation of laboratory and other procedures. Generally, improved managerial methods and controls.

Size, Design and Construction

1. There is a trend towards an increased size and scope of autonomous units. Thinking is now in terms of 1 000 to 2 000 beds, or their equivalent in hospital centres.
2. Greater flexibility of hospital design and a corresponding increase in functional flexibility.
3. The provision of less expensive, compact buildings consisting largely of standardized modules.

4. A relative increase in laboratories and other diagnostic functional units and in day accommodation at the expense of ward and other bed-care provision.
5. With development of intensive care units, the traditional ward concept is being modified. Smaller wards and the provision of convalescent care units and the separation of medical care and hotel functions are accepted as a corollary.

Note: As a consequence of the changes mentioned, the number of hospital beds is no longer an adequate index of functional size.

PLANNING OF HOSPITAL SYSTEMS

1. The location of hospitals is determined less and less by geographical consideration and population density because of improved transport.
2. The advantage of regional planning of the hospital services has been demonstrated and is likely to become the accepted pattern with the centralization of services, such as laundry, sterile supply, ordering and buying.
3. The provision of a smaller number of larger hospital centres serving a wide area, supported by a larger number of small units for ailing senescents, referrals, etc. (Fewer district general hospitals).
4. The establishment of hospital centres which include provisions for geriatrics, acute psychiatry, and most infectious diseases, in addition to general medicine and surgery.
5. Regional and sub-regional laboratories to provide a non-emergency service, over a wide area, is likely to become the pattern within the next twenty years, leaving only the immediate hot laboratory service on a twenty-four hour-basis within the province of the individual hospital.

WORLD HEALTH
ORGANIZATION

REGIONAL OFFICE FOR THE
EASTERN MEDITERRANEAN

الهيئة الصحية العالمية

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ORGANISATION MONDIALE
DE LA SANTÉ

BUREAU REGIONAL DE LA
MEDITERRANÉE ORIENTALE

REGIONAL COMMITTEE FOR THE
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CONCLUSIONS DRAWN FROM PROGRAMME REVIEWS

C O R R I G E N D U M

Table 3, page 11

Please make the following amendments to the figures for Ethiopia on
line 1:

		<u>1968</u>	<u>1970</u>
Column 2	- Cost to International Agencies	406	146
Column 3	- Total Cost	2 966	4 022
Column 5	- US ¢ per capita	66.2	71.6