# Contens:

1. **Health care and its delivery**

2. ORGANIZATION OF HEALTH SERVICES

3. **Levels of health care.**

4. **Costs of health care.**

5. ADMINISTRATION OF PRIMARY HEALTH CARE

6. MEDICAL PRACTICE IN. DEVELOPED COUNTRIES

7. **Britain.**

8. **United Stales.**

9. **Russia.**

10. **Japan.**

11. **Other developed countries.**

12. MEDICAL PRACTICE IN DEVELOPING COUNTRIES

13. **China**

14. **India.**

15. ALTERNATIVE OR COMPLEMENTARY MEDICINE

16. SPECIAL PRACTICES AND FIELDS OF MEDICINE

17. **Specialties in medicine.**

18. **Teaching.**

19. **Industrial medicine.**

20. **Family health** **care.**

21. **Geriatrics.**

22. **Public health practice.**

23. **Military practice.**

24. **CLINICAL RESEARCH**

25. **Historical notes.**

26. **Clinical** **observation.**

27. **Drug** **research.**

28. **Surgery.**

29. SCREENING PROCEDURES

THE PRACTICE OF MODERN MEDICINE

**Health care and its delivery**

The World Health Organization at its 1978 international, conference held in the Soviet Union produced the Alma-Ata Health Declaration, which was designed to serve gov­ernments as a basis for planning health care that would reach people at all levels of society. The declaration reaf­firmed that "health, which is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity, is a fundamental human rit.nl and that the attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the action of many other social and economic sectors in addition to the health sector." In its widest form the practice of medicine, that is to say the promotion and care of health, is concerned with this ideal.

ORGANIZATION OF HEALTH SERVICES

"It is generally the goal of most countries to have their health services organized in such a way to ensure that individuals, families, and communities obtain the max­imum benefit from current knowledge and technology available for the promotion, maintenance, and restoration of health. In order to play their part in this process, governments and other agencies are faced with numer­ous tasks, including the following: (1) They must obtain as much information as is possible on the size, extent, and urgency of their needs; without accurate information, planning can be misdirected. (2) These needs must then be revised against the resources likely to be available in terms of money, manpower, and materials; developing countries may well require external aid to supplement their own resources. (3) Based on their assessments, countries then need to determine realistic objectives and draw up plans. (4) Finally, a process of evaluation needs to be built into the program; the lack of reliable information and accurate assessment can lead to confusion, waste, and inefficiency.

Health services of any nature reflect a number "I in­terrelated characteristics, among which the most obvious but not necessarily the most important from a national point of view, is the curative function; that is to say caring for those already ill. Others include special services that deal with particular groups (such as children or preg­nant women) and with specific needs such as nutrition or immunization; preventive services, the protection of the health both of individuals and of communities; health education; and, as mentioned above, the collection and analysis of information.

**Levels of health care.**

In the curative domain there are various forms оf medical practice. They may be thought of generally as forming a pyramidal structure, with three tiers representing increasing degrees of specialization and tech­nical sophistication but catering to diminishing numbers of patients as they are filtered out of the system at a lower level. Only those patients who require special attention or treatment should reach the second (advisory) or third (specialized treatment) tiers where the cost per item of service becomes increasingly higher. The first level represents primary health care, or first contact care, or which patients have their initial contact with the health-care system.

Primary health care is an integral part of a country's health maintenance system, of which it forms the largest and most important part. As described in the declaration of Alma-Ata, primary health care should be "based on prac­tical scientifically sound and socially acceptable methods and technology made universally accessible to individuals in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of then development." Primary health care in the developed countries is usually the province of a medically qualified physician; in the developing countries first contact care is often provided by nonmedically qualified personnel.

The vast majority of patients can be fully dealt with at the primary level. Those who cannot are referred to the second tier (secondary health care, or the referral services) for the opinion of a consultant with specialized knowledge or for X-ray examinations and special tests. Secondary health care often requires the technology offered by a local or regional hospital. Increasingly, however, the radiological and laboratory services provided by hospitals are available directly to the family doctor, thus improving his service to palings and increasing its range. The third tier of health care employing specialist services, is offered by institu­tions such as leaching hospitals and units devoted to the care of particular groups—women, children, patients with mental disorders, and so on. The dramatic differences in the cost of treatment at the various levels is a matter of particular importance in developing countries, where the cost of treatment for patients at the primary health-care level is usually only a small fraction of that at the third level- medical costs at any level in such countries, however, are usually borne by the government.

Ideally, provision of health care at all levels will be avail­able to all patients; such health care may be said to be universal. The well-off, both in relatively wealthy industrialized countries and in the poorer developing world, may be able to get medical attention from sources they prefer and can pay for in the private sector. The vast majority of people in most countries, however, are dependent in various ways upon health services provided by the state, to which they may contribute comparatively little or,inthe case of poor countries, nothing at all.

**Costs of health care.** The costs to national economics of providing health care are considerable and have been growing at a rapidly increasing rate, especially in countries such as the United States, Germany, and Sweden; the rise in Britain has been less rapid. This trend has been the cause of major concerns in both developed and developing countries. Some of this concern is based upon the lack of any consistent evidence to show that more spending on health care produces better health. There is a movement in developing countries to replace the type of organization of health-care services that evolved during European colo­nial times with some less expensive, and for them, more appropriate, health-care system.

In the industrialized world the growing cost of health services has caused both private and public health-care delivery systems to question current policies and to seek more economical methods of achieving their goals. De­spite expenditures, health services are not always used effectively by those who need them, and results can vary widely from community to community. In Britain, for example, between 1951 and 1971 the death rate fell by 24 percent in the wealthier sections of the population but by only half that in the most underprivileged sections of society. The achievement of good health is reliant upon more than just the quality of health care. Health entails such factors as good education, safe working conditions, a favourable environment, amenities in the home, well-inte­grated social services, and reasonable standards of living.

*In the developing countries.* The developing countries differ from one another culturally, socially, and econom­ically, but what they have in common is a low average income per person, with large percentages of their popula­tions living at or below the poverty level. Although most have a small elite class, living mainly in the cities, the largest part of their populations live in rural areas. Urban regions in developing and some developed countries in the mid- and late 20th century have developed pockets of slums, which are growing because of an influx of rural peoples. For lack of even the simplest measures, vast num­bers of urban and rural poor die each year of preventable and curable diseases, often associated with poor hygiene and sanitation, impure water supplies, malnutrition, vita­min deficiencies, and chronic preventable infections. The effect of these and other deprivations is reflected by the finding that in the 1980s the life expectancy at birth for men and women was about one-third less in Africa than it was in Europe; similarly, infant mortality in Africa was about eight times greater than in Europe. The extension of primary health-care services is therefore a high priority in the developing countries.

The developing countries themselves, lacking the proper resources, have often been unable to generate or imple­ment the plans necessary to provide required services at the village or urban poor level. It has, however, become clear that the system of health care that is appropriate for one country is often unsuitable for another. Research has established that effective health care is related to the special circumstances of the individual country, its people, culture, ideology, and economic and natural resources.

The rising costs of providing health care have influ­enced a trend, especially among the developing nations to promote services that employ less highly trained pri­mary health-care personnel who can be distributed more widely in order to reach the largest possible proportion of the community. The principal medical problems to be dealt with in the developing world include undernutrition, infection, gastrointestinal disorders, and respiratory com­plaints. which themselves may be the result of poverty, ignorance, and poor hygiene. For the most part, these are easy to identity and to treat. Furthermore, preventive measures are usually simple and cheap. Neither treatment nor prevention requires extensive professional training: in most cases they can be dealt with adequately by the "primary health worker," a term that includes all nonprofessional health personnel.

*In the developed countries.* Those concerned with pro­viding health care in the developed countries face a differ­ent set of problems. The diseases so prevalent in the Third World have, for the most part, been eliminated or are readily treatable. Many of the adverse environmental con­ditions and public health hazards have been conquered. Social services of varying degrees of adequacy have been provided. Public funds can be called upon to support the cost of medical care, and there are a variety of private insurance plans available to the consumer. Nevertheless, the funds that a government can devote to health care are limited and the cost of modern medicine continues to in­crease thus putting adequate medical services beyond the reach of many. Adding to the expense of modern medical practices is the increasing demand for greater funding of health education and preventive measures specifically directed toward the poor.

ADMINISTRATION OF PRIMARY HEALTH CARE

In many parts of the world, particularly in developing countries, people get their primary health care, or first-contact care, where available at all, from nonmedically qualified personnel; these cadres of medical auxiliaries are being trained in increasing numbers to meet over­whelming needs among rapidly growing populations. Even among the comparatively wealthy countries of the world, containing in all a much smaller percentage of the world's population, escalation in the costs of health services and in the cost of training a physician has precipitated some movement toward reappraisal of the role of the medical doctor in the delivery of first-contact care.

In advanced industrial countries, however, it is usually a trained physician who is called upon to provide the first-contact care. The patient seeking first-contact care can go either to a general practitioner or turn directly to a specialist. Which is the wisest choice has become a subject of some controversy. The general practitioner, however, is becoming rather rare in some developed countries. In countries where he does still exist, he is being increasingly observed as an obsolescent figure, because medicine cov­ers an immense, rapidly changing, and complex field of which no physician can possibly master more than a small fraction. The very concept of the general practitioner, it is thus argued, may be absurd.

The obvious alternative to general practice is the direct access of a patient to a specialist. If a patient has problems with vision, he goes to an eye specialist, and if he has a pain in his chest (which he fears is due to his heart), he goes to a heart specialist. One objection to this plan is that the patient often cannot know which organ is respon­sible for his symptoms, and the most careful physician, after doing many investigations, may remain uncertain as to the cause. Breathlessness—a common symptom—may be due to heart disease, to lung disease, to anemia, or to emotional upset. Another common symptom is gen­eral malaise—feeling run-down or always tired; others are headache, chronic low backache, rheumatism, abdominal discomfort, poor appetite, and constipation. Some patients may also be overtly anxious or depressed. Among the most subtle medical skills is the ability to assess people with such symptoms and to distinguish between symptoms that are caused predominantly by emotional upset and those that are predominantly of bodily origin. A specialist may be capable of such a general assessment, but, often, with emphasis on his own subject, he fails at this point. The generalist with his broader training is often the better choice for a first diagnosis, with referral to a specialist as the next option,

It is often felt that there are also practical advantages for the patient in having his own doctor, who knows about his background, who has seen him through various ill­nesses, and who has often looked after his family as well. This personal physician, often a generalist, is in the best position to decide when the patient should be referred to a consultant.

The advantages of general practice and specialization are combined when the physician of first contact is a pediatrician. Although he sees only children and thus acquires a special knowledge of childhood maladies, he remains a generalist who looks at the whole patient. Another combi­nation of general practice and specialization is represented by group practice, the members of which partially or fully specialize. One or more may be general practitioners, and one may be a surgeon, a second an obstetrician, a third a pediatrician, and a fourth an internist. In isolated communities group practice may be a satisfactory com­promise, but in urban regions, where nearly everyone can be sent quickly to a hospital, the specialist surgeon work­ing in a fully equipped hospital can usually provide better treatment than a general practitioner surgeon in a small clinic hospital.

MEDICAL PRACTICE IN. DEVELOPED COUNTRIES

**Britain.** Before 1948, general practitioners in Britain settled where they could make a living. Patients fell into two main groups: weekly wage earners, who were compulsorily insured, were on a doctor's "panel" and were given free medical attention (for which the doctor was paid quarterly by the government); most of the remainder paid the doctor a fee for service at the time of the illness. In 1948 the National Health Service began operation. Under its provisions, everyone is entitled to free medical attention with a general practitioner with whom he is registered. Though general practitioners in the National Health Service are not debarred from also having private patients, these must be people who are not registered with them under the National Health Service. Any physician is free to work as a general practitioner entirely independent of the National Health Service, though there are few who do so. Almost the entire population is registered with a National Health Service general practitioner, and the vast majority automatically sees this physician, or one of his partners, when they require medical attention. A few people, mostly wealthy, while registered with a National Health Service general practitioner, regularly see another physician privately; and a few may occasionally seek a private consultation because they are dissatisfied with their National Health Service physician.

A general practitioner under the National Health Service remains an independent contractor, paid by a capitation fee; that is, according to the number of people registered with him. He may work entirely from his own office, and he provides and pays his own receptionist, secretary, and other ancillary staff. Most general practitioners have one or more partners and work more and more in premises built for the purpose. Some of these structures are erected by the physicians themselves, but many are provided by the local 'authority, me physicians paying rent for using them. Health centres, in which groups of general practi­tioners work have become common.

In Britain only a small minority of general practition­ers can admit patients to a hospital and look after them personally. Most of this minority are in country districts, where, before the days of the National Health Service, there were cottage hospitals run by general practition­ers; many of these hospitals continued to function in a similar manner. All general practitioners use such hospi­tal facilities as X-ray departments and laboratories, and many general practitioners work in hospitals in emergency rooms (casualty departments) or as clinical assistants to consultants, or specialists.

General practitioners are spread more evenly over the country than formerly, when there were many in the richer areas and few in the industrial towns. The maxi­mum allowed list of National Health Service patients per doctor is 3.500; the average is about 2.500. Patients have free choice of the physician with whom they register, with the proviso that they cannot be accepted by one who already has a full list and that a physician can refuse to accept them (though such refusals are rare). In remote rural places there may be only one physician within a reasonable distance.

Until the mid-20th century it was not unusual for the doctor in Britain to visit patients in their own homes. A general practitioner might make 15 or 20 such house calls in a day. as well as seeing patients in his office or "surgery," often in the evenings. This enabled him to become a family doctor in fact as well as in name. In modern practice, however, a home visit is quite exceptional and is paid only to the severely disabled or seriously ill when other recourses are ruled out. All patients are normally required to go to the doctor.

It has also become unusual for a personal doctor to be available during weekends or holidays. His place may be taken by one of his partners in a group practice, a provision that is reasonably satisfactory. General practi­tioners, however, may now use one of several commercial deputizing services that employs young doctors to he on call. Although some of these young doctors may he well experienced, patients do not generally appreciate this kind of arrangement.

**United Stales.** Whereas in Britain the doctor of first contact is regularly a general practitioner, in the United States the nature of first-contact care is less consistent. General practice in the United States has been in a slate of decline in the second half of the 20th century especially in metropolitan areas. The general practitioner, however, is being replaced to some degree by the growing field of family practice. In 1969 family practice was recognized as a medical specialty after the American Academy of General Practice (now the American Academy of Family Physicians) and the American Medical Association created the American Board of General (now Family) Practice. Since that time the field has become one of the larger medical specialties in the United States. The family physicians were the first group of medical specialists in the

United States for whom recertification was required.

Theie is no national health service, as such, in the United Stales. Most physicians in the country have traditionally been in some form of private practice, whether seeing patients in their own offices. clinics, medical centres, or another type of facility and regardless of the patients' in­come. Doctors are usually compensated by such state and federally supported agencies as Medicaid (for treating the poor) and Medicare (for treating the elderly); not all doc­tors, however, accept poor patients. There are also some state-supported clinics and hospitals where the poor and elderly may receive free or low-cost treatment, and some doctors devote a small percentage of their time to treat­ment of the indigent. Veterans may receive free treatment at Veterans Administration hospitals, and the federal gov­ernment through its Indian Health Service provides med­ical services to American Indians and Alaskan natives, sometimes using trained auxiliaries for first-contact care.

In the rural United States first-contact care is likely to come from a generalist I he middle- and upper-income groups living in urban areas, however, have access to a larger number of primary medical care options. Children are often taken to pediatricians, who may oversee the child's health needs until adulthood. Adults frequently make their initial contact with an internist, whose field is mainly that of medical (as opposed to surgical) illnesses; the internist often becomes the family physician. Other adults choose to go directly to physicians with narrower specialties, including dermatologists, allergists, gynecolo­gists, orthopedists, and ophthalmologists.

Patients in the United States may also choose to be treated by doctors of osteopathy. These doctors are fully qualified, but they make up only a small percentage of the country's physicians. They may also branch off into specialties, hut general practice is much more common in their group than among M.D.'s.

It used to be more common in the United States for physicians providing primary care to work independently, providing their own equipment and paying their own ancillary staff. In smaller cities they mostly had full hos­pital privileges, but in larger cities these privileges were more likely to be restricted. Physicians, often sharing the same specialties, are increasingly entering into group as­sociations, where the expenses of office space, staff, and equipment may be shared; such associations may work out of suites of offices, clinics, or medical centres. The increasing competition and risks of private practice have caused many physicians to join Health Maintenance Organizations (HMOs), which provide comprehensive medical. care and hospital care on a prepaid basis. Thе cost sav­ings to patient's are considerable, but they must use only the HMO doctors and facilities. HMOs stress preventive medicine and out-patient treatment as opposed to hospitalization as a means of reducing costs, a policy that has caused an increased number of empty hospital beds in the United States.

While the number of doctors per 100,000 population in the United States has been steadily increasing, there has been a trend among physicians toward the use of trained medical personnel to handle some of the basic services normally performed by the doctor. So-called physician extender services are commonly divided into nurse prac­titioners and physician's assistants, both of whom provide similar ancillary services for the general practitioner or specialist. Such personnel do not replace the doctor. Al­most all American physicians have systems for taking each other's calls when they become unavailable. House calls in the United Stales, as in Britain, have become exceedingly rare.

**Russia.** In Russia general practitioners are prevalent in the thinly populated rural areas. Pediatricians deal with children up to about age 15. Internists look after the med­ical ills of adults, and occupational physicians deal with the workers, sharing care with internists.

Teams of physicians with experience in varying specialties work from polyclinics or outpatient units, where many types of diseases are treated. Small towns usually have one polyclinic to serve all purposes. Large cities commonly have separate polyclinics for children and adults, as well as clinics with specializations such as women's health care, mental illnesses, and sexually transmitted diseases. Polyclinics usually have X-ray apparatus and facilities for examination of tissue specimens, facilities associated with the departments of the district hospital. Beginning in the late 1970s was a trend toward the development of more large, multipurpose treatment centres, first-aid hospitals, and specialized medicine and health care centres.

Home visits have traditionally been common, and much of the physician's time is spent in performing rou­tine checkups for preventive purposes. Some patients in sparsely populated rural areas may be seen first by feldshers (auxiliary health workers), nurses, or midwives who work under the supervision of a polyclinic or hospital physician. The feldsher was once a lower-grade physician in the army or peasant communities, but feldshers are now regarded as paramedical workers.

**Japan.** In Japan, with less rigid legal restriction of the sale of pharmaceuticals than in the West, there was formerly a strong tradition of self-medication and self-treatment. This was modified in 1961 by the institution of health insurance programs that covered a large proportion of the population; there was then a great increase in visits to the outpatient clinics of hospitals and to private clinics and individual physicians.

When Japan shifted from traditional Chinese medicine with the adoption of Western medical practices in the 1870s. Germany became the chief model. As a result of German influence and of their own traditions, Japanese physicians tended to prefer professorial status and schol­arly research opportunities at the universities or positions in the national or prefectural hospitals to private practice. There were some pioneering physicians, however, who brought medical care to the ordinary people.

Physicians in Japan have tended to cluster in the urban areas. The Medical Service Law of 1963 was amended to empower the Ministry of Health and Welfare to control the planning and distribution of future public and non­profit medical facilities, partly to redress the urban-rural imbalance. Meanwhile, mobile services were expanded.

The influx of patients into hospitals and private clinics after the passage of the national health insurance acts of 1961 had, as one effect, a severe reduction in the amount of time available for any one patient. Perhaps in reaction to this situation, there has been a modest resurgence in the popularity of traditional Chinese medicine, with its leisurely interview, its dependence on herbal and other "natural" medicines, and its other traditional diagnostic and therapeutic practices. The rapid aging of the Japanese population as a result of the sharply decreasing death rate and birth rate has created an urgent need for expanded health care services /or the elderly. There has also been an increasing need for centres to treat health problems resulting from environmental causes.

**Other developed countries.** On the continent of Europe there are great differences both within single countries and between countries in the kinds of first-contact medical care. General practice, while declining in Europe as else­where, is still rather common even in some large cities, as well as in remote country areas.

In The Netherlands, departments of general practice are administered by general practitioners in all the medical schools—an exceptional state of affairs—and general prac­tice flourishes. In the larger cities of Denmark, general practice on an individual basis is usual and popular, be­cause the physician works only during office hours. In addition, there is a duty doctor service for nights and weekends. In the cities of Sweden, primary care is given by specialists. In the remote regions of northern Sweden, district doctors act as general practitioners to patients spread over huge areas; the district doctors delegate much of their home visiting to nurses.

In France there are still general practitioners, but their number is declining. Many medical practitioners advertise themselves directly to the public as specialists in inter­nal medicine, ophthalmologists, gynecologists, and other kinds of specialists. Even when patients have a general practitioner, they may still go directly to a specialist. Attempts to stem the decline in general practice are being made hy the development of group practice and of small rural hospitals equipped to deal with less serious illnesses, where general practitioners can look after their patients.

Although Israel has a high ratio of physicians to pop­ulation, there is a shortage of general practitioners, and only in rural areas is general practice common. In the towns many people go directly to pediatricians, gynecolo­gists, and other specialists, but there has been a reaction against this direct access to the specialist. More general practitioners have been trained, and the Israel Medical Association has recommended that no patient should be referred to a specialist except by the family physician or on instructions given by the family nurse. At Tel Aviv University there is a department of family medicine. In some newly developing areas, where the doctor shortage is greatest, there are medical centres at which all patients are initially interviewed by a nurse. The nurse may deal with many minor ailments, thus freeing the physician to treat the more seriously ill.

Nearly half the medical doctors in Australia are general practitioners—a far higher proportion than in most other advanced countries—though, as elsewhere, their numbers are declining. They tend to do far more for their patients than in Britain, many performing such operations as re­moval of the appendix, gallbladder, or uterus, operations that elsewhere would be carried out by a specialist sur­geon. Group practices are common.

MEDICAL PRACTICE IN DEVELOPING COUNTRIES

**China.** Health services in China since the Cultural Rev­olution have been characterized by decentralization and dependence on personnel chosen locally and trained for short periods. Emphasis is given to selfless motivation, self-reliance, and to the involvement of everyone in the community. Campaigns stressing the importance of pre­ventive measures and their implementation have served to create new social attitudes as well as to break down divisions between different categories of health workers. Health care is regarded as a local matter that should not require the intervention of any higher authority; it is based upon a highly organized and well-disciplined system that is egalitarian rather than hierarchical, as in Western societies, and which is well suited to the rural areas where about two-thirds of the population live. In the large and crowded cities an important constituent of the health-care system is the residents' committees, each for a population of 1,000 to 5,000 people. Care is provided by part-time personnel with periodic visits by a doctor. A number of residents' committees are grouped together into neighbourhoods of some 50,000 people where there are clinics and general hospitals staffed by doctors as well as health auxiliaries trained in both traditional and Westernized medicine. Specialized care is provided at the district level (over 100,000 people), in district hospitals and in epidemic and preventive medicine centres. In many rural districts people's communes have organized cooperative medical services that provide primary care for a small annual fee.

Throughout China the value of traditional medicine is stressed, especially in the rural areas. All medical schools are encouraged to teach traditional medicine as part of their curriculum, and efforts are made to link colleges of Chinese medicine with Western-type medical schools. Medical education is of shorter duration than it is in Europe, and there is greater emphasis on practical work. Students spend part of their time away from the med­ical school working in factories or in communes; they are encouraged to question what they are taught and to participate in the educational process at all stages. One well-known form of traditional medicine is acupuncture, which is used as a therapeutic and pain-relieving tech­nique; requiring the insertion of brass-handled needles at various points on the body, acupuncture has become quite prominent as a form of anesthesia.

The vast number of nonmedically qualified health staff, upon whom the health-care system greatly depends, in­cludes both full-time and part-time workers. The latter include so-called barefoot doctors, who work mainly in rural areas, worker doctors in factories, and medical workers in residential communities. None of these groups is medically qualified. They have had only a three-month period of formal training, part of which is done in a hospi­tal, fairly evenly divided between theoretical and practical work. This is followed by a varying period of on-the-job experience under supervision.

**India.** Ayurvedic medicine is an example of a well-organized system of traditional health care, both preven­tive and curative, that is widely practiced in parts of Asia. Ayurvedic medicine has a long tradition behind it, having originated in India perhaps as long as 3.000 years ago. It is still a favoured form of health care in large parts of the Eastern world, especially in India, where a large percentage of the population use this system exclusively or combined with modern medicine. The Indian Medical Council was set up in 1971 by the Indian government to establish maintenance of standards for undergraduate and postgraduate education. It establishes suitable qualifi­cations in Indian medicine and recognizes various forms of traditional practice including Ayurvedic. Unani. and Siddha. Projects have been undertaken to integrate the indigenous Indian and Western forms of medicine. Most Ayurvedic practitioners work in rural areas, providing health care to at least 500,000.000 people in India alone. They therefore represent a major force for primary health care, and their training and deployment are important to the government of India.

Like scientific medicine, Ayurvedic medicine has both preventive and curative aspects. The preventive compo­nent emphasizes the need for a strict code of personal and social hygiene, the details of which depend upon individ­ual, climatic, and environmental needs. Rodilv exercises, the use of herbal preparations, and Yoga form a part of the remedial measures. The curative aspects of Avurvcdic medicine involves the use of herbal medicines, 'external preparations, physiotherapy, and diet. It is a principle of Ayurvedic medicini. that the preventive and therapeutic measures be adapted to the personal requirements of each patient.

Other developing countries. A main goal of the World Health Organization (WHO), as expressed in the Alma-Ata Declaration of 1978, is to provide to all the citizens of the world a level of health that will allow them to lead so­cially and economically productive lives by the year 2000. By the late 1980s, however, vast disparities in health care still existed between the rich and poor countries of the world. In developing countries such as Ethiopia, Guinea, Mali, and Mozambique, for instance, governments in the late 1980s spent less than $5 per person per year on public health, while in most western European countries several hundred dollars per year was spent on each person. The disproportion of the number of physicians available between developing and developed countries is similarly wide.

Along with the shortage of physicians, there is a short­age of everything else needed to provide medical care—of equipment, drugs, and suitable buildings, and of nurses, technicians, and all other grades of staff, whose presence is taken for granted in the affluent societies. Yet there are greater percentages of sick in the poor countries than in the rich countries. In the poor countries a high pro­portion of people are young, and all are liable to many infections, including tuberculosis, syphilis, typhon). and cholera (which, with the possible exception of syphilis, are now rare in the rich countries), and also malaria, yaws. worm infestations, and many other conditions occurring primarily in the warmer climates. Nearly all of these in­fections respond to the antibiotics and other drugs that have been discovered since the 1920s. There is also much malnutrition and anemia, which can be cured if funding is available. There is a prevalence of disorders remediable by surgery. Preventive medicine can ensure clean water supplies, destroy insects that carry infections, teach hy­giene, and show how to make the best use of resources.

In most poor countries there are a few people, usually living in the cities, who can afford to pay for medical care and in a free market system the physicians lend to go where they can make the best living; this situation causes the doctor-patient ratio to be much higher in the towns than in country districts. A physician in Bombay or in Rio de Janeiro, for example, may have equipment as lavish as that of a physician in the United States and can earn an excellent income. The poor, however, both in the cities and in the country, can gel medical attention only if it is paid for by the state, by some supranational body, or by a mission or other charitable organization. Moreover, the quality of the care they receive is often poor, and in remote regions it may be lacking altogether. In practice, hospitals run by a mission maycooperate closely with stale-run health centres.

Because physicians are scarce, their skills must be used to best advantage, and much of the work normally done by physicians in the rich countries has to be delegated to auxiliaries or nurses, who have to diagnose the common conditions, give treatment, take blood samples, help with operations, supply simple posters containing health ad­vice, and carry out other tasks. In such places the doctor has lime only to perform major operations and deal with the more difficult medical problems. People are treated as far as possible on an outpatient basis from health centres housed in simple buildings; few can travel except on foot, and, if they are more than a few miles from a health centre, they tend not to go there. Health centres also may be used for health education.

Although primary health-care service diners from coun­try to country, that developed in Tanzania is represen­tative of many that have been devised in largely rural developing countries. The most important feature of the Tanzanian rural health service is the rural health centre, which, with its related dispensaries, is intended to pro­vide comprehensive health services for the community. The staff is headed by the assistant medical officer and the medical assistant. The assistant medical officer has at least lour years of experience, which is then followed by further training for 18 months. He is not a doctor but serves to bridge the gap between medical assistant and physician. The medical assistant has three years of general medical education. The work of the rural health centres and dispensaries is mainly of three kinds: diagnosis and treatment, maternal and child health, and environmental health. The main categories of primary health workers also include medical aids, maternal and child health aids, and health auxiliaries. Nurses and midwives form another category of worker. In the villages there are village health posts staffed by village medical helpers working under supervision from the rural health centre.

In some primitive elements of the societies of developing countries, and of some developed countries, there exists the belief that illness comes from the displeasure of an­cestral gods and evil spirits, from the malign influence of evil disposed persons, or from natural phenomena that can neither he forecast nor controlled. To deal with such causes there are many varieties of indigenous healers who practice elaborate rituals on behalf of both the physically ill and the mentally afflicled. If it is understood that such beliefs, and other forms of shamanism, may provide a basis upon which health care can be based, then primary health care may he said to exist almost everywhere. It is not only easily available but also readily acceptable, and often preferred, to more rational methods of diagnosis and treatment. Although such methods may sometimes be harmful, they may often be effective, especially where the cause is psychosomatic. Other patients, however, may suffer from a disease for which there is a cure in mod­ern medicine.

In order to improve the coverage of primary health-care services and lo spread more widely some of the benefits of Wesiern medicine, attempts have sometimes been made to tun.) a means of cooperation, or even integration, be­tween traditional and modern medicine (see above *India).* In Aluca, for example, some such attempts are officially sponsored by ministries of health, state governments, universities, and the like, and they have the approval of WHO, which often lakes the lead in this activity. In view, however, of the historical relationships between these two systems of medicine, their different basic concepts, and the fuel that their methods cannot readily be combined, successful merging has been limited.

ALTERNATIVE OR COMPLEMENTARY MEDICINE

Persons dissatisfied with the methods of modern medicine or with its results sometimes seek help from those profess­ing expertise in other, less conventional, and sometimes controversial, forms of health care. Such practitioners are not medically qualified unless they are combining such treatments with a regular (allopathic) practice, which in­cludes osteopathy. In many countries the use of some forms, such as chiropractic, requires licensing and a de­gree from an approved college. The treatments afforded in these various practices are not always subjected to objective assessment, yet they provide services that are al­ternative, and sometimes complementary, to conventional practice. This group includes practitioners of homeopa­thy, naturopathy, acupuncture, hypnotism, and various meditative and quasi-religious forms. Numerous persons also seek out some form of faith healing to cure their ills, sometimes as a means of last resort. Religions commonly include some advents of miraculous curing within their scriptures. The belief in such curative powers has been in part responsible for the increasing popularity of the television, or "electronic," preacher in the United States, a phenomenon that involves millions of viewers. Millions of others annually visit religious shrines, such as the one at Lourdes in France, with the hope of being miracu­lously healed.

SPECIAL PRACTICES AND FIELDS OF MEDICINE

**Specialties in medicine.** At the beginning of World War II it was possible to recognize a number of major medi­cal specialties, including internal medicine, obstetrics and gynecology, pediatrics, pathology, anesthesiology, ophthal­mology, surgery, orthopedic surgery, plastic surgery, psy­chiatry and neurology, radiology, and urology. Hematology was also an important field of study, and microbiology and biochemistry were important medically allied specialties. Since World War II, however, there has been an almost explosive increase of knowledge in the medical sciences as well as enormous advances in technology as applica­ble to medicine. These developments have led to more and more specialization. The knowledge of pathology has been greatly extended, mainly by the use of the electron microscope; similarly microbiology, which includes bacte­riology, expanded with the growth of such other subfields as virology (the study of viruses) and mycology (the study of yeasts and fungi in medicine). Biochemistry, sometimes called clinical chemistry or chemical pathology, has con­tributed to the knowledge of disease, especially in the field of genetics where genetic engineering has become a key to curing some of the most difficult diseases. Hematology also expanded after World War II with the development of electron microscopy. Contributions to medicine have come from such fields as psychology and sociology espe­cially in such areas as mental disorders and mental hand­icaps. Clinical pharmacology has led to the development of more effective drugs and to the identification of adverse reactions. More recently established medical specialties are those of preventive medicine, physical medicine and re­habilitation, family practice, and nuclear medicine. In the United States every medical specialist must be certified by a board composed of members of the specialty in which certification is sought. Some type of peer certification is required in most countries.

Expansion of knowledge both in depth and in range has encouraged the development of new forms of treat­ment that require high degrees of specialization, such as organ transplantation and exchange transfusion; the field of anesthesiology has grown increasingly complex as equipment and anesthetics have improved. New technolo­gies have introduced microsurgery, laser beam surgery, and lens implantation (for cataract patients), all requiring the specialist's skill. Precision in diagnosis has markedly improved; advances in radiology, the use of ultrasound, computerized axial tomography (CAT scan), and nuclear magnetic resonance imaging are examples of the extension of technology requiring expertise in the field of medicine.

To provide more efficient service it is not uncommon for a specialist surgeon and a specialist physician to form a team working together in the field of, for example, heart disease. An advantage of this arrangement is that they can attract a highly trained group of nurses, technologists. operating room technicians, and so on, thus greatly im­proving the efficiency of the service to the patient. Such specialization is expensive, however, and has required an increasingly large proportion of the health budget of insti­tutions, a situation that eventually has its financial effect on the individual citizen. The question therefore arises as to their cost-effectiveness. Governments of developing countries have usually found, for instance, that it is more cost-efficient to provide more people with basic care.

**Teaching.** Physicians in developed countries frequently prefer posts in hospitals with medical schools. Newly qualified physicians want to work there because doing so will aid their future careers, though the actual experience may be wider and better in a hospital without a medical school. Senior physicians seek careers in hospitals with medical schools because consultant, specialist, or professorial posts there usually carry a high degree of prestige. When the posts are salaried, the salaries are sometimes, but not always, higher than in a nonteaching hospital. Usually a consultant who works in private practice earns more when on the staff of a medical school.

In many medical schools there are clinical professors in each of the major specialties—such as surgery, internal medicine, obstetrics and gynecology and psychiatry—and often of the smaller specialties as well. There are also pro­fessors of pathology, radiology, and radiotherapy. Whether professors or not, all doctors in teaching hospitals have the two functions of caring for the sick and educating students. They give lectures and seminars and are accom­panied by students on ward rounds.

**Industrial medicine.** The Industrial Revolution greatly changed, and as a rule worsened, the health hazards caused by industry, while the numbers at risk vastly increased. In Britain the first small beginnings of efforts to ameliorate the lot of the workers in factories and mines began in 1802 with the passing of the first factory act, the Health and Morals of Apprentices Act. The factory act of 1838, however, was the first truly effective measure in the indus­trial field. It forbade night work for children and restricted their work hours to 12 per day. Children under 13 were required to attend School. A factory inspectorate was es­tablished, the inspectors being given powers of entry into factories and power of prosecution of recalcitrant owners. Thereafter there was a succession of acts with detailed reg­ulations for safety and health in all industries. Industrial diseases were made notifiable, and those who developed any prescribed industrial disease were entitled to benefits.

The situation is similar in other developed countries. Physicians are bound by legal restrictions and must report industrial diseases. The industrial physician's most impor­tant function, however, is to prevent industrial diseases. Many of the measures to this end have become stan­dard practice, but, especially in industries working with new substances, the physician should determine if work­ers are being damaged and suggest preventive measures. The industrial physician may advise management about industrial hygiene and the need for safety devices and protective clothing and may become involved in building design. The physician or health worker may also inform the worker of occupational health hazards.

Modern factories usually have arrangements for giving first aid in case of accidents. Depending upon the size of the plant, the facilities may range from a simple first-aid station to a large suite of lavishly equipped rooms and may include a staff of qualified nurses and physiothera­pists and one or perhaps more full-time physicians.

*Periodic medical examination.* Physicians in industry carry out medical examinations, especially on new em­ployees and on those returning to work after sickness or injury. In addition, those liable to health hazards may be examined regularly in the hope of detecting evidence of incipient damage. In some organizations every employee may be offered a regular medical examination.

*The industrial and the personal physician.* When a worker also has a persona! physician, there may be doubt. in some cases, as to which physician bears the main re­sponsibility for his health. When someone has an accident

or becomes acutely ill at work, the first aid is given or directed by the industrial physician. Subsequent treatment may be given either at the clinic at work or by the personal physician. Because of labour-management difficulties, workers sometimes tend not to trust the diagnosis of the management-hired physician.

*Industrial health services.* During the epoch of the So­viet Union and the Soviet bloc. industrial health service generally developed more fully in those countries than in the capitalist countries. At the larger industrial establish­ments in the Soviet Union, polyclinics were created to provide both occupational and general can for workers and their families. Occupational physicians were responsible for preventing occupational diseases and injuries, health screening, immunization and health education.

In the capitalist countries, on the other hand, no fixed pattern of industrial health service has emerged. Legisla­tion impinges upon health in various ways, including the provision of safety measures, the restriction of pollution and the enforcement of minimum standards of lightning, ventilation, and space per person. In most of these countries there is found an infinite variety of schemes financed and run by individual firms or equally, by huge industries. Labour unions have also done much to enforce health codes within their respective industries. In the de­veloping countries there has been generally little advance in industrial medicine.

**Family health** **care.** In many societies special facilities are provided for the health care of pregnant women mothers, and their young children. The health care needs of these three groups, are generally recognized to be so closely related as to require a highly integrated service that includes prenatal care, the birth of the baby. the postnatal period, and the needs of the infant. Such a continuum should be followed by a service attentive to the needs of young children and then by a school health service. Family clinics are common in countries that have state-sponsored health services, such as those in the United Kingdom and elsewhere in Europe. Family health care in some devel­oped countries, such as the United States, is provided for low-income groups by state-subsidized facilities, but other groups defer to private physicians or privately run clinics.

Prenatal clinics provide a number of elements. There is first, the care of the pregnant woman, especially if she is in a vulnerable group likely to develop some complication during the last few weeks of pregnancy and subsequent delivery. Many potential hazards, such as diabetes and high blood pressure, can be identified and measures taken to minimize their effects. In developing countries preg­nant women are especially susceptible to many kinds of disorders, particularly infections such as malaria. Local conditions determine what special precautions should he taken to ensure a healthy child. Most pregnant women, in their concern to have a healthy child, are receptive to simple health education. The prenatal clinic provides an excellent opportunity to teach the mother how to look after herself during pregnancy, what to expect at delivery, and how to care for her baby. If the clinic is attended regularly, the woman's record will he available to the staff that will later supervise the delivery of the baby: this is particularly important for someone who has been determined to be at risk. The same clinical unit should he responsible for prenatal, natal, and postnatal care as well as for the care of the newborn infants.

Most pregnant women can he safely delivered in sim­ple circumstances without an elaborately trained staff or sophisticated technical facilities, provided that these can be called upon in emergencies. In developed countries it was customary in premodern times for the delivery to take place in the woman's home supervised by a qualified midwife or by the family doctor. By the mid-20th century women, especially in urban areas, usually preferred to have their babies in a hospital, either in a general hospital or in a more specialized maternity hospital. In many developing countries traditional birth attendants supervise the deliv­ery. They are women, for the most part without formal training, who have acquired skill by working with others and from their own experience. Normally they belong to the local community where they have the confidence of

the family,where they are content to live and serve, and where their services are of great value. In many developing countries the better training of him attendants has a high priority. In developed Western countries there has been a trend toward delivery by natural childbirth, including de­livery in a hospital without anesthesia, and home delivery.

Postnatal care services are designed to supervise the return to normal of the mother. They are usually given by the staff of the same unit that was responsible for the delivery. Im­portant considerations are the mailer of breast- or artificial feeding and the care of the infant. Today the prospects for survival of babies born prematurely or after a difficult and complicated labour, as well as for neonates (recently born babies) with some physical abnormality, are vastly im­proved. This is due to technical advances, including those that can determine defects in the prenatal stage, as well as to the growth of neonatology as a specialty. A vital part of the family health-care service is the child welfare clinic, which undertakes the care of the newbom. The first step is the thorough physical examination of the child on one or more occasions to determine whether or not it is normal both physically and, if possible, mentally. Later periodic examinations serve to decide if the infant is growing sat­isfactorily. Arrangements can be made for the child to be protected from major hazards by, for example, immuniza­tion and dietary supplements. Any intercurrent condition, such as a chest infection or skin disorder, can be detected early and treated. Throughout the whole of this period mother and child are together, and particular attention is paid to the education of the mother for the care of the child.

A pan of the health service available to children in the developed countries is that devoted to child guidance. This provides psychiatric guidance to maladjusted children usu­ally through the cooperative work of a child psychiatrist, educational psychologist, and schoolteacher.

**Geriatrics.** Since the mid-20th century a change has oc­curred in the population structure in developed countries. The proportion of elderly people has been increasing. Since 1983, however, in most European countries the population growth of that group has leveled off, although it is expected to continue to grow more, rapidly than the rest of the population in most countries through the first third of the 21st century. In the late 20fti century Japan had the fastest growing elderly population.

Geriatrics, the health care of the elderly, is therefore a considerable burden on health services. In the United Kingdom about one-third of all hospital beds are occupied by patients over 65; half of these are psychiatric patients. The physician's time is being spent more and more with the elderly, and since statistics show that women live longer than men, geriatric practice is becoming increas­ingly concerned with the treatment of women. Elderly people often have more than one disorder, many of which are chronic and incurable, and they need more attention from health-care services. In the United States there has been some movement toward making geriatrics a medical specialty, but it has not generally been recognized.

Support services for the elderly provided by private or state-subsidized sources include domestic help, delivery of meals, day-care centres, elderly residential homes or nursing homes, and hospital beds either in general medical wards or in specialized geriatric units. The degree of acces­sibility" of these services is uneven from country to country and within countries. In the United States, for instance, although there are some federal programs, each state has its own elderly programs, which vary widely. However, as the elderly become an increasingly larger part of the pop­ulation their voting rights are providing increased leverage for obtaining more federal and state benefits. The gen­eral practitioner or family physician working with visiting health and social workers and in conjunction with the pa­tient's family often form a working team for elderly care.

In the developing world, countries are largely spared such geriatric problems, but not necessarily for positive reasons. A principal cause, for instance, is that people do not live **so** long. Another major reason is that in the extended family concept, still prevalent among developing countries, most of the caretaking needs of the elderly are provided by the family.

**Public health practice.** The physician working in the field of public health is mainly concerned with the envi­ronmental causes of ill health and in their prevention. Bad drainage, polluted water and atmosphere, noise and smells, infected food had housing, and poverty in general are all his special concern. Perhaps the most descriptive title he can he given is that of community physician. In Britain he has been customarily known as the medical officer of health and. in the United Slates, as the health officer.

The spectacular improvement in the expectation of life in the affluent countries has been due far more to public health measures than to curative medicine. These public health measures began operation largely in the 19lh cen­tury. At the beginning of that century, drainage and water supply systems were all more or less primitive; nearly all the cities of that time had poorer water and drainage systems than Rome had possessed 1,800 years previ­ously. Infected water supplies caused outbreaks of typhoid, cholera, and other waterborne infections. By the end of the century, at least in the larger cities, water supplies were usually safe. Food-home infections were also drasti­cally reduced by the enforcement of laws concerned with the preparation, storage, and distribution of food. Insect-borne infections, such as malaria and yellow fever, which were common in tropical and semitropical climates, were eliminated by the destruction of the responsible insects. Fundamental to this improvement in health has been the diminution of poverty, for most public health measures are expensive. The peoples of the developing countries fall sick and sometimes die from infections that are virtually unknown in affluent countries.

*Britain.* Public health services in Britain are organized locally under the National Health Service. The medical officer of health is employed by the local council and is the adviser in health matters. The larger councils employ a number of mostly full-time medical officers; in some rural areas, a general practitioner may be employed part-time as medical officer of health:

The medical officer has various statutory powers con­ferred by acts of Parliament, regulations and orders, such as food and drugs acts, milk and dairies regulations, and factories acts. He supervises the work of sanitary inspec­tors in the control of health nuisances. The compulsorily notifiable infectious diseases are reported to him, and he takes appropriate action. Other concerns of the medical officer include those involved with the work of the district nurse, who carries out nursing duties in the home, and the health visitor, who gives advice on health matters, espe­cially to the mothers of small babies. He has other duties in connection with infant welfare clinics, creches, day and residential nurseries, the examination of schoolchildren, child guidance clinics, foster homes, factories, problem families, and the care of the aged and the handicapped.

*United States.* Federal, state, county, and city govern­ments all have public health futtctions. Under the U.S. Department of Health end Human Services is the Public Health Service, headed by an assistant secretary for health and the surgeon general. State health departments are headed by a commissioner of health, usually a physician, who is often in the governor's cabinet. He usually has a board of health that adopts health regulations and holds hearings on their alleged violations. A state's public health code is the foundation on which all county and city health regulations must be based. A city health department may be independent of its surrounding county health depart­ment, or there may be a combined city-county health department. The physicians of the local health depart­ments are usually called health officers, though occasion­ally people with this title are not physicians. The larger departments may have a public health director, a district health director, or a regional health director.

The minimal complement of a local health department is a health officer, a public health nurse, a sanitation ex­pert, and a clerk who is also a registrar of vital statistics. There may also be sanitation personnel, nutritionists, so­cial workers, laboratory technicians, and others.

*Japan.* Japan's Ministry of Health and Welfare directs public health programs at the national level, maintain­ing close coordination among the fields of preventive medicine, medical care, and welfare and health insur­ance. The departments of health of the prefectures and of the largest municipalities operate health centres. The integrated community health programs of the centres en­compass maternal and child health, communicable-disease control, health education, family planning, health statis­tics, food inspection, and environmental sanitation. Pri­vate physicians, through their local medical associations, help to formulate and execute particular public health programs needed by their localities.

Numerous laws are administered through the ministry's bureaus and agencies, which range from public health, en­vironmental sanitation, and medical affairs to the children and families bureau. The various categories of institutions run by the ministry, in addition to the national hospitals, include research centres for cancer and leprosy, homes for the blind, rehabilitation centres, for the physically handicapped, and port quarantine services.

*Former Soviet Union.* In the aftermath of the dissolu­tion of the Soviet Union, responsibility for public health fell to the governments of the successor countries.

The public health services for the U.S.S.R. as a whole were directed by the Ministry of Health. The ministry, through the 15 union republic ministries of health, di­rected all medical institutions within its competence as well as the public health authorities; and services through­out the country.

The administration was centralized, with little local au­tonomy. Each of the 15 republics had its own ministry of health, which was responsible for carrying out the plans and decisions established by the U.S.S.R. Ministry of Health. Each republic was divided into *oblasti,* or provinces, which had departments of health directly re­sponsible to the republic ministry of health. Each *oblast,* in turn, had *rayony* (municipalities), which have their own health departments accountable to the *oblast* health de­partment. Finally, each *rayon* was subdivided into smaller *uchastoki* (districts).

In most rural *rayony* the responsibility for public health lay with the chief physician, who was also medical director of the central *rayon* hospital. This system ensured unity of public health administration and implementation of the principle of planned development. Other health personnel included nurses, feldshers, and midwives.

For more information on the history, organization,andprogress of public health, see below.

**Military practice.** The medical services of armies, navies, and air forces are geared to war. During campaigns the first requirement is the prevention of sickness. In all wars before the 20th century, many more combatants died of disease than of wounds. And even in World War II and wars thereafter, although few died of disease, vast numbers became casualties from disease.

The main means of preventing sickness are the provi­sion of adequate food and pure water, thus eliminating starvation, avitaminosis, and dysentery and other bowel infections, which used to be particular scourges of armies; the provision of proper clothing and other means of pro­tection from the weather; the elimination from the service of those likely to fall sick: the use of vaccination and suppressive drugs to prevent various infections, such as typhoid and malaria; and education in hygiene and in the prevention of sexually transmitted diseases, a particular problem in the services. In addition, the maintenance of high morale has a sinking effect on casualty rates, for, when morale is poor, soldiers are likely to suffer psychi­atric breakdowns, and malingering is more prevalent.

The medical branch may provide advice about disease prevention, but the actual execution of this advice is through the ordinary chains of command. It is the duty of the military, not of the medical, officer to ensure that the troops obey orders not to drink infected water and to take tablets to suppress malaria.

*Army medical organisation.* The medical doctor of first contact to the soldier in the armies of developed countries is usually an officer in the medical corps. In реагенте the doctor sees the sick and has functions similar to those of the general practitioner, prescribing drugs and dressings and there may be a sick bay where slightly sick soldiers can remain for a few days. The doctor is usually assisted by trained nurses and corpsmen. If a further medical opinion is required, the patient can be referred to a specialist at a military or civilian hospital.

In a war zone, medical officers have an aid post where, with the help of corpsmen, they apply first aid to the walking wounded and to the more seriously wounded who are brought in. The casualties are evacuated as quickly as possible by field ambulances or helicopters. At a com­pany station, medical officers and medical corpsmen may provide further treatment before patients are evacuated to the main dressing station at the field ambulance head­quarters, where a surgeon may perform emergency oper­ations. Thereafter, evacuation may be to casualty clearing stations, to advanced hospitals,or to base hospitals. Air evacuation is widely used.

In peacetime most of the intermediate medical units exist only in skeleton form; the active units are at the battalion and hospital level. When physicians join the medical corps, they may join with specialist qualifications, or they may obtain such qualifications while in the army. A feature of army medicine is promotion to administra­tive positions. The commanding officer of a hospital and the medical officer at headquarters may have no contacts with actual patients.

Although medical officers in peacetime have some choice of the kind of work they will do, they are in a chain of command and are subject to military discipline. When dealing with patients, however, they are in a special po­sition; they cannot be ordered by a superior officer to give some treatment or take other action that they believe is wrong. Medical officers also do not bear or use arms unless their patients are being attacked.

*Naval and air force medicine.* Naval medical services are run on lines similar to those of the army. Junior medical officers are attached to ships or to shore stations and deal with most cases of sickness in their units. When at sea. medical officers have an exceptional degree of re­sponsibility in that they work alone, unless they are on a very large ship. In peacetime, only the larger ships carry a medical officer; in wartime, destroyers and other small craft may also carry medical officers. Serious cases go to either a shore-based hospital or a hospital ship.

Flying has many medical repercussions. Cold, lack of oxygen, and changes of direction at high speed all have important effects on bodily and mental functions. Armies and air forces may share the same medical services.

A developing field is aerospace medicine. This involves medical problems that were not experienced before space-flight, for the main reason that humans in space are not under the influence of gravity, a condition that has pro­found physiological effects.

**CLINICAL RESEARCH**

The remarkable developments in medicine that have been brought about in the 20th century, especially since World War II, have been based on research either in the basic sci­ences related to medicine or in the clinical field. Advances in the use of radiation, nuclear energy, and space research have played an important part in this progress. Some laypersons often think of research as taking place only in sophisticated laboratories or highly specialized institutions where work is devoted to scientific advances that may or may not be applicable to medical practice. This notion, however, ignores the clinical research that takes placeona day-to-day basis in hospitals and doctors' offices.

**Historical notes.** Although the most spectacular changes in the medical scene during the 20lh century, and the most widely heralded, have been the development of potent drugs and elaborate operations, another striking change has been the abandonment of most of the remedies of the past. In the mid-19th century, persons ill with numer­ous maladies were starved (partially or completely), bled, purged, cupped (by applying a tight-fitting vessel filled with steam to some part and then cooling the vessel), and rested, perhaps for months or even years. Much more recently they were prescribed various restricted diets and were routinely kept in bed for weeks after abdominal oper­ations, for many weeks or months when their hearts were thought to be affected, and for many months or years with tuberculosis. The abandonment of these measures may not be though of as involving research, but the physician who first encouraged persons who had peptic ulcers to eat normally (rather than to live on the customary bland foods) and the physician who first got his patients out of bed a week or two after they had had minor coronary thrombosis (rather than insisting on a minimum of six weeks of strict bed rest) were as much doing research as is the physician who first tries out a new drug on a patient. This research, by observing what happens when remedies are abandoned, has been of inestimable value, and the need for it has not passed.

**Clinical** **observation.** Much of the investigative clinical field work undertaken in the present day requires only relatively simple laboratory facilities because it is observa­tional rather than experimental in character. A feature of much contemporary medical research is that it requires the collaboration of a number of persons, perhaps not all of them doctors. Despite the advancing technology, there is much to be learned simply from the observation and analysis of the natural history of disease processes as they begin to affect patients, pursue their course, and end, either in their resolution or by the death of the patient. Such studies may be suitably undertaken by physicians working in their offices who are in a better position than doctors working only in hospitals to observe the whole course of an illness. Disease rarely begins in a hospital and usually does not end there. It is notable, however, that observational research is subject to many limitations and pitfalls of interpretation, even when it is carefully planned and meticulously carried out.

**Drug** **research.** The administration of any medicament, especially a new drug, to a patient is fundamentally an experiment: so is a surgical operation, particularly if it involves a modification to an established technique or a completely new procedure. Concern for the patient, care­ful observation, accurate recording, and a detached mind are the keys to this kind of investigation, as indeed to all forms of clinical study. Because patients are individuals reacting to a situation in their own different ways, the data obtained in groups of patients may well require statistical analysis for their evaluation and validation.

One of the striking characteristics in the medical field in the 20th century has been the development of new drugs, usually by pharmaceutical companies. Until the end of the 19th century, the discovery of new drugs was largely a matter of chance. It was in that period that Paul Ehrlich, the German scientist, began to lay down the principles for modern pharmaceutical research that made possible the development of a vast array of safe and effective drugs. Such benefits, however, bring with them their own disadvantages: it is estimated that as many as 30 percent of patients in, or admitted to, hospitals suffer from the adverse effect of drugs prescribed by a physician for their treatment. Sometimes it is extremely difficult to determine whether a drug has been responsible for some disorder. An example of the difficulty is provided-by the thalidomide disaster between 1959 and 1962. Only after numerous deformed babies had been born through­out the world did it become clear that thalidomide taken by the mother as a sedative had been responsible.

In hospitals where clinical research is carried out, ethical committees often consider each research project. If the committee believes that the risks are not justified, the project is rejected.

After a potentially useful chemical compound has been identified in the laboratory, it is extensively tested in an­imals, usually for a period of months or even years. Few drugs make it beyond this point. If the tests are satisfactory, the decision may be made for testing the drug in humans. It is this activity that forms the basis of much clinical research. In most countries the first step is the study of its effects in a small number of health volunteers. The response, effect on metabolism, and possible toxicity are carefully monitored and have to be completely satisfactory before the drug can be passed for further studies, namely with patients who have the disorder for which the drug is to be used. Tests are administered at first to a limited number of these patients to determine effectiveness, proper dosage, and possible adverse reactions. These searching studies are scrupulously controlled under stringent condi­tions. Larger groups of patients are subsequently involved to gain a wider sampling of the information. Finally, a full-scale clinical trial is set up. If the regulatory authority is satisfied about the drug's quality, safely, and efficacy. it receives a license to be produced. As the drug becomes more widely used, it eventually finds its proper place in therapeutic practice, a process that may take years.

An important step forward in clinical research was taken in the mid-20th century with the development of the con­trolled clinical trial. This sets out to compare two groups of patients, one of which has had some form of treatment that the other group has not. The testing of a new drug is a case in point: one group receives the drug. the her a product identical in appearance, but which is known to be inert—a so-called placebo. At the end of the trial, the results of which can be assessed in various ways, it can be determined whether or not the drug is effective and safe. By the same technique two treatments can be compared, for example a new drug against a more fa­miliar one. Because individuals differ physiologically and psychologically, the allocation of patients between the two groups must be made in a random fashion; some method independent of human choice must be used so that such differences are distributed equally between the two groups.

In order to reduce bias and make the trial as objective as possible the double-blind technique is sometimes used. In this procedure, neither the doctor nor the patients know which of two treatments is being given. Despite such pre­cautions the results of such trials can be prejudiced, so that rigorous statistical analysis is required. It is obvious that many ethical, not to say legal, considerations arise, and it is essential that all patients have given their informed consent to be included. Difficulties arise when patients are unconscious, mentally confused, or otherwise unable to give their informed consent. Children present a special difficulty because not all laws agree that parents can legally commit a child to an experimental procedure. Trials, and indeed all forms of clinical research that involve patients, must often be submitted to a committee set up locally to scrutinize each proposal.

**Surgery.** In drug research the essential steps are taken by the chemists who synthesize or isolate new drugs in the laboratory; clinicians play only a subsidiary part. In developing new surgical operations clinicians play a more important role, though laboratory scientists and others in the background may also contribute largely. Many new operations have been made possible by advances in anesthesia, and these in turn depend upon engineers who have devised machines and chemists who have produced new drugs. Other operations are made possible by new materi­als, such as the alloys and plastics that are used to make .artificial hip and knee joints.

Whenever practicable, new operations are tried on animals before they are tried on patients. This practice is particularly relevant to organ transplants. Surgeons them­selves—not experimental physiologists—transplanted kid­neys, livers, and hearts in animals before attempting these procedures on patients. Experiments on animals are of limited value, however, because animals do not suffer from all of the same maladies as do humans.

Many other developments in modem surgical treatment rest on a firm basis of experimentation, often first in an­imals but also in humans; among them are renal dialysis (the artificial kidney), arterial bypass operations, embryo implantation, and exchange transfusions. These treatments are but a few of the more dramatic of a large range of therapeutic measures that have not only provided patients with new therapies but also have led to the acquisition of new knowledge of how the body works. Among the research projects of the late 20th century is that of gene transplantation, which has the potential of providing cures for cancer and other diseases.

SCREENING PROCEDURES

Developments in modem medical science have made it possible to detect morbid conditions before a person actually feels the effects of the condition. Examples arc many: they include certain forms of cancer; high blood pressure; heart and lung disease; various familial and congenital conditions; disorders of metabolism, like diabetes; and acquired immune deficiency syndrome (AIDS), the con­sideration to be made in screening is whether or not such potential patients should be identified by periodic exam­inations. To do so is to imply that the subjects should be made aware of their condition and, second, that there are effective measures that can be taken to prevent their condition, if they test positive, from worsening. Such so-called specific screening procedures are costly since they involve large numbers of people. Screening may lead to a change in the life-style of many persons, but not all such moves have been shown in the long run to be fully effective. Although screening clinics may not be run by doctors, they are a factor of increasing importance in the, preventive health service.

Periodic general medical examination of various sections of the population, business executives for example, is an­other way of identifying risk factors that, if not corrected, can lead to the development of overt disease.